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Monterey, California

THESIS

PREDICTING THE PROFICIENCY OF ARABIC AND PERSIAN LINGUISTS TRAINED AT THE DEFENSE LANGUAGE INSTITUTE FOREIGN LANGUAGE CENTER

by

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March 1999

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The mission of the Defense Language Institute Foreign Language Center (DLIFLC) is to train, sustain, and evaluate foreign language skills of linguists under the guidelines of the Defense Foreign Language Program (DFLP). The DFLP provides the Department of Defense and other Federal agencies with linguists capable of supporting United States national interests worldwide. The DLIFLC is responsible for the language training of enlisted and officer personnel of the four armed services and a small number of federal civilians.

Program tests and semester grade point averages (GPAs) evaluate progress within any DLIFLC language program. Satisfactory progress is defined as maintaining at least a C– average in course work. Student success is realized in the student's attainment of minimum proficiency requirements in listening, reading, and speaking skills on the Defense Language Proficiency Test (DLPT).

The purpose of this study is to determine how major program tests, semester GPAs, and cumulative skills GPAs in the Arabic and Persian language departments relate to success on the DLPT. The results of this study will assist the school deans within these language departments in interpreting the meaning of program tests, semester GPAs, and cumulative skills GPAs when making decisions about attrition and academic performance.

The results indicate that the semester GPAs are the most predictive variables of overall DLPT performance for both Arabic and Persian languages.

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ABSTRACT

The mission of the Defense Language Institute Foreign Language Center (DLIFLC) is to train, sustain, and evaluate foreign language skills of linguists under the guidelines of the Defense Foreign Language Program (DFLP). The DFLP provides the Department of Defense and other Federal agencies with linguists capable of supporting United States national interests worldwide. The DLIFLC is responsible for the language training of enlisted and officer personnel of the four armed services and a small number of federal civilians.

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The purpose of this study is to determine how major program tests, semester GPAs, and cumulative skills GPAs in the Arabic and Persian language departments relate to success on the DLPT. The results of this study will assist the school deans within these language departments in interpreting the meaning of program tests, semester GPAs, and cumulative skills GPAs when making decisions about attrition and academic performance.

The results indicate that the semester GPAs are the most predictive variables of overall DLPT performance for both Arabic and Persian languages.

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TABLE OF CONTENTS

I. INTRODUCTION 1

A. BACKGROUND 1
B. LITERATURE REVIEW 7
C. PROBLEM DESCRIPTION 8
D. ORGANIZATION OF THESIS 9

II. DATA AND VARIABLES CONSIDERED 11

A. BACKGROUND OF DATA 11
B. POPULATION CONSIDERED 15
C. VARIABLES 16
D. LIMITATIONS OF DATA 17

III. PERSIAN LANGUAGE PROGRAM METHODOLOGY AND FINDINGS 21

A. EXPLORATORY DATA ANAYLSIS RESULTS 22
B. PREDICTING DLPT PERFORMANCE WITH PHASE TESTS 26
C. PREDICTING DLPT PERFORMANCE WITH SEMESTER GPAS 31
D. BEST OVERALL PREDICTOR OF DLPT PERFORMANCE 37

IV. ARABIC LANGUAGE PROGRAM METHODOLOGY AND FINDINGS 39

A. EXPLORATORY DATA ANAYLSIS RESULTS 39
B. PREDICTING DLPT PERFORMANCE WITH C-TESTS 44
C. PREDICTING DLPT PERFORMANCE WITH SEMESTER GPAS 52
D. PREDICTING DLPT PERFORMANCE WITH CUMULATIVE SKILLS GPAS 55
E. BEST OVERALL PREDICTOR OF DLPT PERFORMANCE 61

V. SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS 63

A. SUMMARY 63
B. CONCLUSIONS 63
C. RECOMMENDATIONS 65

APPENDIX A. PERSIAN TEST NUMERICAL SUMMARIES 67

APPENDIX B. PERSIAN PAIRWISE CORRELATIONS 69

APPENDIX C. PREDICTING PERSIAN SUSTAINED STUDENT PERFORMANCE 73

APPENDIX D. PERSIAN SEMESTER GPA CROSSTABULATIONS 75

APPENDIX E. IDENTIFYING POTENTIAL DECISION POINTS FOR PERSIAN ATTRITION BASED ON MAJOR PROGRAM TESTS 79

APPENDIX F. PERSIAN S-PLUS LOGISTIC REGRESSION RESULTS 81

APPENDIX G. ARABIC TEST NUMERICAL SUMMARIES 83

APPENDIX H. ARABIC PAIRWISE CORRELATIONS 87

APPENDIX I. PREDICTING ARABIC SUSTAINED STUDENT PERFORMANCE.....97

APPENDIX J. ARABIC SEMESTER GPA CROSSTABULATIONS 101

APPENDIX K. ARABIC CUMULATIVE SKILLS SEMESTER GPA CROSSTABULATIONS 105

APPENDIX L. IDENTIFYING POTENTIAL DECISION POINTS FOR ARABIC ATTRITION BASED ON MAJOR PROGRAM TESTS TESTS 115

APPENDIX M. ARABIC S-PLUS LOGISTIC REGRESSION RESULTS 119

INDEX OF TERMS 121

LIST OF REFERENCES 123

BIBLIOGRAPHY 125

INITIAL DISTRIBUTION LIST 127

LIST OF FIGURES

FIGURE 1: PERSIAN BOXPLOT OF CATEGORY VERSUS FIRST SEMESTER GPA 26

FIGURE 2: PREDICTING PERSIAN DLPT PERFORMANCE WITH SEMESTER GPAS 36

FIGURE 3: OVERALL PERSIAN DLPT PERFORMANCE PREDICTORS 38

FIGURE 4: LISTENING DLPT PERFORMANCE PREDICTORS IN ARABIC (FULL MODEL) 46

FIGURE 5: LISTENING DLPT PERFORMANCE PREDICTORS IN ARABIC (PARTIAL MODEL) 47

FIGURE 6: READING DLPT PERFORMANCE PREDICTORS IN ARABIC (FULL MODEL) 48

FIGURE 7: READING DLPT PERFORMANCE PREDICTORS IN ARABIC (PARTIAL MODEL) 49

FIGURE 8: SPEAKING DLPT PERFORMANCE PREDICTORS IN ARABIC (FULL MODEL) 50

FIGURE 9: SPEAKING DLPT PERFORMANCE PREDICTORS IN ARABIC (PARTIAL MODEL) 51

FIGURE 10: PREDICTING ARABIC DLPT PERFORMANCE WITH SEMESTER GPAS 54

FIGURE 11: DLPT AND LISTENING CUMULATIVE SKILLS GPA (FULL MODEL) 57

FIGURE 12: DLPT AND LISTENING CUMULATIVE SKILLS GPA (PARTIAL MODEL) 58

FIGURE 13: DLPT AND SPEAKING CUMULATIVE SKILLS GPA (FULL MODEL) 59

FIGURE 14: DLPT AND SPEAKING CUMULATIVE SKILLS GPA (PARTIAL MODEL) 60

FIGURE 15: OVERALL ARABIC DLPT PERFORMANCE PREDICTORS 62

FIGURE 16: PERSIAN BOXPLOT OF CATEGORY VERSUS FIRST SEMESTER GPA 75

FIGURE 17: PERSIAN BOXPLOT OF CATEGORY VERSUS SECOND SEMESTER GPA 76

FIGURE 18: PERSIAN BOXPLOT OF CATEGORY VERSUS THIRD SEMESTER GPA 77

FIGURE 19: ARABIC BOXPLOT OF CATEGORY VERSUS FIRST SEMESTER GPA 101

FIGURE 20: ARABIC BOXPLOT OF CATEGORY VERSUS SECOND SEMESTER GPA 102

FIGURE 21: ARABIC BOXPLOT OF CATEGORY VERSUS THIRD SEMESTER GPA 103

FIGURE 22: BOXPLOT OF LISTENING CATEGORY VERSUS FIRST SEMESTER CUMULATIVE SKILLS GPA 105

FIGURE 23: BOXPLOT OF LISTENING CATEGORY VERSUS SECOND SEMESTER CUMULATIVE SKILLS GPA 106

FIGURE 24: BOXPLOT OF LISTENING CATEGORY VERSUS THIRD SEMESTER CUMULATIVE SKILLS GPA 107

FIGURE 25: BOXPLOT OF READING CATEGORY VERSUS FIRST SEMESTER CUMULATIVE SKILLS GPA 108

FIGURE 26: BOXPLOT OF READING CATEGORY VERSUS SECOND SEMESTER CUMULATIVE SKILLS GPA 109

FIGURE 27: BOXPLOT OF READING CATEGORY VERSUS THIRD SEMESTER CUMULATIVE SKILLS GPA 110

FIGURE 28: BOXPLOT OF SPEAKING CATEGORY VERSUS FIRST SEMESTER CUMULATIVE SKILLS GPA 111

FIGURE 29: BOXPLOT OF SPEAKING CATEGORY VERSUS SECOND SEMESTER CUMULATIVE SKILLS GPA 112

FIGURE 30: BOXPLOT OF SPEAKING CATEGORY VERSUS THIRD SEMESTER CUMULATIVE SKILLS GPA 113

LIST OF TABLES

TABLE I.1: DOD PROFICIENCY STANDARDS (ILR DESCRIPTIONS) 5

TABLE II.1: ARABIC C-TEST TWO (READING) GRADING SCALE 13

TABLE II.2: PERSIAN PHASE TEST CONVERSION TABLE 14

TABLE II.3: RESPONSE AND PREDICTOR VARIABLES 18

TABLE II.4: LETTER GRADE NUMERICAL EQUIVALENTS 19

TABLE III.1: PERSIAN DLPT VS. DLPT CORRELATIONS 23

TABLE III.2: PERSIAN DLPT AND FIRST SEMESTER GPA CROSSTABULATIONS 25

TABLE III.3: RESULTS OF STEPWISE LINEAR REGRESSION ON PERSIAN FULL MODEL 29

TABLE III.4: RESULTS OF STEPWISE LINEAR REGRESSION ON PERSIAN PARTIAL MODEL 30

TABLE IV.1: ARABIC DLPT.L AND LISTENING CUMULATIVE SKILLS FIRST SEMESTER GPA CROSSTABULATIONS 43

TABLE A.1: PERSIAN LISTENING PHASE TEST NUMERICAL SUMMARIES 67

TABLE A.2: PERSIAN READING PHASE TEST NUMERICAL SUMMARIES 67

TABLE A.3: PERSIAN SPEAKING PHASE TEST NUMERICAL SUMMARIES 67

TABLE A.4: PERSIAN GPA AND PROFICIENCY NUMERICAL SUMMARIES 68

TABLE B.1: PERSIAN DLPT-PROGRAM TEST CORRELATIONS 69

TABLE B.2: PERSIAN DLPT-SEMESTER GPA CORRELATIONS 70

TABLE B.3: PERSIAN LISTENING PHASE TEST-PHASE TEST CORRELATIONS 70

TABLE B.4: PERSIAN READING PHASE TEST-PHASE TEST CORRELATIONS 71

TABLE B.5: PERSIAN SPEAKING PHASE TEST-PHASE TEST CORRELATIONS 71

TABLE B.6: PERSIAN SEMESTER GPA CORRELATIONS 72

TABLE C.1: PREDICTING SUSTAINED PERFORMANCE ON PERSIAN PHASE TESTS 73

TABLE C.2: PREDICTING SUSTAINED PERFORMANCE WITH PERSIAN SEMESTER GPAS 73

TABLE D.1: PERSIAN DLPT AND FIRST SEMESTER GPA CROSSTABULATIONS 75

TABLE D.2: PERSIAN DLPT AND SECOND SEMESTER GPA CROSSTABULATIONS 76

TABLE D.3: PERSIAN DLPT AND THIRD SEMESTER GPA CROSSTABULATIONS 77

TABLE E.1: IDENTIFYING POTENTIAL DECISION POINTS FOR PERSIAN ATTRITION 79

TABLE G.1: ARABIC LISTENING C-TEST NUMERICAL SUMMARIES 83

TABLE G.2: ARABIC READING C-TEST NUMERICAL SUMMARIES 84

TABLE G.3: ARABIC SPEAKING C-TEST NUMERICAL SUMMARIES 84

TABLE G.4: ARABIC GPA NUMERICAL SUMMARIES 85

TABLE G.5: ARABIC DLPT NUMERICAL SUMMARIES 85

TABLE H.1: ARABIC DLPT-DLPT CORRELATIONS 87

TABLE H.2: ARABIC DLPT AND LISTENING C-TEST CORRELATIONS 87

TABLE H.3: ARABIC DLPT AND READING C-TEST CORRELATIONS 88

TABLE H.4: ARABIC DLPT AND SPEAKING C-TEST CORRELATIONS 88

TABLE H.5: ARABIC DLPT AND SEMESTER GPA CORRELATIONS 89

TABLE H.6: ARABIC DLPT AND CUMULATIVE SKILLS GPA CORRELATIONS 89

TABLE H.7.1: ARABIC LISTENING C-TEST CORRELATIONS 90

TABLE H.7.2: ARABIC LISTENING C-TEST CORRELATIONS 91

TABLE H.8.1: ARABIC READING C-TEST CORRELATIONS 92

TABLE H.8.2: ARABIC READING C-TEST CORRELATIONS 93

TABLE H.9.1: ARABIC SPEAKING C-TEST CORRELATIONS 94

TABLE H.9.2: ARABIC SPEAKING C-TEST CORRELATIONS 95

TABLE H.10: ARABIC SEMESTER GPA CORRELATIONS 96

TABLE H.11: ARABIC CUMULATIVE SKILLS SEMESTER GPA CORRELATIONS 96

TABLE I.1: PREDICTING SUSTAINED PERFORMANCE ON ARABIC LISTENING C-TESTS 97

TABLE I.2: PREDICTING SUSTAINED PERFORMANCE ON ARABIC READING C-TESTS 98

TABLE I.3: PREDICTING SUSTAINED PERFORMANCE ON ARABIC SPEAKING C-TESTS 99

TABLE I.4: PREDICTING SUSTAINED PERFORMANCE WITH ARABIC SEMESTER GPAS 99

TABLE I.5: PREDICTING SUSTAINED PERFORMANCE WITH ARABIC CUMULATIVE SKILLS SEMESTER GPAS 100

TABLE J.1: ARABIC DLPT AND FIRST SEMESTER GPA CROSSTABULATIONS 101

TABLE J.2: ARABIC DLPT AND SECOND SEMESTER GPA CROSSTABULATIONS 102

TABLE J.3: ARABIC DLPT AND THIRD SEMESTER GPA CROSSTABULATIONS 103

TABLE K .1: ARABIC DLPT.L AND LISTENING CUMULATIVE SKILLS FIRST SEMESTER GPA CROSSTABULATIONS 105

TABLE K.2: ARABIC DLPT.L AND LISTENING CUMULATIVE SKILLS SECOND SEMESTER GPA CROSSTABULATIONS 106

TABLE K.3: ARABIC DLPT.L AND LISTENING CUMULATIVE SKILLS THIRD SEMESTER GPA CROSSTABULATIONS 107

TABLE K.4: ARABIC DLPT.R AND READING CUMULATIVE SKILLS FIRST SEMESTER GPA CROSSTABULATIONS 108

TABLE K.5: ARABIC DLPT.R AND READING CUMULATIVE SKILLS SECOND SEMESTER GPA CROSSTABULATIONS 109

TABLE K.6: ARABIC DLPT.R AND READING CUMULATIVE SKILLS THIRD SEMESTER GPA CROSSTABULATIONS 110

TABLE K.7: ARABIC DLPT.S AND SPEAKING CUMULATIVE SKILLS FIRST SEMESTER GPA CROSSTABULATIONS 111

TABLE K.8: ARABIC DLPT.S AND SPEAKING CUMULATIVE SKILLS SECOND SEMESTER GPA CROSSTABULATIONS 112

TABLE K.9: ARABIC DLPT.S AND SPEAKING CUMULATIVE SKILLS THIRD SEMESTER GPA CROSSTABULATIONS 113

TABLE L.1: IDENTIFYING POTENTIAL DECISION POINTS FOR ARABIC ATTRITION IN LISTENING 115

TABLE L.2: IDENTIFYING POTENTIAL DECISION POINTS FOR ARABIC ATTRITION IN READING 116

TABLE L.3: IDENTIFYING POTENTIAL DECISION POINTS FOR ARABIC ATTRITION IN SPEAKING 117

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EXECUTIVE SUMMARY

The Defense Language Institute Foreign Language Center (DLIFLC) is responsible for the language training of enlisted and officer personnel of the four armed services and a small number of federal civilians. Program tests and semester grade point averages (GPAs) evaluate satisfactory progress within any DLIFLC language program. Student success is realized in the evaluation of student proficiency in listening, reading, and speaking skills on the Defense Language Proficiency Test (DLPT). Completion of the DLPT is a graduation requirement for all students enrolled in any of the twenty-one language programs at DLIFLC.

The purpose of this study is to determine how major program tests, semester grade point averages, and cumulative skills GPAs in the Arabic and Persian language departments relate to success on the DLPT. These two particular languages are studied at the request of the Arabic and Persian deans. The results of this study will assist the deans managing these language departments in interpreting the meaning of program tests, semester GPAs, and cumulative skills GPAs when making decisions about attrition and academic performance.

The focus of this thesis is threefold. First, we seek to determine if major program tests, cumulative skills GPAs, or semester GPAs are predictive of DLPT performance in the Arabic and Persian language programs by determining the relationship between each major program test grade or semester GPA and the DLPT in listening, reading, and speaking. The relationship of cumulative skill semester GPAs to the DLPT is also explored. Secondly, we concentrate our attention on sustained student performance across all three semesters and predictors of performance from test to test and semester to semester through the relationships among each of the major program tests, semester GPAs, and cumulative skills GPAs. Finally, we determine if individual program tests could be identified as having a strong relationship to DLPT performance to aid the language programs in recycling or dropping students.

The major program tests, known as "phase tests" in Persian and "C-Tests" in Arabic, are useful predictors of DLPT performance in the skills of listening, reading, and speaking because the major program tests independently assess these three skills as well. In addition, tests taken towards the latter half of the curriculum tend to be more predictive of DLPT performance than those of the first half. Stepwise regression and regression trees are used to create the models. In the Persian analysis, the last two phase tests are selected as the most predictive in all three skills. However, the first two phase tests appear in the models as well. In the Arabic analysis, the following C-Tests appear in the models: eleven, twelve, fourteen, fifteen, and semester tests two and three. C-Test eleven appears in the majority of the models, and semester tests two and three appear in half of the models, each. Very few tests taken earlier in the course appear in the models.

Our initial belief is that the cumulative skills GPAs are the best overall predictors of Arabic DLPT performance. From the classification tree analysis, we find the cumulative skills GPAs prove themselves to be valuable tools in forecasting DLPT performance in listening, reading, and speaking. The GPA intervals provide the Arabic language program with an objective, versus subjective, instrument to predict DLPT performance. Interestingly, the cumulative skills GPAs are not identified as the best overall predictors of DLPT performance.

Instead, we find semester GPAs to be the best overall predictors. We are interested in how well semester GPAs can predict DLPT performance. Classification trees and continuation ratio models are used. Because the semester GPA includes a variety of different grades and areas of study not strictly limited to the assessment of the three skill areas, we believe that the semester GPA would not be as useful as the program tests or cumulative skills GPAs. However, the analysis shows the value of the semester GPAs. For Persian, semester GPAs one and two are good indicators, and for Arabic, semester GPAs two and three are good indicators of DLPT

performance. Semester GPAs are identified as being the best overall predictors of DLPT performance for both Persian and Arabic.

In trying to predict performance on a future test or GPA based on previous test or GPA performance, we find inconsistent results. For Persian phase tests, the analysis provides little evidence that we can predict future achievement based on past achievement. However, for Arabic, there appears to be some credence to this. The inconsistency could be because the Arabic C-Tests were designed and carefully orchestrated to address a content and skill progression in their tests. Although Persian phase tests relate to the course content and a skill progression, they appear to do so to a lesser extent than Arabic. For both the Persian and Arabic, we find previous semester GPAs and cumulative skills semester GPAs to be predictive of future GPAs. These results are supported by the very high correlations between the GPAs.

This study shows that major program tests, semester GPAs, and cumulative skills GPAs are all useful tools in predicting DLPT success. I recommend that DLFLC use the results and models to predict student performance in the Arabic and Persian language programs. Each of the models presented can also be used in similar analysis for other DLIFLC language programs. However, these models are only as reliable as their inputs. To increase the reliability of these models, I recommend that DLIFLC review the program tests for content and the testing of skill progression. This will ensure students are being exposed to questions specifically related to course material, but more importantly to questions that will increasingly assess their proficiency within the language and the three skills with each successive test. I also recommend that complete student records, including semester GPAs, program test raw scores, and cumulative skills GPAs, be retained for a period of at least two years to facilitate further analysis.

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I. INTRODUCTION

The Defense Language Institute Foreign Language Center (DLIFLC) is located at the United States Army Presidio of Monterey, California. It is responsible for the language training of enlisted and officer personnel of the four armed services and a small number of federal civilians. Satisfactory progress within any language program is defined as maintaining at least a C– average in course work as evaluated by program tests and semester grade point averages (GPAs). Student success is realized in the evaluation of student proficiency in listening, reading, and speaking skills on the Defense Language Proficiency Test (DLPT). The purpose of this study is to determine how major program tests, semester GPAs, and cumulative skills GPAs in the Arabic and Persian language departments relate to success on the DLPT. These two particular languages are studied at the request of the Arabic and Persian deans. The results of this study will assist the deans managing these language departments in interpreting the meaning of program tests, semester GPAs, and cumulative skills GPAs when making decisions about attrition and academic performance.

A. BACKGROUND

1. History of DLI and its Purpose

The mission of the DLIFLC is to train, sustain, and evaluate foreign language skills of linguists under the guidelines of the Defense Foreign Language Program (DFLP). The DFLP provides the Department of Defense and other Federal agencies with linguists capable of supporting United States national interests worldwide. In accomplishing its three primary mission areas, DLIFLC ensures that our military forces are prepared to meet global foreign language requirements. (DLIFLC General Catalog, 1996)

Training consists of basic, intermediate, advanced, and specialized programs. There are 21 languages taught at DLIFLC Monterey with a total capacity of 3000 students per year. Eighty percent of students receiving training at DLIFLC also receive post-graduation training at Goodfellow Air Force Base, Texas or Fort Huachucha, Arizona. The student population is comprised of 70% Cryptologic Training System students, 21% General Intelligence Training System, and 9% Astronauts, Federal Agency students, and International students. (Payne, 1993)

DLIFLC curricula are designed to develop the language skills and knowledge service members will need at their final field assignments. The bases for the curricula are the Final Learning Objectives (FLOs). The National Security Agency and Defense Intelligence Agency, in coordination with the four military services, set the standards for the vast majority of students in the Defense Foreign Language Program. DLIFLC combined the requirements from both communities into a single set of program objectives for all students known as the FLOs (DLIFLC General Catalog, 1996).

2. DLI Tests

DLIFLC uses four testing tools to assess student aptitude and performance. These tests are (1) the Defense Language Aptitude Battery (DLAB), administered prior to DLIFLC training; (2) the "major program tests" administered periodically throughout a DLFLC basic course; (3) the Performance FLO tests, administered at the end of DLIFLC training; and (4) the Defense Language Proficiency Test (DLPT), also administered at the end of DLIFLC training. The DLAB is used by all of the Services as a screening device for identifying individuals who have the potential to study a foreign language under the DFLP. It has been shown that the higher the DLAB score, the better the chances for success in the course (Lett & O'Mara, 1990). The major program tests are developed within the respective language departments, by teaching teams or individual instructors, in order to evaluate student progress in course work. Specific linguist job

skills such as translation and transcription are tested by the Performance FLO tests. These tests were developed by DLI to be used with the DLPT to evaluate whether or not graduating students have met the training objectives (DLIFLC, 1995). Proficiency FLOs, which encompass the traditional language skills of listening, reading, and speaking, are tested by the DLPT. This research will focus exclusively on major program tests and the DLPT, specifically in the Arabic and Persian language programs.

A major program test is a test developed by a particular language department given to all students enrolled in that language department at predetermined testing intervals to assess student progress in course work. Arabic has 18 major program tests administered over the course of 63 weeks and Persian has six tests administered over the course of 47 weeks. These tests individually appraise the listening, reading, and speaking skills of the students.

Program tests are developed in the language schools and not by the centralized DLIFLC Test Development Division. Program tests are not routinely evaluated for their validity and reliability in the manner that the DLPT and Performance FLO tests developed by the DLIFLC Test Development Division are. However, performance on these major program tests determines whether or not an individual is succeeding in assigned course work. A minimum grade of C– must be maintained in all course work to remain in the language program. If an individual fails to maintain a C– in course work for a period of four consecutive weeks, he or she may be recycled to a point earlier in the course or removed from the class altogether. Thus, performance on the major program tests is key to the success of the student. The major program speaking test is an oral response test administered and graded at the target language school by a speaker of the target language. For Arabic, major program reading and listening tests are constructed-response tests except for semester tests, which are multiple-choice. For Persian Farsi, major program reading and listening tests are multiple-choice.

The DLPT has been used since 1958 to evaluate military personnel's acquired or maintained language proficiency in listening, reading, and speaking. DLPT listening and reading tests are multiple-choice tests graded by computer. DLPT speaking tests are oral response tests administered and graded under the auspices of the DLIFLC Proficiency Tester Education Division by certified testers. Military personnel continue to take the DLPT listening and reading tests throughout their careers. The results of the DLPT are used to award incentive pay for those in billets requiring language skills to ensure they remain proficient.

The DLPT is designed to assess how well individuals can use their foreign language functionally, regardless of how they acquired their language proficiency. The DLPT is developed by the Test Development Division of the Directorate of Evaluation and Standardization, DLIFLC. It has been shown to be both reliable and valid, and has been endorsed by the American Council on Education (ACE) as an acceptable basis for the awarding of college or university credits (Payne, 1996).

Completion of the DLPT is a graduation requirement for all students enrolled in one of the twenty-one language programs at DLIFLC. Department of Defense (DoD) DLPT proficiency standards, also known as Interagency Language Roundtable (ILR) Descriptions, are outlined in Table I.1. The level of proficiency is assigned based on a "base level" of 0, 1, 2, or 3. Each level also has an associated "plus level." The "plus level" designation is assigned when proficiency exceeds one base skill level but does not fully meet the criteria for the next base level. (DLPT IV Familiarization Guide, 1991)

DLIFLC's training goal is to have at least 80 percent of graduates in all basic courses meeting Level 2 in listening, reading, and speaking on the DLPT. Level 2 students exhibit sufficient comprehension to understand conversations and to meet routine social demands and limited job requirements, and they possess sufficient comprehension to read simple, authentically

written material. Level 1 students possess elementary proficiency in areas of immediate need or on very familiar topics.

Instead of being defined in terms of individual skills scores, success on the DLPT is sometimes defined in terms of attaining a " 2/2/1 or higher" or a "2/2/2 or higher." A 2/2/1 indicates that a student has attained a proficiency level of 2 in both listening and reading skills and a proficiency level of 1 in speaking for his or her language. A 2/2/2 indicates that a student has attained a level 2 in all three skills. To be eligible for follow-on training, enlisted personnel must attain a 2/2/1 for training at Goodfellow AFB or a 2/2/2 for training at Fort Huachucha, Arizona.

Table I.1: DoD Proficiency Standards (ILR Descriptions)

LEVEL	FUNCTIONS/TASKS	CONTEXT/TOPICS	ACCURACY
3	Support Opinions Hypothesize Explain Deal with Unfamiliar topics	Practical Abstract Special Interests	Errors never interfere with communication and rarely disturb the native speaker
2	Narrate Describe Give directions	Concrete Real-World Factual	Intelligible even if not used to dealing with non-native speaker
1	Q and A Create with the Language	Everyday survival	Intelligible with effort or practice
0	Memorized	Random	Unintelligible

3. Test Review and Evaluation

The Arabic course is comprised of fifteen training units. Each succeeding unit is intended to further develop language skills by building on material previously learned in earlier units. These units span the three semesters, and each unit is accompanied by a major program test. Semester tests are given at the end of each semester and are considered to be major program tests as well.

In May 1995, the Arabic language major program tests, known as C-Tests, underwent major revisions. The goal of the revisions was to tailor the curriculum so that the C-Tests would gradually reflect progressively higher proficiency levels in the functions, tasks, context, and

topics depicted in Table I.1. The development of performance FLO skills requires the development of reading, listening, and speaking skills. The C-Tests were designed to reflect a progression of the skills needed to ultimately achieve proficiency and performance FLO objectives at the end of the course. Material reflective of the real-world is incorporated into the tests to help achieve this. In developing the new C-Tests, the Arabic language program received general assistance and advice from the DLIFLC Test Development Division in database management and statistical analysis.

The Arabic question format of C-Tests was changed from multiple-choice response to constructed response, except for semester tests. Semester tests remain multiple-choice. Because there is no single correct answer for constructed responses, a comprehensive list of acceptable responses for each question was compiled to guide teachers in grading and scoring. Graders are permitted to raise the question as to whether answers not found on the protocol are also correct. If such an answer is deemed as being acceptable by a program test review committee, the answer is added to the protocol. As the C-Tests were being developed, each test question on all eighteen C-Tests was evaluated for its difficulty and discriminating power. Difficult and redundant questions were eliminated. Beyond this, further Item Analysis has seldom been performed.

The Persian language program has not undergone major revisions in its major program tests, known as phase tests, within the last ten years. There are six, multiple-choice response phase tests. The phase tests in place have not been validated nor undergone Item Analysis on a large scale. The content and tasks of each successive program test were not selected, when the tests were developed, to reflect a progression of the skills needed to achieve the proficiency and performance FLO objectives at the end of the course. However, the Persian department chair believes that the phase tests include content compatible with the progressive development of proficiency and performance FLO skills throughout the course.

4. Student Characteristics

The overall student population is approximately 57 percent Army, 25 percent Air Force, 12 percent Navy, five percent Marine Corps; the remainder are civilian or foreign service students. The percentage of language students arriving directly from Basic Military Training is approximately 75 percent for the Army, 81 percent for the Air Force, 86 percent for the Navy, and 60 percent for the Marine Corps.

A language class could potentially consist of initial entry students, recycled students, and "re-languaged" students. Initial entry students are students new to the military. Recycled students are students placed back into a later class at a point within the course to make up deficiencies in performance. Re-languaged students are students who do not make satisfactory progress in a difficult language, such as Arabic; those students are then assigned to languages that are easier for English-speaking students to learn. Re-languaged students are seldom, if ever, placed into Arabic or Persian.

B. LITERATURE REVIEW

Although success on Arabic and Persian major program tests is germane to completing all course work in the language and success on the DLPT is germane to success on the job, no studies have been performed to determine the relationship between the two for either language. No studies have been done to determine if the cumulative skills GPA is predictive of DLPT performance nor have any studies been done to determine if the semester GPA is predictive of DLPT performance. However, DLIFLC has conducted a study, the Language Skill Change Project, to identify student characteristics predictive of DLPT performance. Additionally, a study relating performance objectives to DLPT performance has been conducted.

The Language Skill Change Project Report II (O'Mara, Lett, and Alexander, 1994) reports that cognitive ability and aptitude, as measured by the DLAB, consistently predict

success in foreign language learning. However, student attitudes, motivation, and applied learning strategies also make significant contributions to the prediction of listening and reading skills. These results coincide with the results of a civilian study conducted by Ehrman and Oxford (1995) at the Foreign Service Institute of the U. S. Department of State. The variables tested were cognitive aptitude, learning strategies, personality, and motivation. Results show that cognitive aptitude, as measured by the Modern Language Aptitude Test (MLAT), is strongly correlated with proficiency. Motivational factors showed the next highest level of correlation with proficiency.

Marchant (1998) performed a study that compared proficiency objectives (DLPT performance), performance objectives (performance FLO tests), and success at follow-on training. The population for her analysis included all twenty-one languages at DLIFLC. She found that in some languages such as Polish, the performance objectives are better predictors of success on the DLPT than in other languages. However, for Arabic and Persian, the performance objectives are not good predictors of DLPT success in listening, reading, or speaking. Overall, Marchant found that the performance FLO tests do not have consistent patterns of correlations with DLPT results across the languages or skills. Additionally, the DLPT reading and speaking portions are predictive of success at follow-on training for the Army Russian course but not for the Navy/Marine Corps Russian course.

C. PROBLEM DESCRIPTION

This study will determine if major program tests, cumulative skills GPAs, or semester GPAs are predictive of DLPT performance in the Arabic and Persian language programs. It will do this by determining the relationship between each major program test grade or semester GPA and the DLPT in listening, reading, and speaking. The relationship of cumulative skill semester GPAs to the DLPT will also be explored.

Additionally, this study will focus on sustained student performance across all three semesters and predictors of performance from test to test and semester to semester through the correlations among each of the major program tests, semester GPAs, and cumulative skills GPAs. With linear regression, we will also determine if the combination of all previous program tests or semester GPAs has a relationship to the next successive program test or semester GPA.

Finally, if individual program tests are shown to have a strong relationship to DLPT performance, these particular test grades should be looked at more carefully before a decision is made to drop a student. To identify an appropriate point for recycling or dropping students, successive multiple linear regression in the chronological order of the tests will be used.

None of the linear regression models include interactions because DLIFLC research personnel believe that the linear terms fully capture the models and that interaction terms are not interpretive for DLIFLC test performance. Residual analysis was done for the regression models to verify that the linear modeling assumptions are appropriate (Hamilton, 1992). The results of the residual analysis reveal that the errors have constant variance, the errors are normally distributed, and there are no signs of autocorrelation (errors are uncorrelated with each other).

D. ORGANIZATION OF THESIS

Chapter II is a description of the population, data, and variables considered. Chapter III is a description of the methods used to analyze the Persian language program data and the results of the analysis. Chapter IV contains a description of the methods used to analyze the Arabic language program data and the results of the analysis. Chapter V contains a summary of the findings, the conclusions, and recommendations based on the findings. The Appendices present the tables, figures, and S-Plus results for the models.

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II. DATA AND VARIABLES CONSIDERED

DLIFLC maintains a database of all students who have attended the school. The database includes demographic and academic statistics for each student. DLPT scores were acquired from this database. Program test scores for both the Arabic and Persian language programs are maintained by each program and were acquired directly from them.

A. BACKGROUND OF DATA

Arabic C-Tests are evaluated based on the number of correct responses. Each skill portion (i.e., listening, reading, and speaking) of each test is assigned a raw score, the number of points awarded by the graders, based on correct responses. The raw score is then converted to a letter grade based on the current conversion table for that particular test. Eleven letter grades are possible. They are A, A–, B+, B, B–, C+, C, C–, D+, D, and F. The letter grade is archived for each student and kept on record for a period of one year. Grading is accomplished by teams, but team makeup changes over time.

There is a separate conversion table (to letter grades) for each Arabic C-Test and for each skill portion of the test, except for speaking. The conversion from raw score to letter grade is invariant across C-Tests for speaking. The conversion tables are reviewed every six months, and if necessary, grade cut-offs are adjusted. This adjustment is to maintain a consistent distribution of letter grades across C-Tests. Generally, the Arabic language program desires approximately 15 percent of students to receive either an A or A–, 40 percent to receive either a B+, B, or B–, 35 percent to receive a C+, C, or C–, and the remainder to receive less than a C–. If the percentages in the six months of historical data sharply differ from these goals, the conversion table is adjusted for that particular skill portion of that particular test. In other words,

the conversion table of each skill portion of each C-Test is evaluated, and if necessary, adjusted based on six months of historical data.

It is desired that the conversion from raw score to the letter grade be smooth. This means that the intervals for each letter grade should not be of greatly different magnitude (i.e., within the category of B scores, a B– of 31-33, a B of 34-36, and a B+ of 37-40, would be preferred to a B– of 31-32, a B of 33-39, and a B+ of 40). Conversions to letter grades lower than C– pose a problem since a score lower than a C– could spur the placement of a student onto probation. The cutoffs for C– and D+ receive particular attention to determine if students making lower than a C– are actually plausible candidates for probation. Conversely, there is concern to determine if there are any students scoring C– or higher who ultimately do not perform well on later tests.

Due to the adjustment of the conversion tables, a raw score may be equivalent to one letter grade on a particular test at one point in time, and equivalent to a different letter grade on the same program test administered at another point in time. For example, Table II.1 shows two grading scales for C-Test two in reading. Note how the raw score conversions of the last four rows differ. Data from six classes before April 1997 were used to produce the April 1997 scale and data from the six classes between April and October were used to produce the October 1997 scale. There was no effort to produce conversions based on all the data available for the particular test, as with a moving average.

Students in the Arabic language program are evaluated with a cumulative skills GPA and a semester GPA. A separate cumulative skills GPA is computed for each skill (listening, reading, and speaking) for each semester. Thus, three cumulative skills GPAs are computed at the end of every semester. The cumulative skills GPA for each semester in each skill is calculated based upon certain weights assigned to the C-Tests and certain weights assigned to the semester tests. The cumulative skills GPA scale ranges from 0.00 to 4.00 for each skill. The semester GPA is a

comprehensive average that includes the components of the cumulative skills GPAs for each semester and the grades for other subjects such as the area studies, geography, and history related to the language. It is computed by assigning certain weights to each of the course grades within a given semester. The semester GPA also is reported on a scale from 0.00 to 4.00.

Table II.1: Arabic C-Test Two (Reading) Grading Scale

15 Apr 97		07 Oct 97	
Raw Score	**Letter Grade**	**Raw Score**	**Letter Grade**
56-55	A	56-55	A
54	A–	54	A–
53	B+	53	B+
52	B	52	B
51-50	B–	51-50	B–
49-47	C+	49-47	C+
46-44	C	46-44	C
43-41	C–	43-36	C–
40-35	D+	35-33	D+
34-25	D	32-25	D
24	F	24	F

Persian phase test grades are evaluated based on the number of correct responses. Each skill portion (i.e., listening, reading, and speaking) of each test is assigned a raw score based on correct responses. The raw score is then converted to a letter grade based on the conversion grade scale. However, the raw score, not the letter grade, is archived for each student. Tests are sometimes graded by teams, and often times by an individual. This may lead to inconsistencies in grading.

Unlike Arabic, the Persian departments do not have a separate grading scale for each Persian phase test or for each skill portion of the test. The current grading scale has been in place for at least five years, and there is one grading scale applied to every phase test in each skill. Adjustments to grades may be made if a class performs poorly on a phase test compared to previous classes. This adjustment is made after reviewing the class mean and standard deviation in comparison to other classes. The standard grading scale used by the Persian language program is shown in Table II.2.

Persian language students are evaluated with a semester GPA. The Persian departments do not compute a cumulative skills grade like the Arabic language program, although each skill is assessed separately per phase test. The semester GPA is calculated in a fashion similar to that of Arabic. It is computed by assigning certain weights to each of the course grades within a given semester. Course grades are comprised of phase test grades and grades for other subjects such as the area studies, geography, and history related to the language. Again, it is reported on a scale from 0.00 to 4.00.

Table II.2: Persian Phase Test Conversion Table

Raw Score	Letter Grade
100-98	A
97-95	A–
94-91	B+
90-87	B
86-84	B–
83-80	C+
79-77	C
76-74	C–
73-68	D

B. POPULATION CONSIDERED

Training at DLIFLC consists of basic, intermediate, advanced, and specialized programs. However, the scope of this study is limited to students in the basic programs of Arabic and Persian language instruction. The basic program is largely composed of enlisted military students who have had one or fewer years of military service.

In exploring the relationship between each major program test score, semester GPAs, cumulative skills GPA, and DLPT scores, we include students from nine Persian classes and nine Arabic classes who successfully completed all basic program course work and took the DLPT. The earliest Persian class considered is from FY93, with most classes falling between FY96 and FY97. The Arabic classes considered belong to FY96 through FY98. Since Arabic program test scores are categorical and Persian program test scores are numeric, it is impractical to analyze the Persian and Arabic data together or to report combined results. For DLPT analysis, the original Arabic data set contains records for 319 students, and the original Persian data set contains records for 232 students. However, due to missing test scores in the database, the data set was reduced to 268 Arabic and 161 Persian students.

In exploring the relationship between each of the major program tests, the relationship of previous program tests to the next successive program test, and the relationship between each of the cumulative skills GPA and semester GPAs, we include students from nine Persian classes and nine Arabic classes who have data for all the variables of interest. For this analysis, the original Arabic data set contains records of 409 students, and the original Persian data set contains records of 232 students. Due to missing test scores in the database, the data set was reduced to 311 Arabic and 209 Persian students.

Cumulative skills GPAs are relevant only to the Arabic language program. Both the Arabic and Persian language programs appraise listening, reading, and speaking skills separately

on each of their major program tests. In the Arabic language program, the grades assigned to each skill portion of each test are averaged across a semester to make up the semester cumulative skills GPA for each of the three skills, weighted based on the semester, and used to determine a final cumulative skills GPA for each of the three skills. The Persian language program does not use a cumulative skills GPA because there are only six major program tests (two per semester) in Persian compared to eighteen major program tests in Arabic (eight in semester one, six in semester two, and four in semester three).

C. VARIABLES

A detailed listing of the variables is given in Table II.3.

1. DLPT Analysis: Response Variables

The response, or dependent, variables for this portion of the study are the scores obtained on the DLPT in listening, reading, and speaking. The DLPT is used as the standard for successful completion of the initial course of language instruction. There are three types of DLPT scores: raw, converted, and level. The raw score is the number of questions answered correctly, and the DLPT raw scores in listening and reading are based on a scale of 0 to 60 points. This score is then transformed into the converted score, which is also based on a scale of 0 to 60 points. These numeric, converted scores may then be transformed into level scores which is based on a scale of eleven points. The possible level scores are 0, 0+, 1, 1+, 2, 2+, 3, 3+, 4, 4+, and 5. Levels 3+, 4, 4+, and 5 are not awarded at DLIFLC for reading and listening; however any score may be awarded for DLPT in speaking. The scale of level scores (Table I.1) indicates levels of proficiency for military linguists as defined by verbal descriptions approved by the Federal Interagency Language Roundtable. For this analysis, the converted scores are used.

2. DLPT Analysis: Predictor Variables

The predictor variables used in this portion of the study are the listening, reading, and speaking major program test grades per test per semester, semester GPAs for three semesters, and for Arabic, the cumulative skills semester GPAs for listening, reading, and speaking. For Persian, program test scores are based on a scale of zero to 100. For Arabic, program test scores are converted letter grades based on a numeric score for each program test. Each program test's conversion of the raw score to a letter grade is based on a different scale. Semester GPAs and cumulative skills GPAs range from 0.0 to 4.0.

3. Program Test and GPA Analysis: Response/Predictor Variables

The response and predictor variables for this portion of the study are the scores obtained on each of the program tests, semester GPAs, and cumulative skills GPAs.

D. LIMITATIONS OF DATA

The data obtained from the Persian language program consists only of those students who took the DLPT. It does not include those students who began the basic program and were later dropped due to academic or administrative reasons. Those program test scores and GPAs could have been useful in exploring the pairwise relationships among the program tests and GPAs.

The data obtained from the Arabic language program is not in a standardized form for the period from FY96 to FY98. Most of the program test scores are letter grades based on a changing, sliding scale. An 'A' on a particular program test for one particular class may not correspond to an 'A' on that same program test in another class at a later point in time. Numeric raw scores were obtained, where possible, but complete numeric raw scores for all program tests for any one particular class were not available in the Arabic language program database. Mixed forms (i.e., numeric and categorical) of the data could present confusing and meaningless results.

However, to a lesser degree, using just the categorical letter grade could also produce confusing results because of the sliding grade scales. For consistency, letter grades will be converted to their numerical equivalent as outlined in Table II.4 and used in the Arabic analysis.

Table II.3: Response and Predictor Variables

Variable Name	Description
DLPT.L	DLPT Listening Score
DLPT.R	DLPT Reading Score
DLPT.S	DLPT Speaking Score
SEM1.GPA	First Semester GPA
SEM2.GPA	Second Semester GPA
SEM3.GPA	Third Semester GPA
LCSK1.GPA	First Semester Listening Cumulative Skills GPA
LCSK2.GPA	Second Semester Listening Cumulative Skills GPA
LCSK3.GPA	Third Semester Listening Cumulative Skills GPA
RCSK1.GPA	First Semester Reading Cumulative Skills GPA
RCSK2.GPA	Second Semester Reading Cumulative Skills GPA
RCSK3.GPA	Third Semester Reading Cumulative Skills GPA
SCSK1.GPA	First Semester Speaking Cumulative Skills GPA
SCSK2.GPA	Second Semester Speaking Cumulative Skills GPA
SCSK3.GPA	Third Semester Speaking Cumulative Skills GPA
$\mathbf{LPHASE_i}$	Listening Persian Phase Test Score on test i, $\{i = 1,\ldots,6\}$
$\mathbf{RPHASE_i}$	Reading Persian Phase Test Score on test i, $\{i = 1,\ldots,6\}$
$\mathbf{SPHASE_i}$	Speaking Persian Phase Test Score on test i, $\{i = 1,\ldots,6\}$
$\mathbf{LC_i}$	Listening Arabic C-Test Score on test i, $\{i = 1,\ldots,18\}$
$\mathbf{RC_i}$	Reading Arabic C-Test Score on test i, $\{i = 1,\ldots,18\}$
$\mathbf{SC_i}$	Speaking Arabic C-Test Score on test i, $\{i = 1,\ldots,18\}$

Table II.4: Letter Grade Numerical Equivalents

LETTER GRADE	NUMERICAL EQUIVALENT
A	4.0
A–	3.7
B+	3.3
B	3.0
B–	2.7
C+	2.3
C	2.0
C–	1.7
D+	1.3
D	1.0
F	0.7

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III. PERSIAN LANGUAGE PROGRAM METHODOLOGY AND FINDINGS

DLIFLC's training goal is to have at least 80 percent of graduates in all basic courses meeting Level 2 in listening, reading, and speaking on the DLPT. The results obtained on the DLPT are used to award incentive pay and to assign follow-on training. Because of the importance of the DLPT in these two regards, DLIFLC is interested in identifying factors that are predictive of DLPT performance. The factors explored include major program tests and semester GPAs.

Section A introduces preliminary analysis in the form of correlations and crosstabulations. Additionally, Section A focuses on sustained student performance on phase tests and semester GPAs as predicted by previous phase tests and semester GPAs. DLIFLC research personnel hypothesize that performance on previous tests or semester GPAs should be predictive of performance on a successive test or GPA (e.g., can we predict a student's performance on phase test three from his or her performance on phase tests one and two?). This relationship will be examined using multiple linear regression. Section B explores whether major program tests are predictive of DLPT performance. It does this by ascertaining the relationship between each program test grade and the DLPT in listening, reading, and speaking with stepwise linear regression. Section B also attempts to identify an appropriate point for recycling or removing students. Section C determines if semester GPAs are predictive of DLPT performance with a continuation ratio model and a classification tree. Section D identifies the overall best predictor of Persian DLPT performance. The tables applicable to the Persian data analysis are included in the text and Appendices A through F.

A. EXPLORATORY DATA ANAYLSIS RESULTS

The results in this section are exploratory. The focus of this discussion is correlations and crosstabulations. In particular, we use correlations to describe the relationship among DLPT tests, phase tests, and semester GPAs. We also use crosstabulations to describe the relationship between the DLPT and semester GPAs. From the correlations and crosstabulations, conclusions cannot be made about the relationship among several variables at once, only between pairs of variables. Both the correlations and crosstabulations are included at the request of DLIFLC research personnel to help them gain a preliminary understanding of the data. Thus, a more detailed analysis (multiple regression) of the data describing the relationship between phase tests and semester GPAs is also included in Section A. In addition, multiple regression between the DLPT and phase tests examining the relationship among several variables at once is included in Section B. Descriptive statistics for variables are found in Appendix A.

1. Correlations

A correlation is a numerical summary used to measure the strength of the linear relationship between variables (Frees, 1996). It does not distinguish between a dependent and independent variable. Nor does it quantify relationships among several variables, only between pairs of variables. Linear regression is a way to understand the relationship among several variables at once. The results of the linear regression will be provided in Section B.

We will define the correlation to be low, moderate or high if the correlation coefficient meets the following criteria: low if coefficient is between 0.01 and 0.400, moderate if correlation coefficient is between 0.401 and 0.699, and high if the coefficient is between 0.700 and 1.00. Appendix B lists pairwise correlations among all the phase tests, semester GPAs, and DLPT scores. However, as an example, the DLPT vs. DLPT correlation matrix is shown in Table III.1.

From Table III.1, there appears, for the most part, to be moderate correlation among the DLPT skill tests. The DLPT reading and listening tests have the highest correlation at 0.581.

Table III.1: Persian DLPT vs. DLPT Correlations

	DLPT.L	DLPT.R	DLPT.S
DLPT.L	1	.581	.469
DLPT.R	.581	1	.349
DLPT.S	.469	.349	1

In regard to all correlations with the DLPT, we note that from Table B.1 in Appendix B, the DLPT listening test has the highest correlations with phase tests two, five, and six across all three skills of listening, reading, and speaking. Likewise, the DLPT reading test has the highest correlations with phase tests two, five, and six across all three skills of listening, reading, and speaking. The DLPT speaking test has the highest correlations with phase tests two, five, and six in listening and reading and phase tests three, four, and six in speaking. These results agree with linear regression results obtained in Section B. From Table B.2 in Appendix B, we note that there is a low to moderate correlation between DLPT skill tests and semester GPAs. The DLPT speaking test and all three semester GPAs have moderate correlations with semester 3 GPA having the highest correlation at 0.561. The DLPT listening test and semester 1 and semester 3 GPAs have moderate correlations as well at 0.476 and 0.477, respectively. The DLPT reading test is moderately correlated with semester 3 GPA at 0.408.

Correlations between phase tests and between semester GPAs may be seen in Tables B.3, B.4, B.5, and B.6. Detailed relationships among phase tests and semester GPAs, to include determining the relationship among several variables at once, can be seen in Appendix C. Appendix C presents the results of the studies focusing on sustained student performance on phase tests and GPAs as predicted by other phase tests and GPAs. Multiple linear regression is

used to determine if student performance on previous phase tests can be used to predict performance on the next successive phase test in each respective skill of listening, reading, and speaking. The residual standard error (RSE), degrees of freedom (d.o.f.), unadjusted R^2, and phase tests with significant p-values ($p < 0.05$) are reported for each model. The degrees of freedom vary from model to model because of missing test scores. This analysis follows Hamilton (1992). Overall, because of the low R^2 for each of the phase test models in Table C.1, it appears that previous tests are not as predictive of successive tests as we would like. To gauge the predictability of one test by other tests, the correlation table may be a better tool. The same holds true for the semester GPAs.

2. Crosstabulations

To get an idea of dependence, we analyze the data by cross-classifying it and obtaining a count of the number of cases in each cell. From this, a multi-way contingency table, or crosstabulation table, can be created to show the levels and counts. Like correlations, crosstabulations indicate relationships between pairs of variables and not the relationships among several variables at once. In this regard, it is limited in its value when several variables, such as three semester GPAs, are used as predictors.

The crosstabulations show semester GPA intervals, one semester GPA at a time, that correspond to attaining minimum DLPT scores. When there are several predictor variables, a more useful tool in predicting semester GPA intervals that correspond to attaining minimum DLPT scores, taking into account all of the GPAs at once, is a classification tree, discussed in Section C. Appendix D details the crosstabulations between semester GPAs and achieving at least a 2/2/2, either a 2/2/1 or 2/2/1+, and less than a 2/2/1 on the DLPT. The categories are defined as follows: 2 - at least a 2/2/2, 1 - either a 2/2/1 or 2/2/1+, 0 - not achieving at least a 2/2/1. The 2/2/1 and 2/2/1+ are combined because a student who receives a 2/2/1+ is not eligible

for follow-on training at Fort Huachuca, whose DLPT cutoff is 2/2/2, but is eligible for training at Goodfellow AFB.

The cell of each semester "GPA interval" contains the number of students falling within a particular GPA range and the percentage within that row. For example, Table III.2 shows the crosstabulations of semester one GPA to the DLPT score. For the first semester GPA, it appears that students with a GPA of 2.9 or greater are most likely to get at least a 2/2/2 on the DLPT since the row percentages in category 2 for GPAs at least 2.9 are all greater than 75%. For example, 80.5% of the students with GPAs between 3.0 and 3.2 finished in category 2. Results of obtaining a 2/2/1 or 2/2/1+ on the DLPT are also shown.

Figure 1 is a boxplot that provides us with a graphical representation of the column spread of the first semester GPA versus the three categories. It shows that there is roughly constant variability across the three categories. We see that the median first semester GPA for category 2 is about 3.3, whereas the medians for category 0 and 1 are approximately the same at 2.9. Please see Hamilton (1992) for a detailed description of boxplots.

Table III.2: Persian DLPT and First Semester GPA Crosstabulations

First Semester GPA Intervals		**Category**		
		0 (less than 2/2/1)	**1 (2/2/1 or 2/2/1+)**	**2 (2/2/2 or better)**
1.0 – 2.8	**n**	16	10	12
	%	.421	.263	.316
2.8 – 2.9	**n**	10	7	11
	%	.357	.250	.393
2.9 – 3.0	**n**	0	2	10
	%	0	.167	.833
3.0 – 3.2	**n**	5	3	33
	%	.122	.073	.805
3.2 – 3.5	**n**	4	3	40
	%	.085	.064	.851
3.5 – 3.7	**n**	4	4	25
	%	.121	.121	.758
3.7 – 4.0	**n**	4	0	27
	%	.129	0	.871
Column Totals		43	29	158

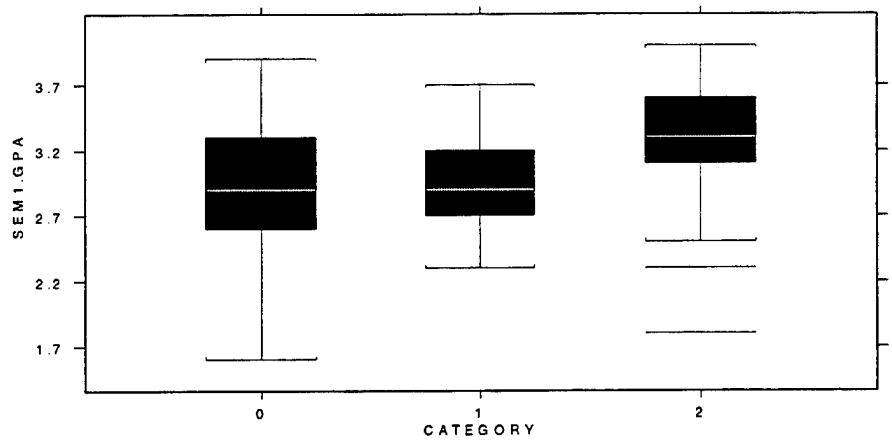


Figure 1: Persian Boxplot of Category versus First Semester GPA

Appendix D shows that for the second semester GPA, individuals with a GPA greater than 2.3 are highly likely to get at least a 2/2/2 on the DLPT. This is without taking first semester GPA into account. For the third semester GPA, it appears that individuals with a GPA greater than 3.0 are highly likely to get at least a 2/2/2 on the DLPT, again ignoring first and second semester GPAs. These results provide us with GPA intervals that correspond to DLPT performance with respect to just one semester GPA at a time. It does not consider the interactions of the three semester GPAs. Consequently, it is not the best method for predicting DLPT performance based on semester GPAs.

B. PREDICTING DLPT PERFORMANCE WITH PHASE TESTS

Stepwise linear regression, with backward elimination, is performed to determine the relationship of the DLPT to the phase tests. Stepwise regression is a multiple linear regression technique that selects a set of independent variables for inclusion. Backward elimination chooses a subset of models by starting with the full model and then eliminating at each step the one variable whose deletion will cause the residual sum of squares to increase the least (Rawlings, 1988). The first set of models ("full" models) consists of all six phase tests taken over the course of three semesters. The second set of models ("partial" models) consists only of tests taken the

first two semesters. The second set of models is included because DLIFLC is more likely to recycle or drop a student during the first two semesters than in the third semester. As a consequence, it is important to DLIFLC to know which first and second semester tests are predictive of DLPT performance. As stated in Chapter II, Section A, interaction terms are not considered in these models at the request of DLIFLC research personnel, and residual analsyis was performed to ensure the linear modeling assumptions are appropriate.

We believe that program tests administered in the second and third semesters, especially phase tests four, five, and six, will be the best predictors of DLPT performance. These tests tend to focus more on the proficiency of the student rather than achievement, as earlier tests do.

The low R^2 of the full and partial models reveal that there is a lot of variation in the DLPT that cannot be explained by the phase tests. However, we must take note that within the full models, the stepwise regression identifies at least one test from the beginning of the course and two phase tests from the end of the course as being predictive of DLPT performance. The results of these three models support DLIFLC's belief that tests administered in the latter part of the course will be predictive of DLPT performance but it also verifies the importance of earlier tests. In all three models, phase test six was identified as a predictor, and phase test five was identified in two of the models. Within the partial models, stepwise regression identified phase test two in all three models and phase test four in two of the models. Phase test two is administered in the first semester and phase test four is administered in the second semester. Even less variability is explained by the partial models than the full models.

1. Full Models

Using stepwise regression to fit the DLPT in each of the three skills versus the six phase tests in each skill gives the following models for listening, reading, and speaking, respectively:

$$\text{DLPT.L} = 19.5 + 0.082\ \text{LPHASE2} + 0.087\ \text{LPHASE5} + 0.132\ \text{LPHASE6}, \qquad (1)$$

with a residual standard error of 3.38 on 161 degrees of freedom and R^2 of 0.351;

$$DLPT.R = 16.0 + 0.070\ RPHASE1 + 0.120\ RPHASE5 + 0.153\ RPHASE6, \quad (2)$$

with a residual standard error of 4.96 on 161 degrees of freedom and R^2 of 0.234; and

$$DLPT.S = -16.7 + 0.081\ SPHASE2 + 0.102\ SPHASE3 + 0.219\ SPHASE6, \quad (3)$$

with a residual standard error of 3.16 on 161 degrees of freedom and R^2 of 0.275.

Table III.3 includes the coefficient values and the associated standard errors obtained from the full model stepwise regression results.

2. Partial Models

The partial models contain only the four tests taken during the first two semesters. These models are included because DLIFLC is more likely to recycle or drop a student during the first two semesters than the third semester. As a consequence, it is important to DLIFLC to know which first and second semester tests are predictive of DLPT performance.

Using stepwise regression to fit the DLPT in each of the three skills versus the four phase tests in each skill gives the following models for listening, reading, and speaking, respectively:

$$DLPT.L = 26.6 + 0.134\ LPHASE2 + 0.088\ LPHASE4, \quad (4)$$

with a residual standard error of 3.61 on 162 degrees of freedom and R^2 of 0.254;

$$DLPT.R = 23.8 + 0.096\ RPHASE1 + 0.150\ RPHASE2, \quad (5)$$

with a residual standard error of 5.41 on 162 degrees of freedom and R^2 of 0.089; and

$$DLPT.S = -12.9 + 0.091\ SPHASE2 + 0.127\ SPHASE3 + 0.143\ SPHASE4, \quad (6)$$

with a residual standard error of 3.27 on 161 degrees of freedom and R^2 of 0.221.

Table III.4 includes the coefficient values and the standard errors associated with the coefficients obtained from the partial model stepwise regression results.

Table III.3: Results of Stepwise Linear Regression on Persian Full Model

	Coefficient Value	Standard Error
Full Model 1 (DLPT.L):		
Intercept	19.5	3.10
LPHASE2	0.082	0.033
LPHASE5	0.087	0.042
LPHASE6	0.132	0.033
Full Model 2 (DLPT.R):		
Intercept	16.0	4.96
RPHASE1	0.070	0.044
RPHASE5	0.120	0.050
RPHASE6	0.153	0.054
Full Model 3 (DLPT.S):		
Intercept	−16.7	4.83
SPHASE2	0.081	0.043
SPHASE3	0.102	0.045
SPHASE6	0.219	0.050

Table III.4: Results of Stepwise Linear Regression on Persian Partial Model

	Coefficient Value	Standard Error
Partial Model 4 (DLPT.L):		
Intercept	26.6	2.53
LPHASE2	0.134	0.035
LPHASE4	0.088	0.031
Partial Model 5 (DLPT.R):		
Intercept	23.8	5.76
RPHASE1	0.096	0.048
RPHASE2	0.150	0.051
Partial Model 6 (DLPT.S):		
Intercept	−12.9	5.11
SPHASE2	0.091	0.045
SPHASE3	0.127	0.047
SPHASE6	0.143	0.055

Now that we have shown which program tests provide some measure of predictability of DLPT performance, we also want to identify an appropriate point for recycling or dropping students. We seek to answer the question "which tests should be looked at more carefully before a decision is made to drop a student?" An approach to answering this question is successive, multiple linear regression by adding the program tests in their chronological order. This analysis was performed, and the program tests with a significant change in R^2 (increase of 0.05 or greater) and a significant F-statistic were the exact same tests identified in the stepwise regression full models. The F-statistic measures the change in goodness of fit of the model if a variable is added or deleted from the model. By adding or deleting a test, it can be determined if the model is significantly better or worse. The results are included in Appendix E.

C. PREDICTING DLPT PERFORMANCE WITH SEMESTER GPAS

This portion of the study determines if semester GPAs are predictive of DLPT performance. It does this by exploring the relationship of semester GPAs to achieving at least a 2/2/2, either a 2/2/1 or a 2/2/1+, or less than a 2/2/1 on the DLPT. The categories are defined as follows: 2 - at least a 2/2/2, 1 - either a 2/2/1 or 2/2/1+, 0 - not achieving at least a 2/2/1. A secondary goal of this analysis is to determine cutoff GPAs associated with these DLPT categories. The probabilities of achieving each category as a function of semester GPA are estimated.

1. Continuation Ratio Model

The analysis is performed based on a continuation ratio model for a multinomial response variable (i.e., the response variable that indicates whether an individual achieves a category 0, 1, or 2 is modeled as a multinomial response). The underpinnings of the ratio model require the analysis to be done in two separate logistic regression sub-models. The first sub-model determines the likelihood of getting at least a 2/2/1 response as a function of semester GPAs. The second sub-model determines the likelihood of getting at least a 2/2/2 among those who have at least a 2/2/1 as a function of semester GPAs. Thus, we fit a continuation ratio model (McCullagh and Nelder, 1983) which is a generalization of a logistic regression model where the response is binary.

To ensure the continuation ratio model is appropriate for the Persian data, a generalized additive model is fitted to the data (Hastie and Tibshirami, 1990). In particular, for the continuation ratio model to be appropriate, Equations (7) and (8) are equivalent to requiring that the logit of the probabilities (left hand side of Equations (7) and (8)) be linear in the semester GPAs. The results of the generalized additive model shows that this is the case for the Persian data.

The formulation of the ratio model is as follows:

Let Y_i be the category of DLPT score received by each individual student, where

$$Y_i = \begin{cases} 2 \text{ if the student gets 2/2/2 or better on DLPT,} \\ 1 \text{ if the student gets 2/2/1 or 2/2/1+ on DLPT,} \\ 0 \text{ if the student scores below 2/2/1 on DLPT.} \end{cases}$$

For the first logistic regression sub-model, let

$$Y_i = \begin{cases} 1 \text{ if } Y_i \text{ is equal to 1 or 2 for student i,} \\ 0 \text{ if } Y_i \text{ is equal to 0 for student i} \end{cases}$$

be the binomial response variable with the three semester GPAs as the predictors. The semester GPA coefficients from the model are the β's for the following equation:

$$\hat{P}(Y_i = 1 \text{ or } 2 \mid \text{GPAs}) =$$

$$\frac{\exp(\beta_0 + \beta_1 \text{ SEM1.GPA} + \beta_2 \text{ SEM2.GPA} + \beta_3 \text{ SEM3.GPA})}{1 + \exp(\beta_0 + \beta_1 \text{ SEM1.GPA} + \beta_2 \text{ SEM2.GPA} + \beta_3 \text{ SEM3.GPA})}. \tag{7}$$

For the second logistic regression sub-model analysis, let

$$Z_i = \begin{cases} 1 \text{ if } Y_i \text{ is equal to 2 for student i,} \\ 0 \text{ otherwise} \end{cases}$$

be the binomial response variable with the three semester GPAs as the predictors. The semester GPA coefficients from the model are the β's for the following equation:

$$\hat{P}(Y_i = 2 \mid Y_i = 1 \text{ or } 2 \text{ and GPAs}) =$$

$$\frac{\exp(\beta_0 + \beta_1 \text{ SEM1.GPA} + \beta_2 \text{ SEM2.GPA} + \beta_3 \text{ SEM3.GPA})}{1 + \exp(\beta_0 + \beta_1 \text{ SEM1.GPA} + \beta_2 \text{ SEM2.GPA} + \beta_3 \text{ SEM3.GPA})}. \tag{8}$$

Under the null hypothesis that the fitted model is correct, the residual deviance of each logistic regression sub-model has approximately the χ^2 distribution (Hamilton, 1992). The residual deviance for the first sub-model is 191.8 with 227 degrees of freedom, and for the second sub-model, the residual deviance is 139.6 with 184 degrees of freedom. For logistic

regression, the χ^2 approximation can be poor. Therefore, it is prudent not to read too much into the lack of fit tests based on the residual deviance. However, because both residual deviances are less than their respective degrees of freedom, there does not appear to be strong evidence of a lack of fit by the two logistic sub-models. From the statistical results of the sub-models presented in Appendix F, the sub-models reveal that the second semester GPA is a less significant predictor of DLPT performance than first and third semester GPAs.

The values from Equations (7) and (8) for each student are then used in Equations (9), (10), and (11) to calculate individual probabilities of getting at least a 2/2/2, either a 2/2/1 or 2/2/1+, and less than a 2/2/1, respectively for that student. The equations are:

$$\hat{P}(Y_i = 2) = \hat{P}(Y_i = 1 \text{ or } 2 \mid \text{GPAs}) * \hat{P}(Y_i = 2 \mid Y_i = 1 \text{ or } 2 \text{ and GPAs}) , \tag{9}$$

$$\hat{P}(Y_i = 1) = [1 - \hat{P}(Y_i = 2 \mid Y_i = 1 \text{ or } 2 \text{ and GPAs})] * \hat{P}(Y_i = 1 \text{ or } 2 \mid \text{GPAs}) , \tag{10}$$

$$\hat{P}(Y_i = 0) = 1 - \hat{P}(Y_i = 1 \text{ or } 2 \mid \text{GPAs}) . \tag{11}$$

For example, a student has the following semester GPAs: SEM1.GPA = 3.8, SEM2.GPA=3.9, SEM3.GPA=3.9. In this instance, $Y^*_i = 1$ and $Z^*_i = 1$. Substituting the coefficients of the first generalized linear sub-model into Equation (7) yields

$$\hat{P}(Y_i = 1 \text{ or } 2 \mid \text{GPAs}) =$$

$$\frac{\exp(-4.72 + 1.34 \text{ SEM1.GPA} - .920 \text{ SEM2.GPA} + 1.56 \text{ SEM3.GPA})}{1 + \exp(-4.72 + 1.34 \text{ SEM1.GPA} - .920 \text{ SEM2.GPA} + 1.56 \text{ SEM3.GPA})}$$

$$= 0.946.$$

Substituting the coefficients of the second generalized linear sub-model into Equation (8) yields

$$\hat{P}(Y_i = 2 \mid Y_i = 1 \text{ or } 2 \text{ and GPAs}) =$$

$$\frac{\exp(-5.84 + 1.48\ \text{SEM1.GPA} + .561\ \text{SEM2.GPA} + .384\ \text{SEM3.GPA})}{1 + \exp(-5.84 + 1.48\ \text{SEM1.GPA} + .561\ \text{SEM2.GPA} + .384\ \text{SEM3.GPA})}$$

$$= 0.970.$$

Substituting the results of Equations (7) and (8) into Equations (9), (10), and (11) yields

$\hat{P}(Y_i = 2) = 0.946 * 0.970 = 0.918$, $\hat{P}(Y_i = 1) = [1\text{-}0.970] * 0.946 = 0.028$, and

$\hat{P}(Y_i = 0) = (1\text{-}0.946) = 0.054$.

We estimated that this particular individual had probability 0.918 of getting at least a 2/2/2, 0.028 of getting a 2/2/1 or 2/2/1+, and 0.054 of not getting at least a 2/2/1 based on his or her semester GPA scores. In fact, this student scored a 2/2/2 on the DLPT. The continuation ratio model allows you to estimate probabilities only for an individual student based on that student's GPAs. The misclassification rate of this model is estimated to be 29.2%.

2. Classification Tree Model

We have seen that the continuation ratio model allows us to estimate individual probabilities of getting at least a 2/2/2, either a 2/2/1 or a 2/21+, and less than a 2/2/1 for each student. A classification tree is a nonparametric version of the continuation ratio model. Classification trees have a categorical response variable in contrast to regression trees, which have a continuous response variable. Pruning is used to obtain optimal tree size. This analysis follows Chambers and Hastie (1992) and Venables and Ripley (1997). Please refer to Figure 2. The percentages under each node or leaf represents the predicted percentages of students obtaining less than a 2/2/1, either a 2/2/1 or 2/2/1+, or a 2/2/2, in that order. The categories are

defined as follows: 2 - at least a 2/2/2, 1 - either a 2/2/1 or 2/2/1+, 0 - not achieving at least a 2/2/1. Each node or leaf contains the sample size for that leaf or node.

As with the continuation ratio model, the first semester GPA is more predictive of DLPT performance than the second semester GPA. Although all three semester GPAs are included as predictor variables, the third semester GPA does not appear in the tree because the first and second semester GPAs capture all of the third semester GPA predictive abilities. The tree indicates that if an individual has a first semester GPA greater than 2.95, the individual will receive a 2/2/2 on the DLPT with probability of 0.82. If an individual has a first semester GPA less than 2.25, he or she will receive less than a 2/2/1 on the DLPT with probability of 0.86. A tree model is superior to crosstabulations in its ability to take into account interactions and multiple predictors to predict DLPT performance. Overall, the misclassification rate of the tree based on the data is estimated to be 26%. Although the semester GPA includes grades that are not exclusively phase test listening, reading, and speaking grades, they appear to be good predictors of DLPT performance.

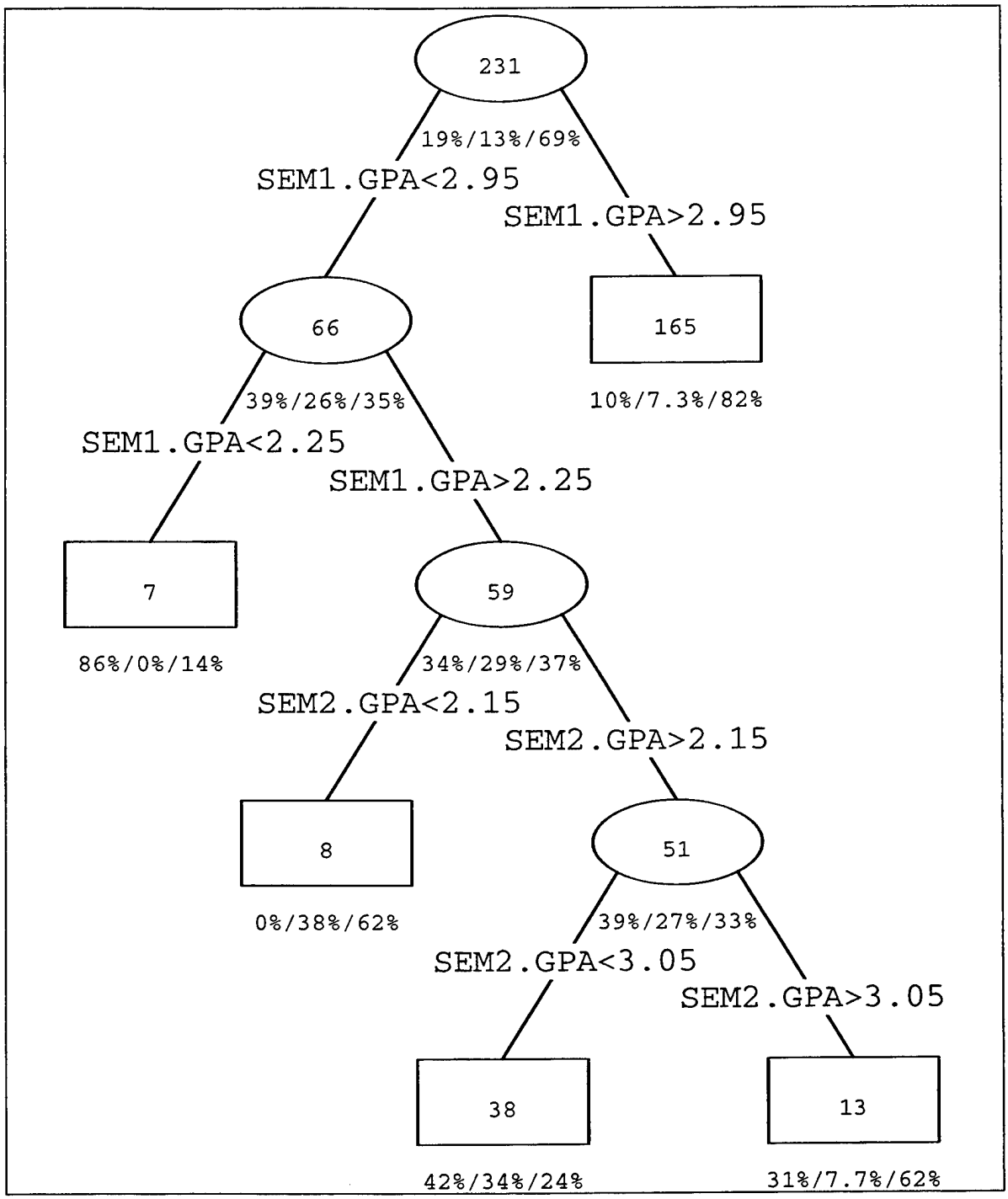
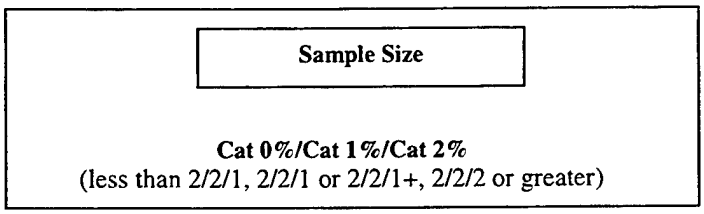


Figure 2: Predicting Persian DLPT Performance with Semester GPAs

Legend:



D. BEST OVERALL PREDICTOR OF DLPT PERFORMANCE

We have identified which phase tests are independently predictive of DLPT performance for each skill and which semester GPAs and their related cutoff scores are predictive of DLPT performance. We would also like to identify what the overall best predictors are of DLPT performance, taking into account all three semester GPAs and all of the phase tests for all three skills. This answers the question: "Given everything we know academically about the student (i.e., listening, reading, and speaking phase test grades and semester GPAs), what is the best predictor of DLPT performance?" Figure 3, a classification tree, answers this question. As in Figure 2, the percentages under each node or leaf represents the predicted percentages of students obtaining less than a 2/2/1, either a 2/2/1 or 2/2/1+, or a 2/2/2, in that order. Each node contains the sample size for that node. It identifies the first semester GPA and listening phase tests four and five as being the most predictive. The sample size at the root node is smaller in Figure 3 than Figure 2 because of missing test and GPA scores. This model's overall misclassification rate is estimated to be 22.3%.

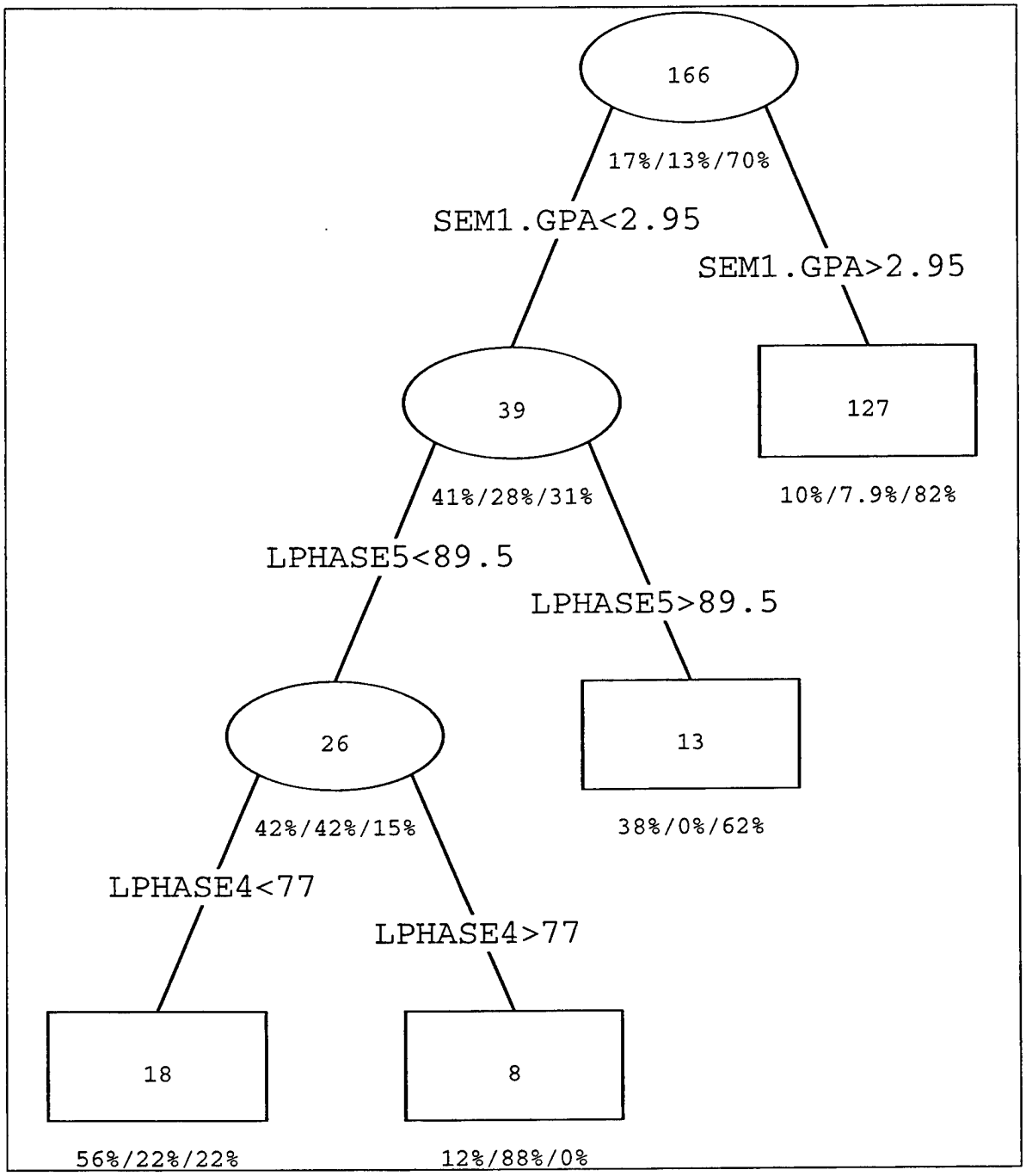
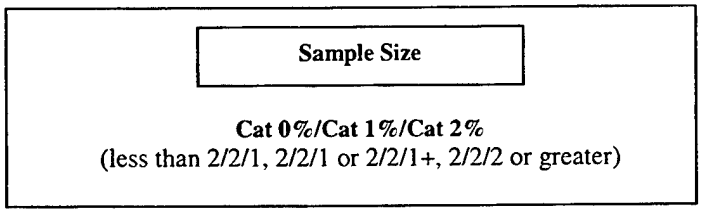


Figure 3: Overall Persian DLPT Performance Predictors

Legend:



IV. ARABIC LANGUAGE PROGRAM METHODOLOGY AND FINDINGS

The results of the Arabic analysis are presented in a fashion similar to those of the Persian analysis. Generally, the sections are the same with the addition of the cumulative skills semester GPA analysis.

A. EXPLORATORY DATA ANAYLSIS RESULTS

The results in this section are exploratory. Conclusions cannot be made as to the relationship among several variables at once, only pairs of variables. Both the correlations and crosstabulations are included at the request of DLIFLC research personnel to help them gain a preliminary understanding of the data. Detailed analysis of the data, to include determining the relationship among several variables at once, begins in Section B. The tables applicable to the Arabic data analysis are included in Appendices G through M.

1. Correlations

We define the correlation to be low, moderate or high if the correlation coefficient meets the following criteria: low if coefficient is between 0.01 and 0.400, moderate if correlation coefficient is between 0.401 and 0.699, and high if the coefficient is between 0.700 and 1.00. Appendix H lists all pairwise correlations among all the C-Tests, semester GPAs, cumulative skills GPAs, and DLPT scores.

From Table H.1 in Appendix H, we note that there is a moderate correlation between the DLPT skill tests. As in the Persian results, the DLPT reading and listening tests have the highest correlation at 0.660.

From Tables H.2, H.3, and H.4 in Appendix H, the DLPT listening test has the highest correlations with listening C-Tests ten, eleven, semester test two, and all four tests taken in semester three. It has the highest correlations with reading C-Tests eleven, twelve, fifteen, and

semester test three. The DLPT listening test also has the highest correlations with speaking C-Tests semester test two and all four tests taken in semester three. Likewise, the DLPT reading test has the highest correlations with listening C-Tests ten, eleven, and semester test two, and all four tests taken in semester three. It has the highest correlations with reading C-Tests nine through twelve and thirteen through semester test three. The DLPT reading test also has the highest correlations with speaking C-Tests twelve, fourteen, fifteen, and semester test three. The DLPT speaking test has the highest correlations with C-Tests semester test two and fifteen in listening, C-Tests eleven and twelve in reading, and C-Tests twelve, semester test two, fourteen, fifteen, and semester test three in speaking. In summary, the DLPT tests appear to have higher correlation coefficients for the latter half of semester two tests and a predominance of semester three tests across all skills. The correlations with semester one tests appear to be the lowest across all three skills.

From Table H.5 in Appendix H, we note that there are moderate correlations between DLPT skill tests and semester GPAs. The DLPT listening, reading, and speaking tests have the highest correlations with semesters 2 and 3 GPAs. The highest correlation observed is that of semester 3 GPA and the reading portion of the DLPT test at 0.679. Table H.6 displays the correlations between the DLPT skill tests and the cumulative skills GPAs. The DLPT listening test is moderately correlated with the three listening cumulative skills GPAs at 0.550, 0.628, and 0.632, respectively. The DLPT reading test is moderately correlated with the three listening cumulative skills GPAs at 0.560, 0.581, and 0.676, respectively. However, it is worth mentioning that two of the highest correlations are with listening cumulative skills GPAs two and three at 0.620 and 0.606, respectively. The DLPT speaking test has the highest correlations with the three listening cumulative skills GPAs at 0.520, 0.587, and 0.499 and the speaking cumulative skills GPAs two and three at 0.507 and 0.501, respectively.

Detailed relationships among C-Tests, cumulative skills semester GPAs and semester GPAs, to include determining the relationship among several variables at once, can be seen in Appendix I. Appendix I presents the results of the studies focusing on sustained student performance on C-Tests and GPAs as predicted by other C-Tests and GPAs. The models in this section are the same as that used in the Persian analysis in Chapter III, Section A. The residual standard error (RSE), degrees of freedom (d.o.f.), unadjusted R^2, and phase tests with significant p-values ($p < 0.05$) are reported for each model. The analysis in this section follows Hamilton (1992). As in Persian, the degrees of freedom vary from model to model because of missing test scores.

To determine if student performance on previous C-Tests can be used to predict performance on the next successive C-Test, we refer to Tables I.1 through I.3. From Table I.1, we observe that LS01 and LC08 tests are the most predictive of future test performance. These two tests are identified as having p-values less than 0.05 for five of the ten models they are included in. From Table I.2 we note that RC04 and RS01 are the most predictive with RS04 being identified in five of the models and RS01 being identified in six of the models as having p-values less than 0.05. Tests SC01, SC04, and SC07 are identified in Table I.3 as being the most predictive tests of future test performance. Based on these results, we may infer that to a small degree performance on future C-Tests may be assessed by performance on past C-Tests especially in the simple linear regression case. However, we should note that there is much variability in the models that is not explained by the program tests.

To determine if student performance in previous semester GPAs/cumulative skills semester GPAs can be used to predict other semester GPAs/cumulative skills semester GPAs, we refer to Tables I.4 and I.5. From Table I.4, it appears previous semester GPAs are highly predictive of future semester GPAs, especially in regards to semester two GPA being predictive

of semester three GPA. That model has a high R^2 of 0.718. In Table I.5 we see that R^2 is moderately high (above 0.50) for four of the six models. Thus, it appears that previous cumulative skills semester GPAs can be a useful tool in predicting future cumulative skills semester GPAs.

2. Crosstabulations

The crosstabulations in Appendices J and K show semester GPA and cumulative skills semester GPA intervals, one GPA at a time, that correspond to attaining minimum DLPT scores. Appendix J details the crosstabulations of semester GPAs to achieving at least a 2/2/2, either a 2/2/1 or 2/2/1+, and less than a 2/2/1 on the DLPT. The categories are defined as follows: 2 - at least a 2/2/2, 1 - either a 2/2/1 or 2/2/1+, 0 - not achieving at least a 2/2/1. The cell of each semester GPA interval contains the number of students falling within a particular GPA range, the percentage within that row, and the percentage within that column. The semester GPA crosstabulation results are presented in a fashion similar to those of Chapter III, Section A, subsection (2). Appendix J shows that for the first semester GPA, individuals with a GPA greater than 3.2 are highly likely to get at least a 2/2/2 on the DLPT. The same holds true for second and third semester GPAs - having at least a 3.2 semester GPA characterizes the individual as being likely to get a 2/2/2 on the DLPT. Results of obtaining a 2/2/1 on the DLPT are also presented in Appendix J.

Appendix K details the crosstabulations of cumulative skills semester GPAs by skill with achieving at least a level 2 in that particular skill and with achieving either a level 1 or 1+ in that particular skill. The categories for each skill are defined as follows: 2 - at least a level 2, 1 - either a level 1 or 1+, 0 - not achieving at least a 1. For example, Table IV.1 shows the crosstabulations of listening cumulative skills semester one GPA to the listening DLPT score. For the first listening cumulative skills semester GPA, it appears that students with a GPA of at

least 2.0 are most likely to get at least a level 2 on the listening portion of the DLPT since the row percentages for GPAs greater than 2.0 in category 2 are at least 64%.

Appendix K shows that for the second and third listening semester cumulative skills GPAs, individuals with a GPA greater than 2.0 are also highly likely to get at least a level 2 on the listening portion of the DLPT. To obtain at least a level 2 on the reading portion of the DLPT, a minimum GPA of 1.0 is required for all three reading cumulative skills semester GPAs. For speaking, a minimum GPA of 3.2 is required for all three speaking cumulative skills semester GPAs in order to achieve at least a level 2 on the speaking portion of the DLPT. Results of obtaining a level 1 on the DLPT are also presented in Appendix K.

As stated in Chapter II, these results provide us with GPA intervals that correspond to DLPT performance with respect to just one semester GPA or cumulative skills GPA at a time. It does not consider the interactions of the three semester GPAs or cumulative skills GPAs.

Table IV.1: Arabic DLPT.L and Listening Cumulative Skills First Semester GPA Crosstabulations

Listening First Semester GPA Intervals		Category		
		0 (less than 1)	1 (1 or 1+)	2 (2 or better)
1.0 – 2.0	n	0	24	31
	%		.436	.564
2.0 – 2.5	n	0	29	52
	%		.358	.642
2.5 – 2.9	n	0	8	41
	%		.163	.837
2.9 – 3.2	n	0	6	32
	%		.158	.842
3.2 – 3.5	n	0	0	19
	%			1.00
3.5 – 3.7	n	0	0	17
	%			1.00
3.7 – 4.0	n	0	0	10
	%			1.00
Column Totals		0	67	202

B. PREDICTING DLPT PERFORMANCE WITH C-TESTS

Regression tree analysis is performed to determine the relationship of the DLPT to the C-Tests. Regression trees have a continuous response variable. The results are presented with two sets of models similar to those in the Persian analysis done in Chapter III, Section B. The full models, shown in Figures 4, 6, and 8, use all eighteen C-Tests taken over the course of three semesters. The partial models, shown in Figures 5, 7, and 9, use only tests taken during the first two semesters. The predicted value of the response variable is printed inside the node. The node size is listed underneath each node or leaf. The second set of models is included because DLIFLC is more likely to recycle or drop a student during the first two semesters than the third semester. As a consequence, it is important to DLIFLC to know which first and second semester tests are predictive of DLPT performance.

We see in Figure 4 that listening C-Tests eleven and fifteen, and listening semester tests two and three are identified as being the most predictive of DLPT listening performance. In Figure 5, listening C-Tests eleven and semester test two are again identified as predictive of DLPT performance, as well as listening C-Tests five, eight and listening semester test one. In Figure 6, reading C-Tests four, fourteen, fifteen, and semester test three are identified as being predictive of reading DLPT performance. Figure 7 identifies reading C-Tests eight, eleven, and twelve. In Figure 8 we see speaking C-Tests eleven, twelve, and semester three test as being predictive of speaking DLPT performance. Figure 9 displays speaking C-Tests one and semester test two. Not surprisingly, each of the full models mainly identified tests administered towards the latter part of the last two semesters.

As in the Persian analysis in Chapter III, Section B, we want to identify an appropriate point for recycling or dropping students. This analysis was performed in the same manner as the Persian analysis, and the program tests with a significant F-statistic and significant change in R^2

(change of 0.05 or greater) are not the same tests identified in the full model regression trees. Please refer to Appendix L. It is expected that both models (multiple linear regression and regression trees) would yield similar results although one is parametric and the other is nonparametric. The discrepancy between the two models cannot be explained.

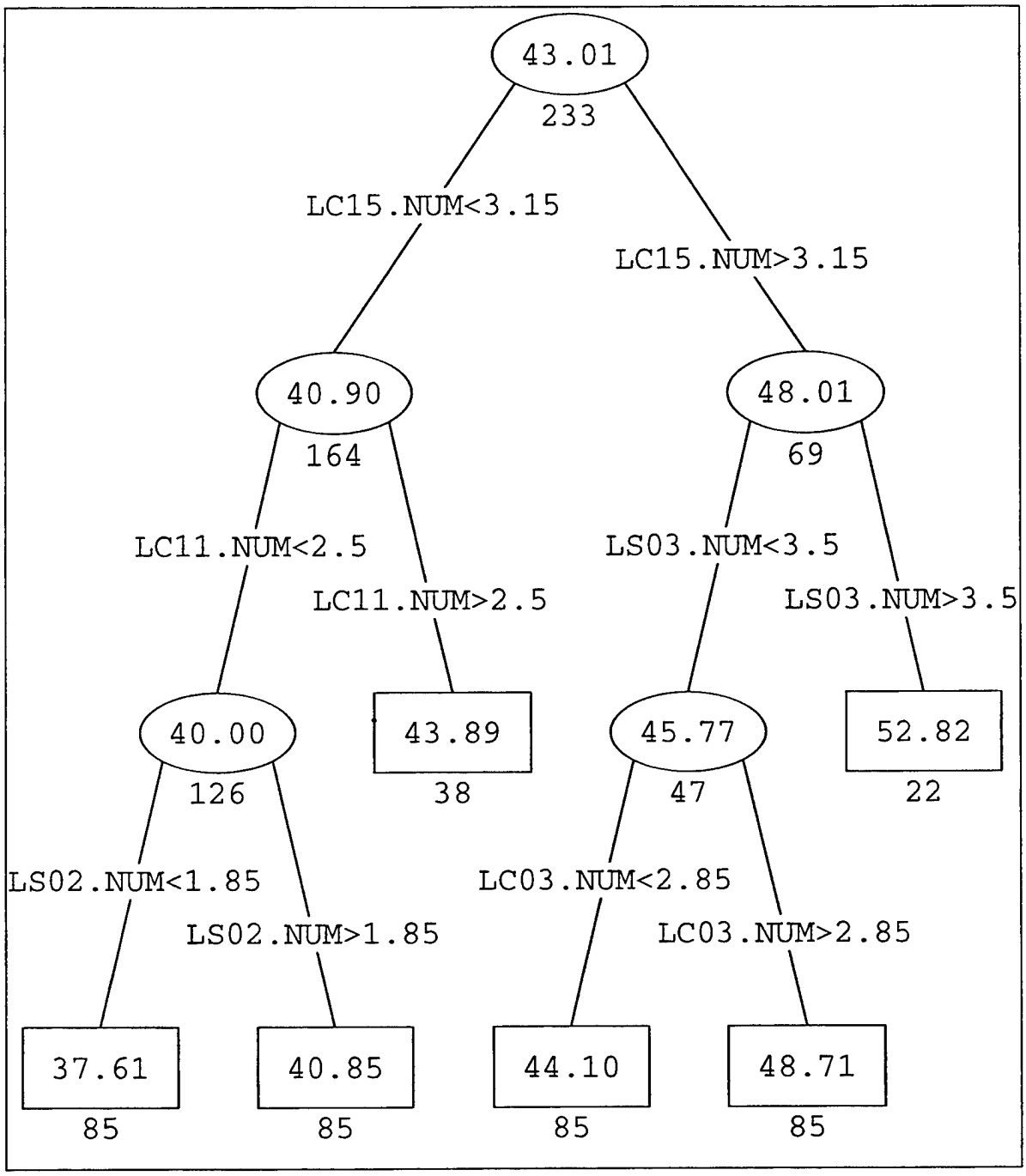
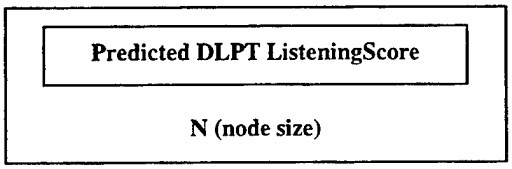


Figure 4: Listening DLPT Performance Predictors in Arabic (Full Model)

Legend:



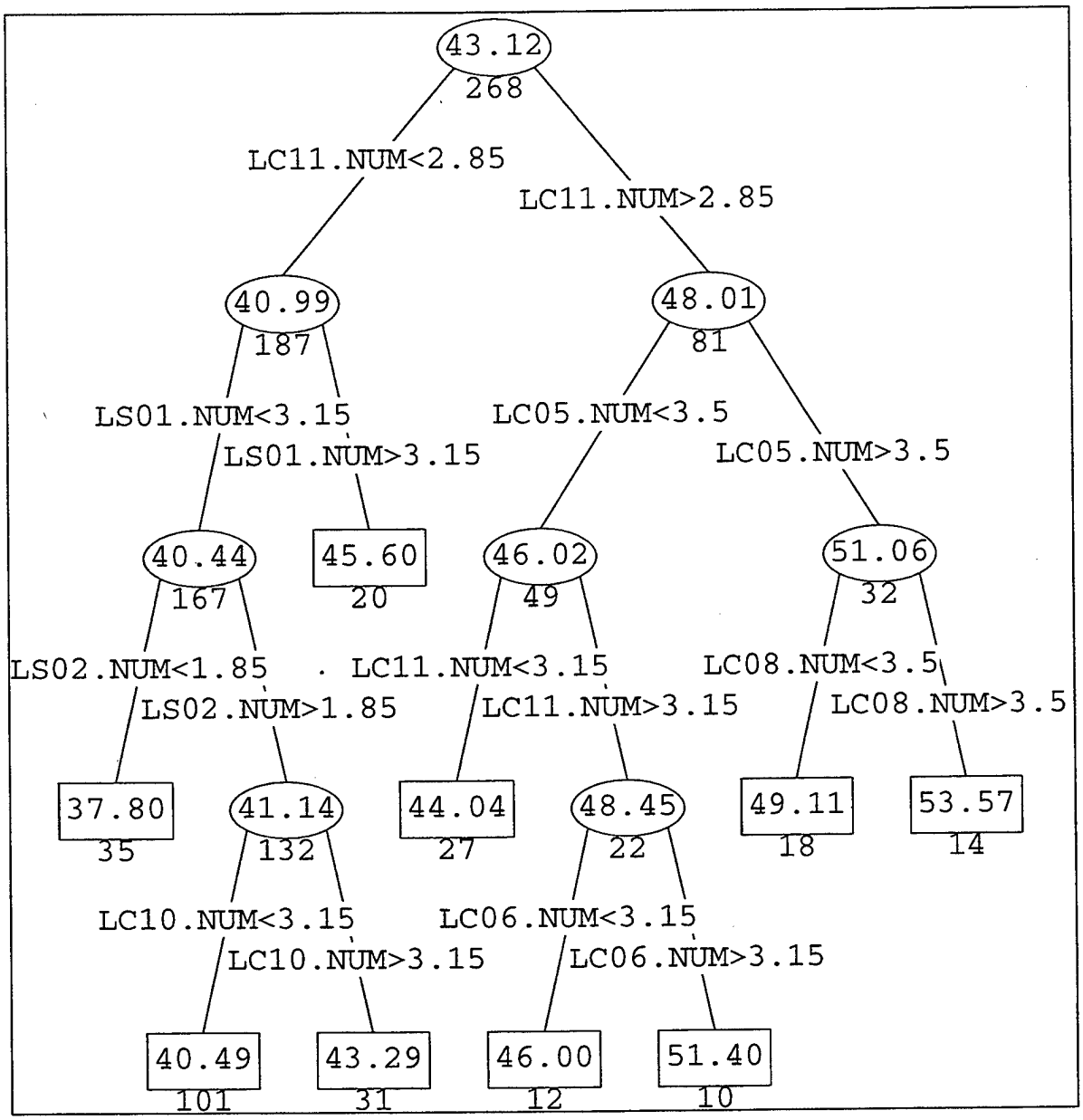
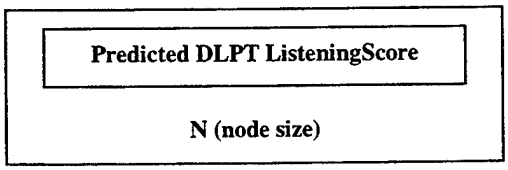


Figure 5: Listening DLPT Performance Predictors in Arabic (Partial Model)

Legend:



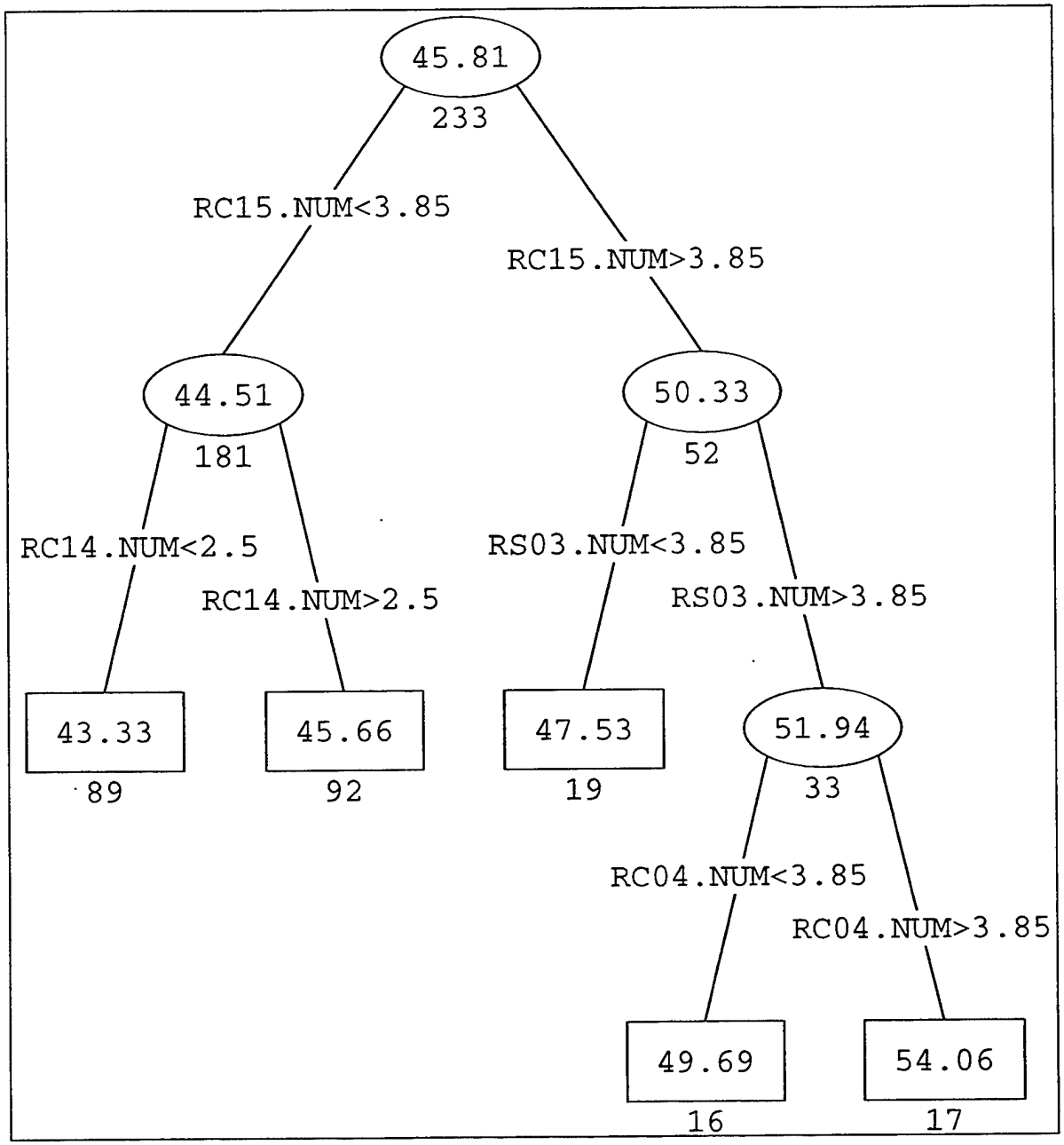
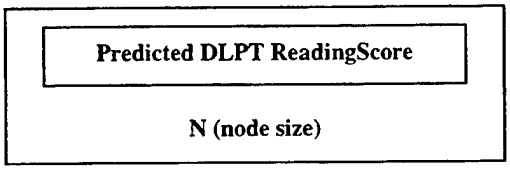


Figure 6: Reading DLPT Performance Predictors in Arabic (Full Model)

Legend:



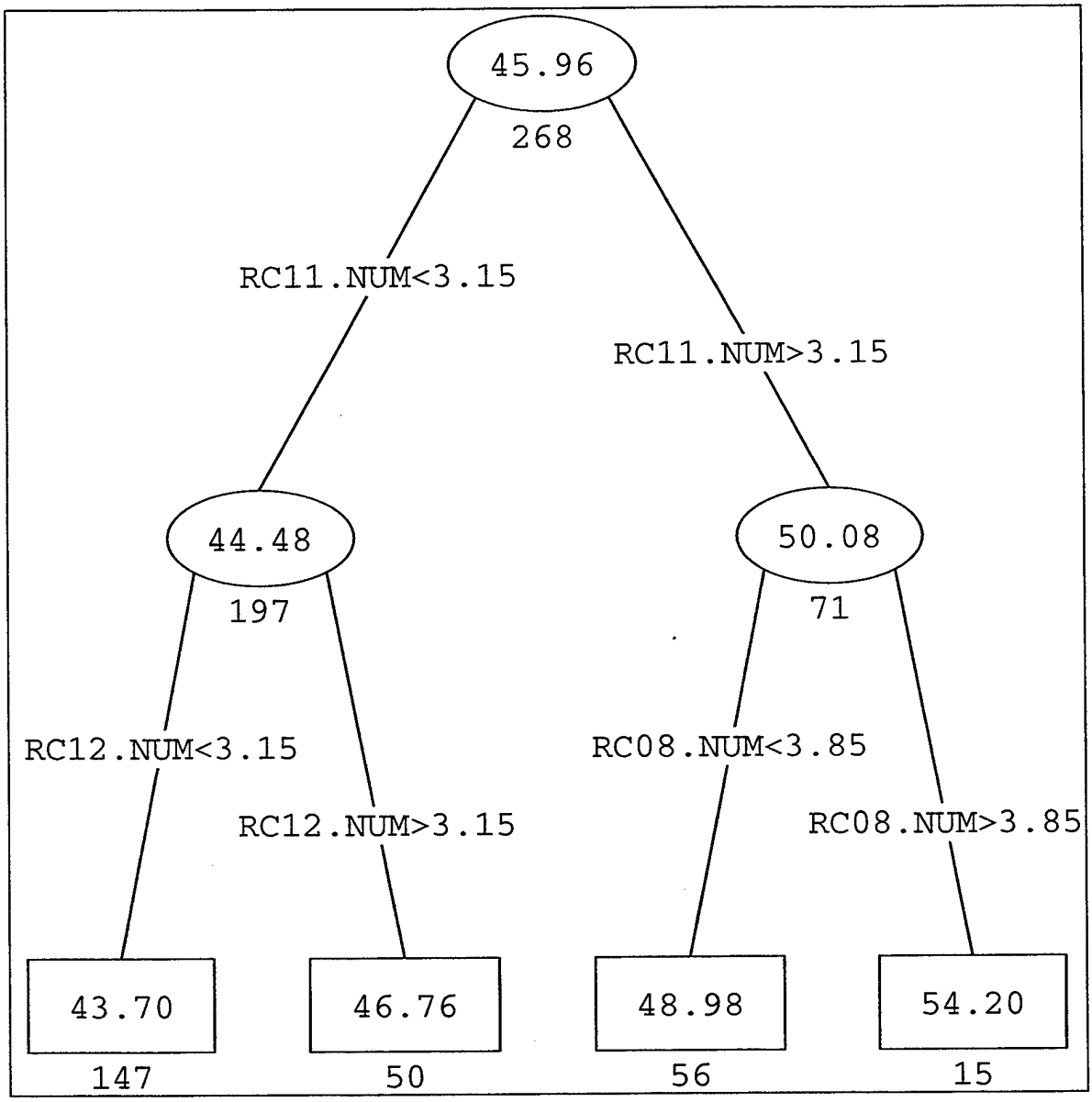
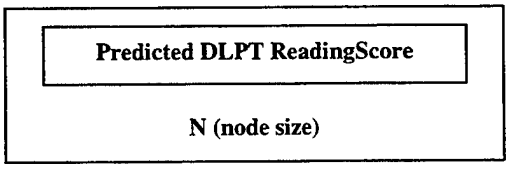


Figure 7: Reading DLPT Performance Predictors in Arabic (Partial Model)

Legend:



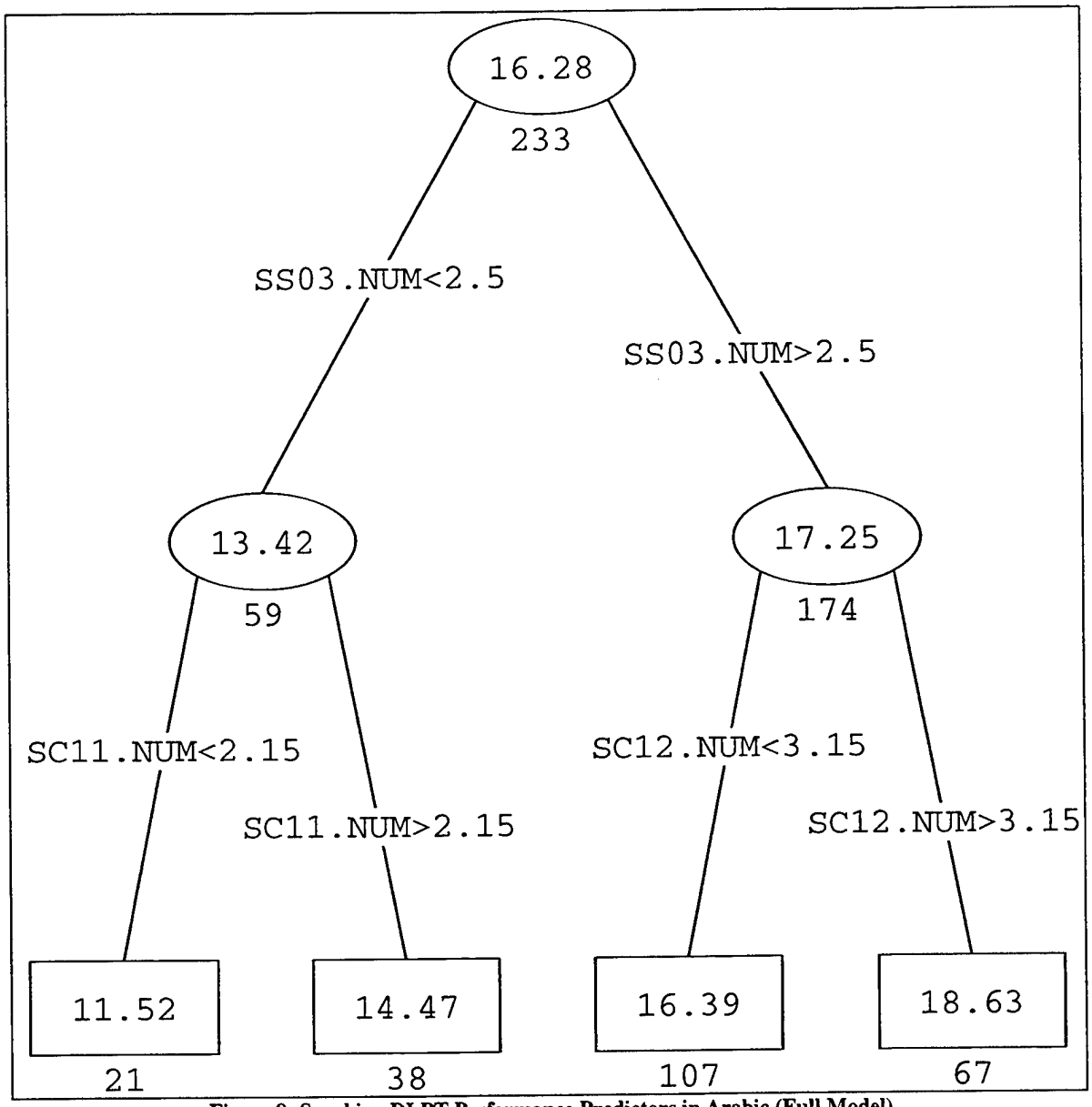
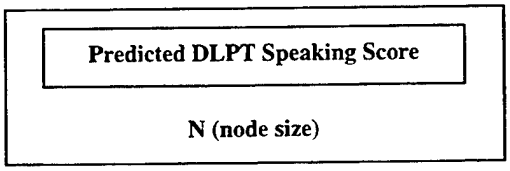


Figure 8: Speaking DLPT Performance Predictors in Arabic (Full Model)

Legend:



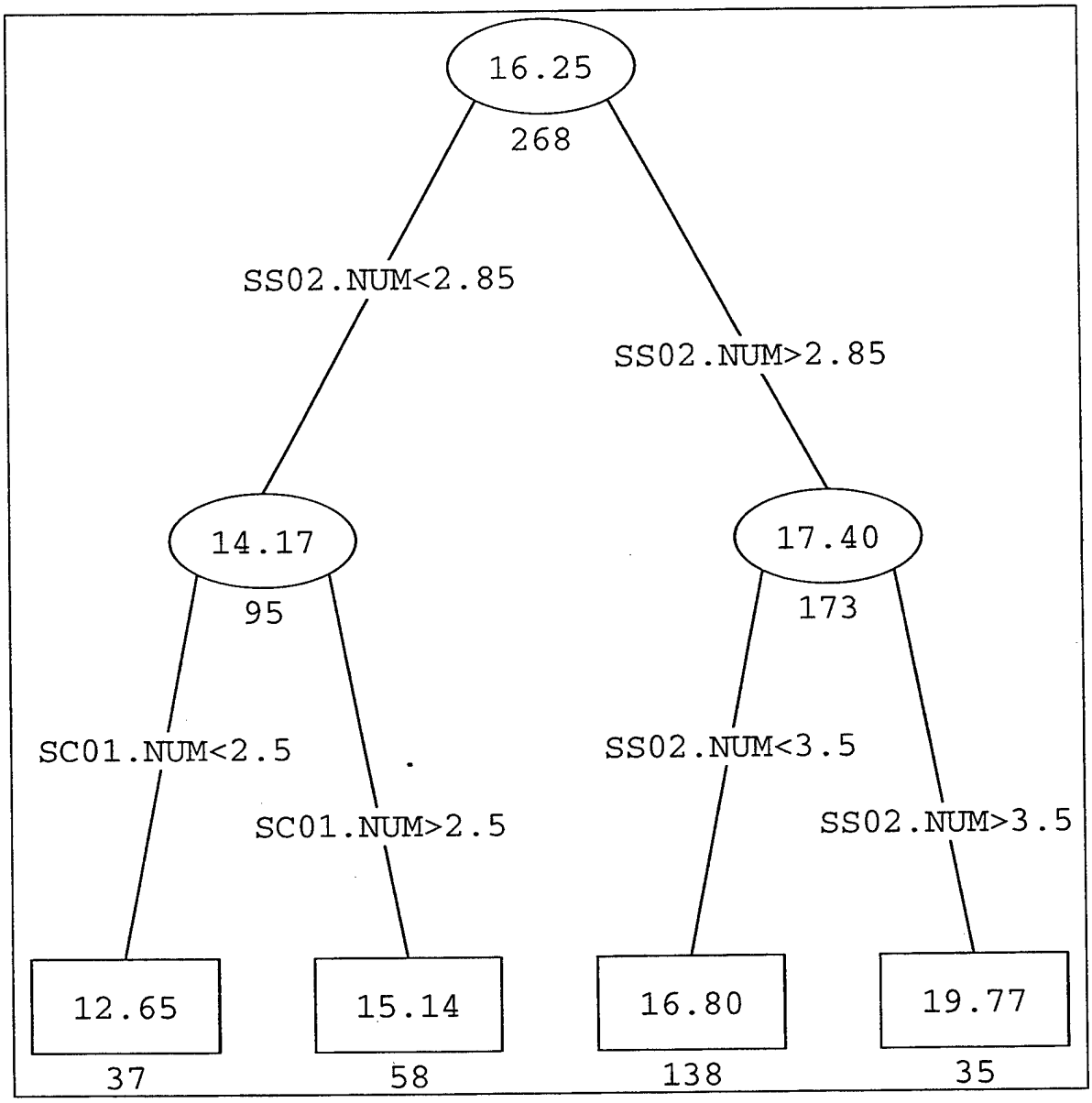
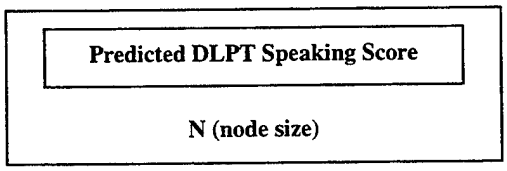


Figure 9: Speaking DLPT Performance Predictors in Arabic (Partial Model)

Legend:



C. PREDICTING DLPT PERFORMANCE WITH SEMESTER GPAS

We wish to determine if semester GPAs are predictive of DLPT performance. Again, we do this by exploring the relationship of semester GPAs to achieving at least a 2/2/2, either a 2/2/1 or 2/2/1+, or less than a 2/2/1 on the DLPT. The associated probabilities of achieving each are calculated as well. The model formulations are exactly the same as in the Persian analysis shown in Chapter III.

1. Continuation Ratio Model

The analysis in this section follows Chapter III, Section C, sub-section (1). Once again, the appropriate semester GPA coefficients from the model are the β's for Equations (7) and (8). Equations (9), (10), and (11) are calculated in a like manner. The misclassification rate of this model is estimated to be 40.8%. Refer to Appendix M to review the pertinent logistic regression models.

To ensure the continuation ratio model is appropriate for the Arabic data, a generalized additive model is fitted to the data (Hastie and Tibshirami, 1990). In particular, for the continuation ratio model to be appropriate, Equations (7) and (8) are equivalent to requiring that the logit of the probabilities (left hand side of Equations (7) and (8)) be linear in the semester GPAs. The results of the generalized additive model show that this is not the case for the Arabic data. Thus, it is more apropos to fit a nonparametric model (classification tree) to the data.

2. Classification Tree Model

The analysis in this section follows Chapter III, Section C, sub-section (2). In Chapter III, we noted that the continuation ratio model allows us to calculate individual probabilities of getting at least a 2/2/2, either a 2/2/1 or 2/2/1+, or less than a 2/2/1 for each student, but if standard cutoff GPAs are needed independent of the student, a classification tree model is more appropriate. Please refer to Figure 10.

Although all three semester GPAs are included as predictor variables, the first semester GPA does not appear in the tree because the second and third semester GPAs capture all of the first semester GPA predictive abilities. The second and third semester GPAs are more predictive of DLPT performance than the first semester GPA. Each node of the tree contains the sample size used in the splitting of that node. Underneath each node are the classification percentages related to DLPT performance in the following manner: not obtaining at least a 2/2/1, obtaining either a 2/2/1 or 2/2/1+, or obtaining at least a 2/2/2. The tree indicates that if an individual has a second semester GPA greater than 2.85, the student will receive a 2/2/2 on the DLPT with probability of 0.64. Overall, the misclassification error rate of the tree is estimated to be 37%.

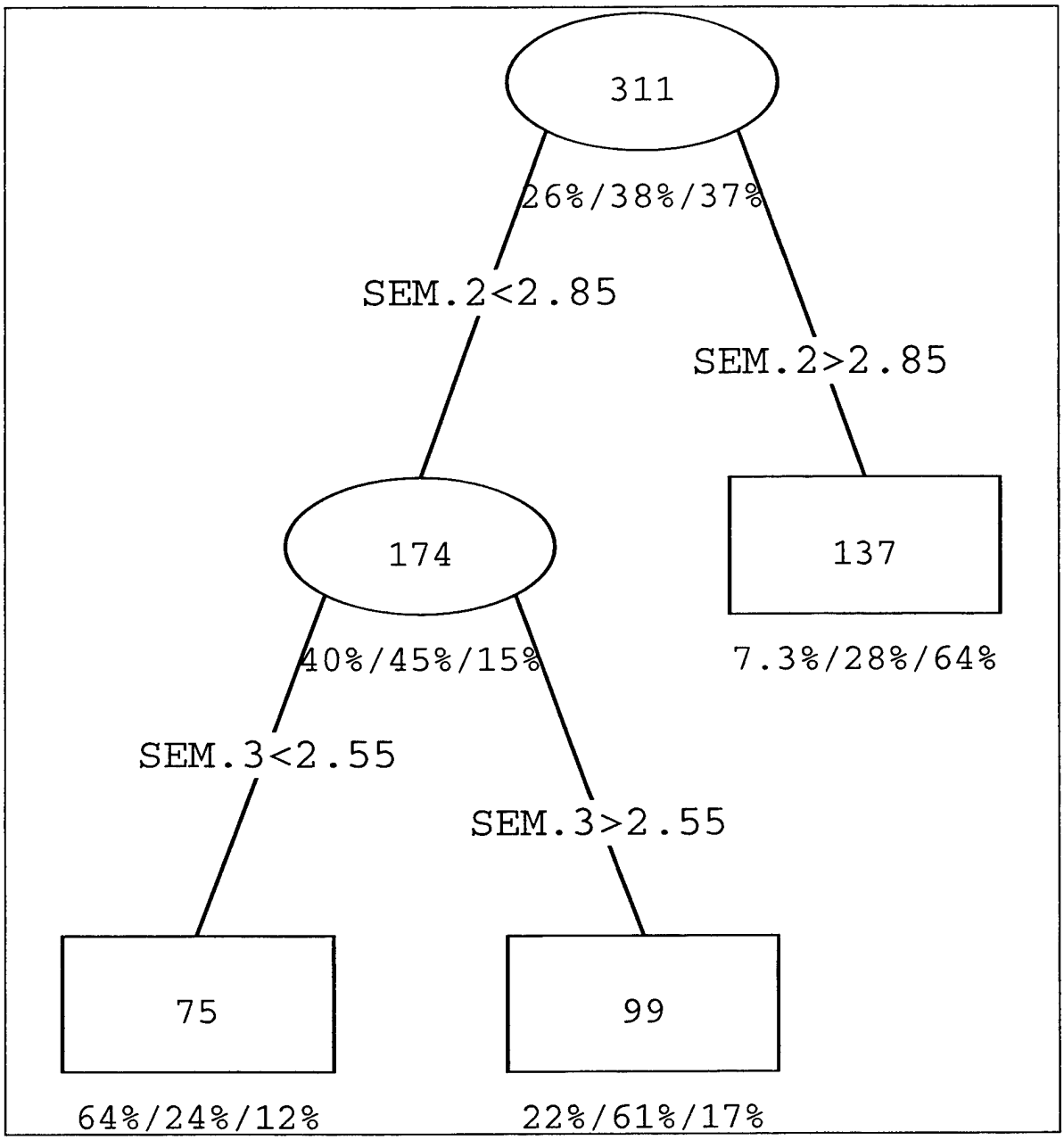
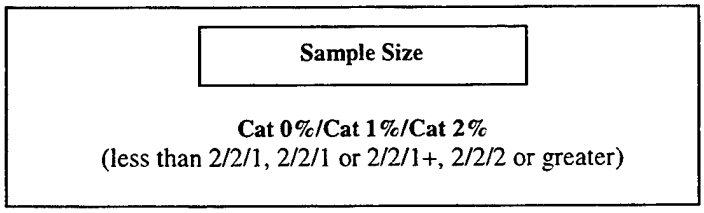


Figure 10: Predicting Arabic DLPT Performance with Semester GPAs

Legend:



D. PREDICTING DLPT PERFORMANCE WITH CUMULATIVE SKILLS GPAS

This portion of the study determines if cumulative skills semester GPAs are predictive of DLPT performance. It does this by exploring the relationship of cumulative skills semester GPAs in listening, reading, and speaking to achieving at least a level 2 in the particular skill and to achieving either a level 1 or 1+ in the particular skill. The categories for each skill are defined as follows: 2 - at least a level 2, 1 - either a level 1 or 1+, 0 - not achieving at least a level 1. The percentages under each node or leaf represent the predicted percentages of students in category 0, 1, and 2, in that order. However, because no students fell into category 0, there are no percentages associated with this category in the listening models, only categories 1 and 2. Each node contains the sample size for that node.

The full models, shown in Figures 11 and 13, consist of all three cumulative skills semester GPAs. The partial models, shown in Figures 12 and 14, consist only of cumulative skills semester GPAs from the first two semesters. Trees for the reading cumulative skills semester GPAs are not included because analysis revealed the root node as being the best model for the full and partial models. There is a 0.97 probability for both models that a student will receive a 2 on the reading portion of the DLPT regardless of the reading cumulative skills semester GPAs.

In listening and speaking, the second and third cumulative skills semester GPAs are more predictive of DLPT performance than the first cumulative skills semester GPA in all of the models. Cumulative skills semester GPAs two and three are predictive of DLPT listening performance in the full model, and cumulative skills semester GPA two is predictive in the partial model. Cumulative skills semester GPA three is predictive of DLPT speaking performance in the full model, and cumulative skills semester GPAs one and two are predictive in the partial model. The tree in Figure 11 has an overall misclassification rate of 18%, Figure 12

has a misclassification rate of 18.3%, Figure 13 has an overall misclassification rate of 24.9%, and Figure 14 has an overall misclassification rate of 24.6%.

Figure 11 shows that if an individual has a listening cumulative skills semester three GPA greater than 2.66, he or she has a 0.95 probability of getting a 2 on the listening portion of the DLPT. Taking into consideration just the first two semesters as shown in Figure 12, the student would need a listening cumulative skills semester two GPA greater than 2.93 to have a 0.98 probability of getting a 2 on the DLPT. In speaking, Figure 13 shows that in order for a student to receive a 2 on the speaking portion of the DLPT, he or she would require a semester three cumulative skills GPA greater than 3.38 and a semester one cumulative skills GPA greater than 3.23 for the partial model.

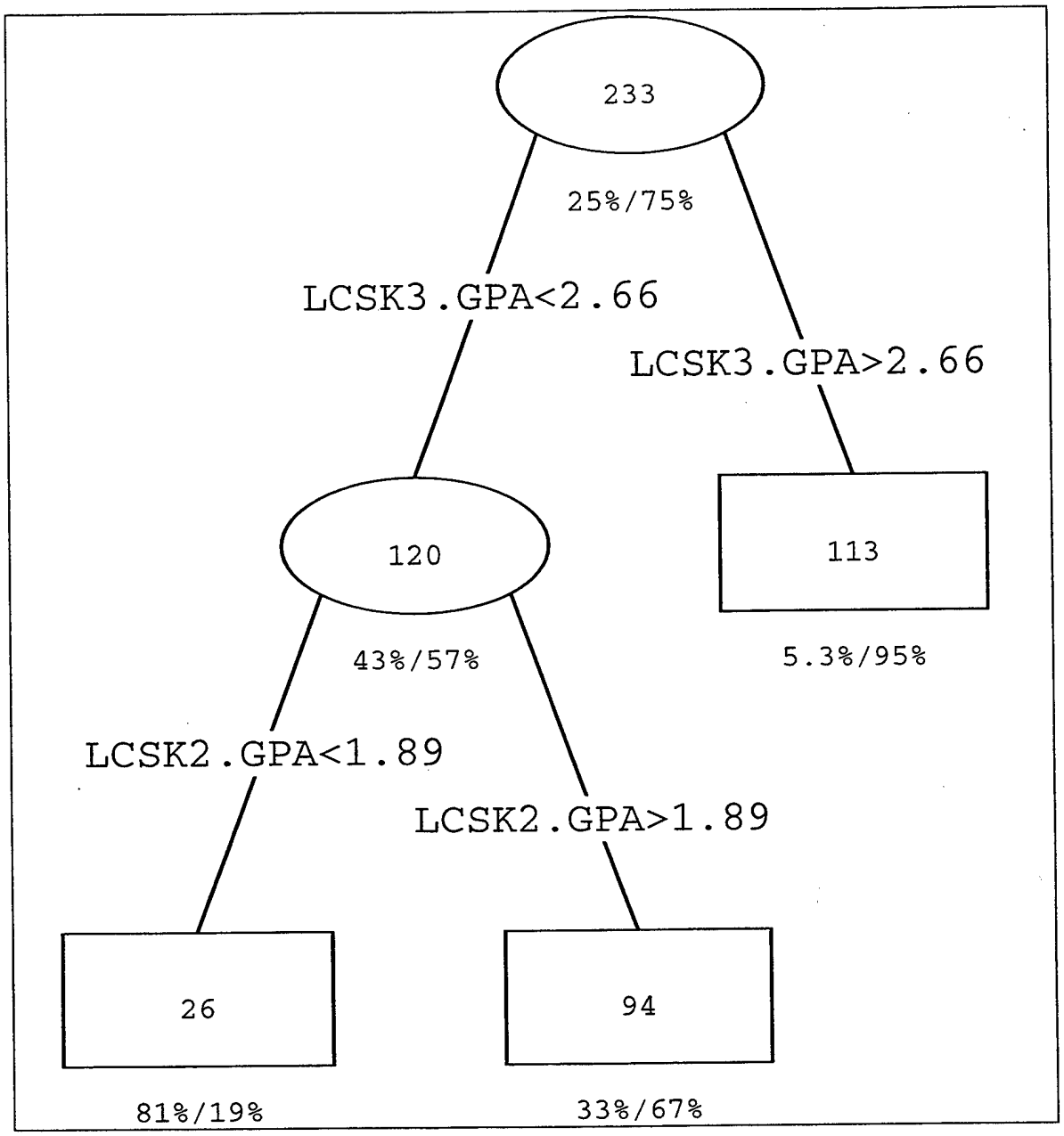
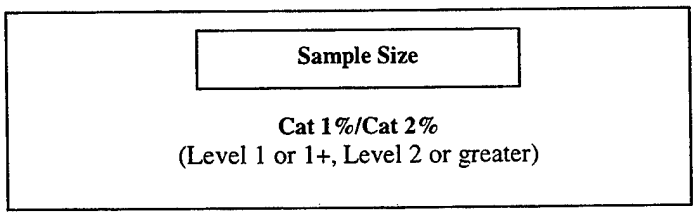


Figure 11: Arabic DLPT.L and Listening Cumulative Skills GPA (Full Model)

Legend:



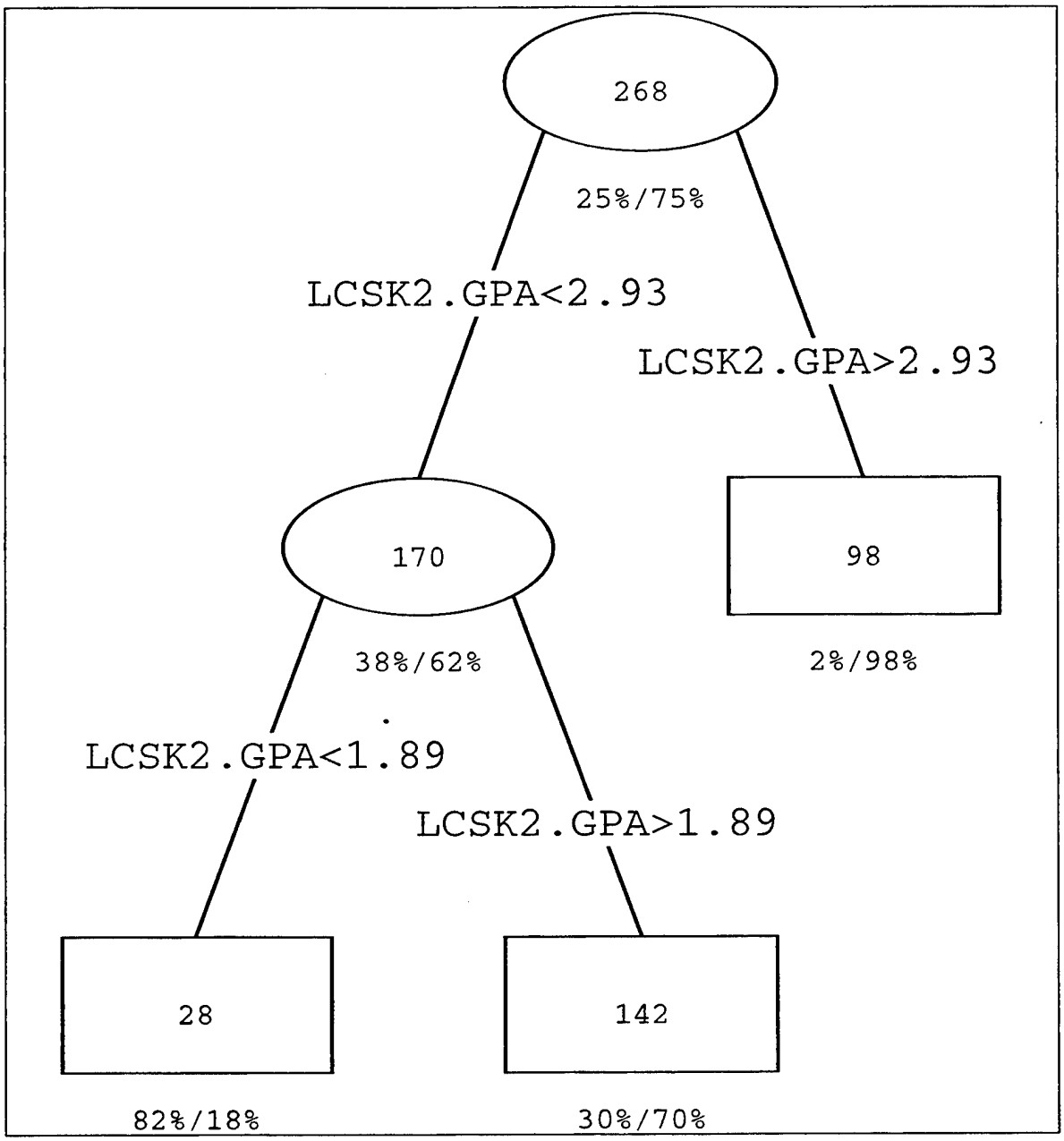
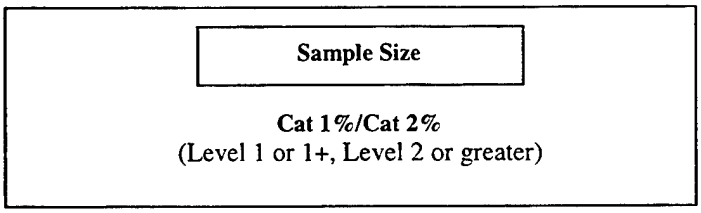


Figure 12: Arabic DLPT.L and Listening Cumulative Skills GPA (Partial Model)

Legend:



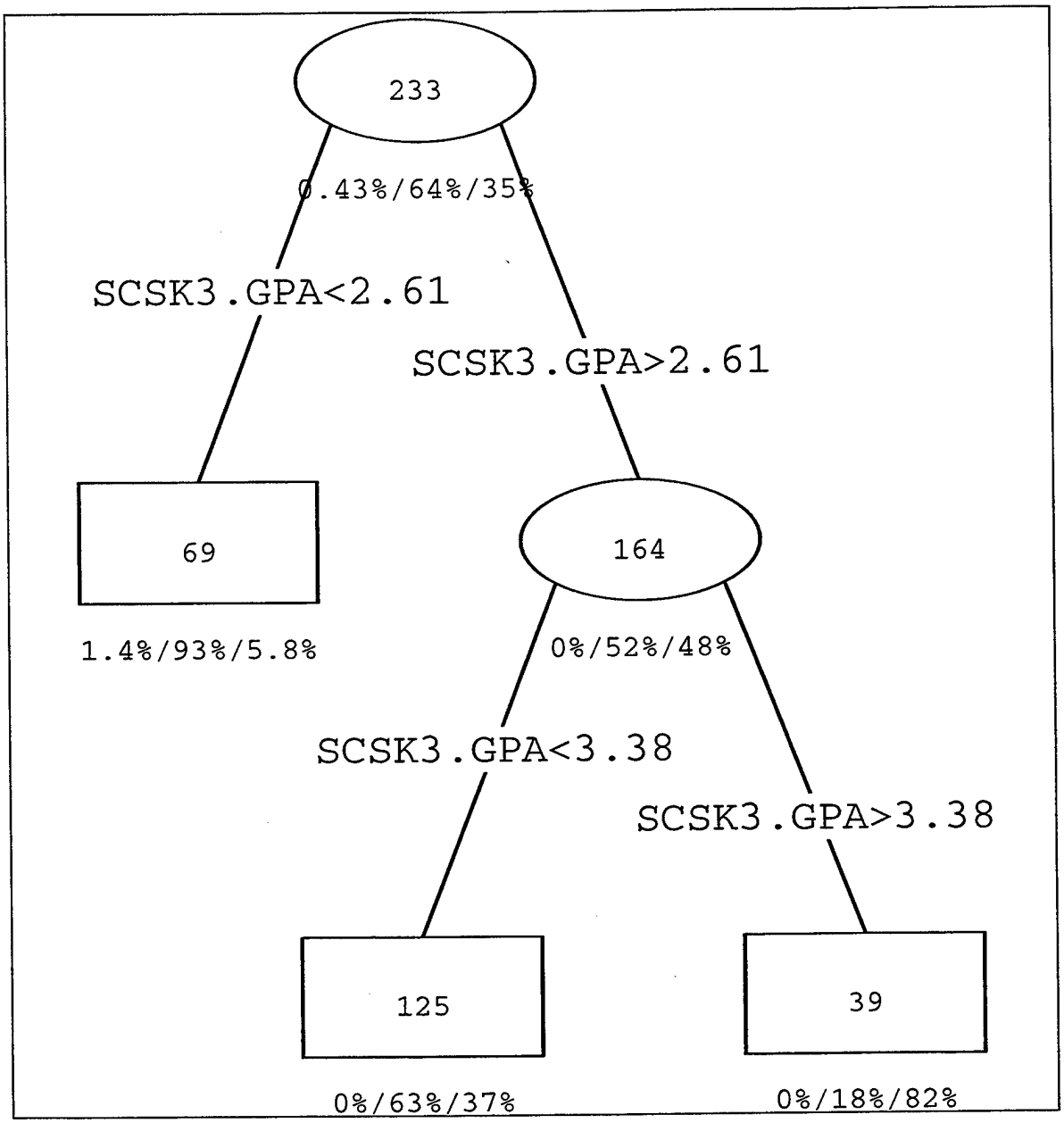
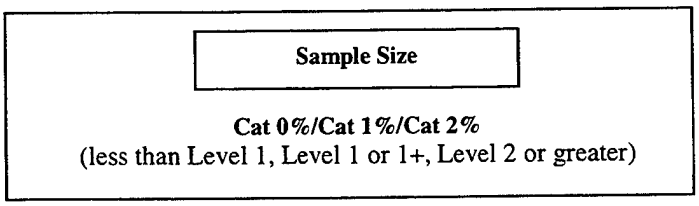


Figure 13: Arabic DLPT.S and Speaking Cumulative Skills GPA (Full Model)

Legend:



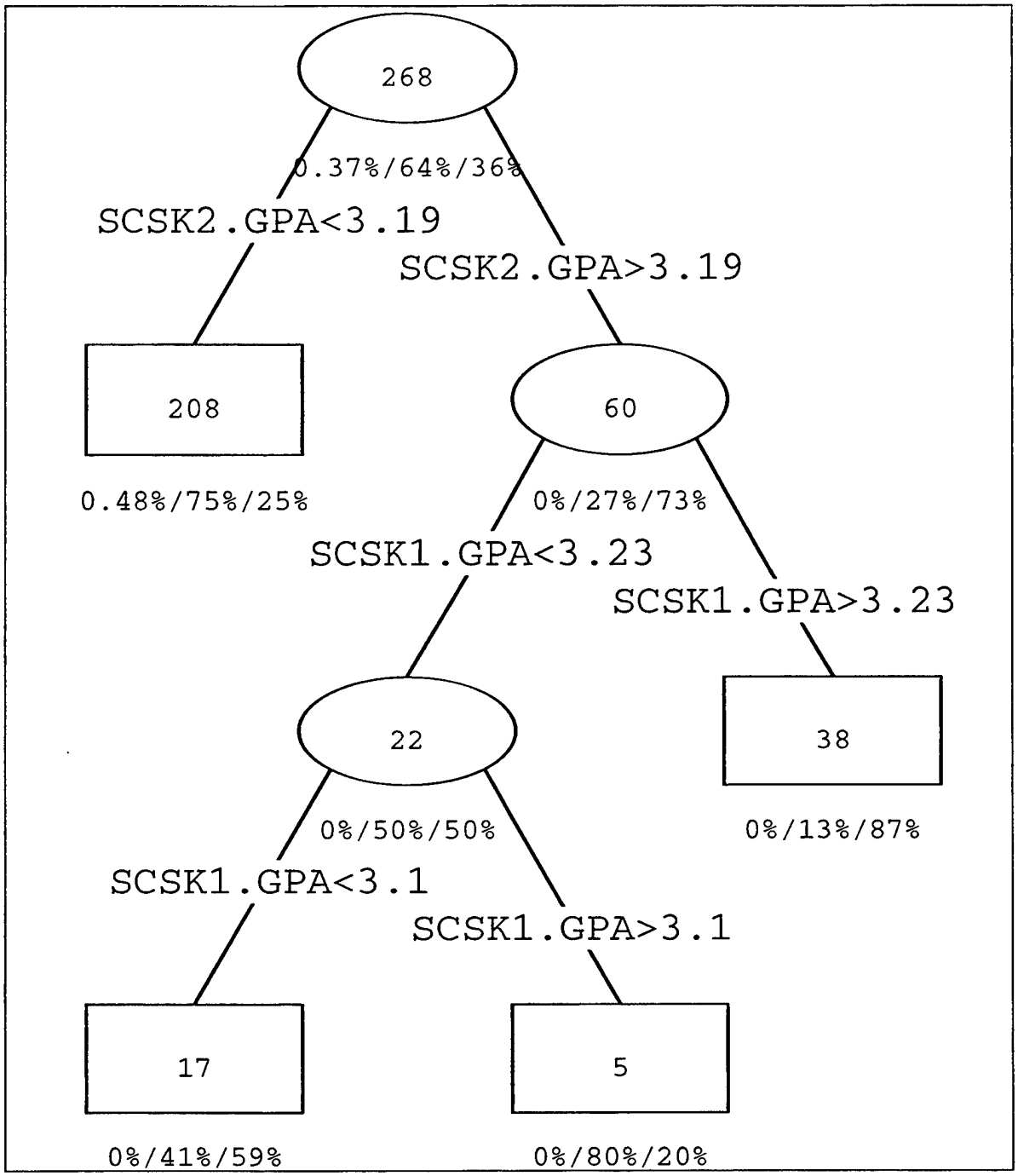
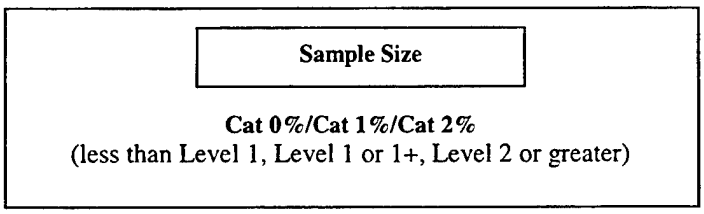


Figure 14: Arabic DLPT.S and Speaking Cumulative Skills GPA (Partial Model)

Legend:



E. BEST OVERALL PREDICTOR OF DLPT PERFORMANCE

As in the Persian Language Program, we would also like to identify what the overall best predictors of DLPT performance within the Arabic Language Program are, taking into account all three semester GPAs, all nine cumulative skills GPAs, and all of the C-Tests for all three skills. This answers the question: "Given everything we know academically about the student (listening, reading, and speaking C-Test grades, semester GPAs, and cumulative skills GPAs), what is the best predictor of DLPT performance?" Figure 15, a classification tree, answers this question. Each node contains the sample size used in the splitting of that node. Underneath each node are the classification percentages related to DLPT performance in the following manner: not obtaining at least a 2/2/1, obtaining either a 2/2/1 or 2/2/1+, or obtaining at least a 2/2/2. It identifies the second and third semester GPAs as being the most predictive. Figure 15 is almost exactly the same as Figure 10. This is quite surprising and counter-intuitive. The Arabic language program's belief is that the cumulative skills semester GPAs are the best predictors of DLPT performance, and the cumulative skills semester GPAs are currently being subjectively used to predict DLPT performance as stated in Chapter I. The misclassification rate of this model is estimated to be 38.2%.

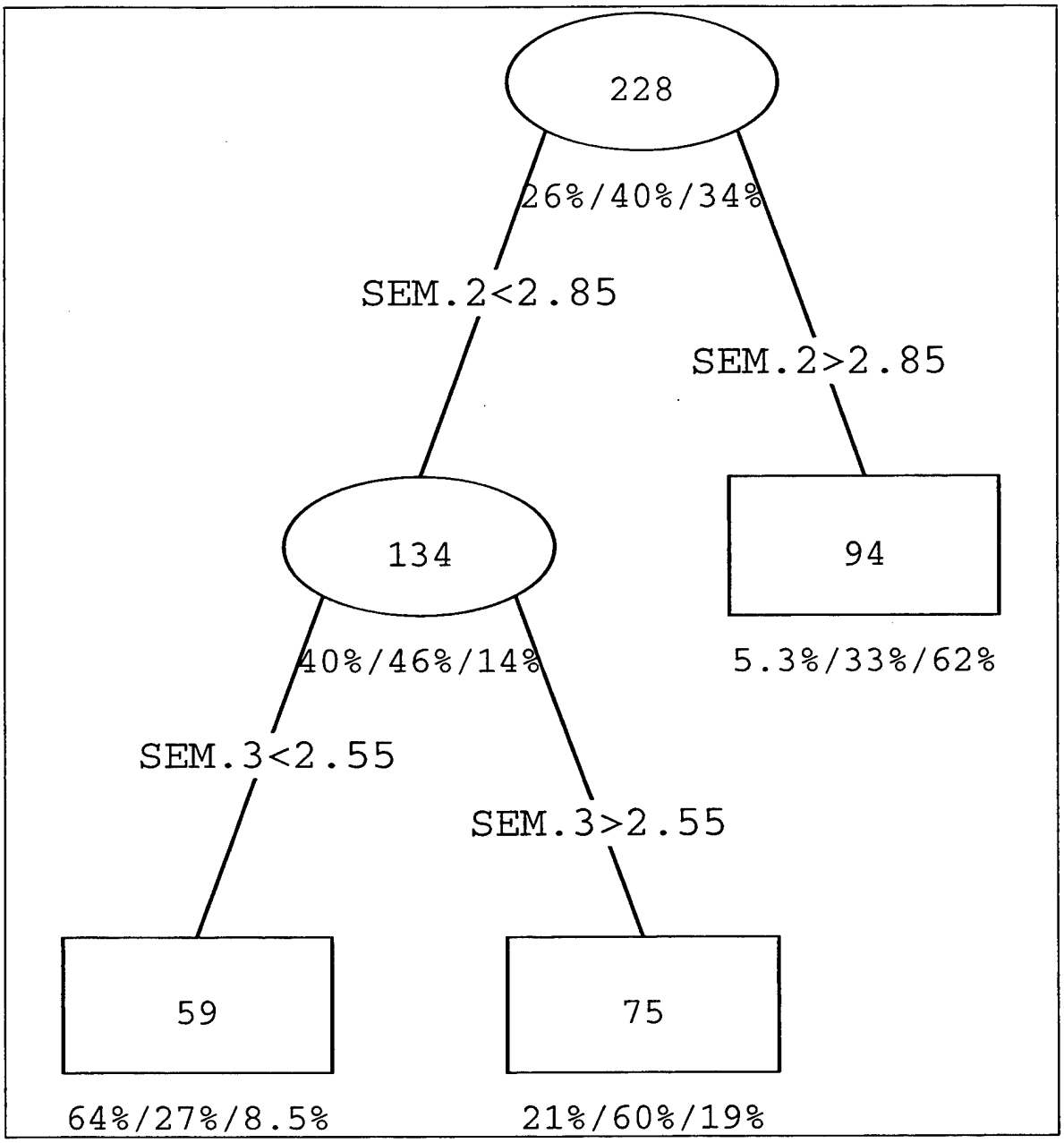
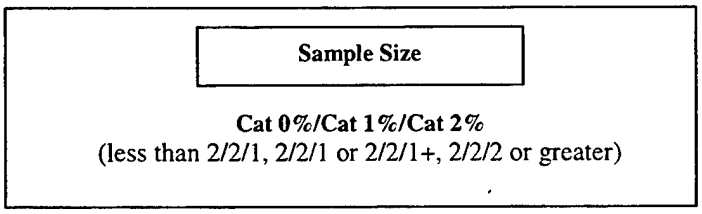


Figure 15: Overall Arabic DLPT Performance Predictors

Legend:



V. SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

A. SUMMARY

The focus of this thesis is threefold. First, we determine if major program tests, cumulative skills GPAs, or semester GPAs are predictive of DLPT performance in the Arabic and Persian language programs by determining the relationship between each major program test grade or semester GPA and the DLPT in listening, reading, and speaking. The relationship of cumulative skill semester GPAs to the DLPT is also explored. Secondly, we concentrate attention on sustained student performance across all three semesters and predictors of performance from test to test and semester to semester through the relationships among each of the major program tests, semester GPAs, and cumulative skills GPAs. Finally, we determine if individual program tests can be identified as having a strong relationship to DLPT performance as an aid to the language programs in recycling or dropping students.

B. CONCLUSIONS

The major program tests, known as phase tests in Persian and C-Tests in Arabic, are useful predictors of DLPT performance in the skills of listening, reading, and speaking. The major program tests independently assess these three skills as well. In addition, tests taken towards the latter half of the curriculum tend to be more predictive of DLPT performance than those of the first half. In the Persian analysis, phase tests five and six are selected as the most predictive in all three skills. However, phase tests one and two appear in the models as well. In the Arabic analysis, C-Tests eleven, twelve, fourteen, fifteen, and semester tests two and three appear in the models. C-Test eleven appears in four of the six models, and semester tests two and three appear in three of the six models, each. Tests taken earlier in the course do not appear in the tree models until the third or fourth level.

In contrast to program tests and cumulative skills GPAs, the semester GPA includes a variety of different grades and areas of study not strictly limited to the assessment of the three skill areas tested by the DLPT. Thus it was expected that the semester GPA would not be as useful as the program tests or cumulative skills GPAs. However, our analysis shows the value of the semester GPAs. For Persian, semester GPAs one and two are good indicators, and for Arabic, semester GPAs two and three are good indicators of DLPT performance. The misclassification rate of the classification trees for Persian is 26% and for Arabic 37%. Later, we again see the importance of the semester GPAs in determining the overall best predictors of DLPT performance. Semester GPAs are identified as being the best overall predictors of DLPT performance for both Persian and Arabic.

Prior to our analysis, our intial belief was that the cumulative skills GPAs are the best predictors of DLPT performance. When used in a regression model with the DLPT scores in listening, reading, and speaking as the response variable for each skill, the cumulative skills GPAs prove themselves to be valuable tools. The cut-off GPAs provide the Arabic language program with an objective, versus subjective, instrument to forecast DLPT performance. Interestingly, the cumulative skills GPAs are not identified as the best overall predictors of DLPT performance as we had believed they would be.

In trying to predict performance on a future test or GPA based on previous test or GPA performance, we find inconsistent results. For both Arabic and Persian program tests, it seems plausible to predict performance based on pairwise relationships of program tests. Many of the program tests have moderate to high correlations. However, the multiple regression analysis for the Persian phase tests provides little support that we can measure how well a student will do on future tests based on past test performance. Yet, for Arabic, there appears to be some credence in doing so. The inconsistency could be because the Arabic C-Tests are designed to address a

content and skill progression in their tests. Although Persian phase tests relate to the course content and a skill progression, they appear to do so to a lesser extent than Arabic. For both Persian and Arabic, we find previous semester GPAs and cumulative skills semester GPAs to be predictive of future GPAs. These results are supported by the very high correlations between the GPAs.

We use successive linear multiple regression to determine appropriate attrition points for students. Prior to our analysis, we believed the results of this analysis would mirror the Persian stepwise linear regression models and the Arabic regression tree models because a test identified as being predictive of DLPT performance could be argued to also be useful in determining when to drop a student. For Persian, the results of this model support the stepwise regression results. For Arabic, the results of this model do not support the results of the regression tree models.

C. RECOMMENDATIONS

I recommend that DLIFLC use the previously mentioned results and models to predict student performance in the Arabic and Persian language programs. Each of the models presented can also be used in similar analysis for other DLIFLC language programs. Additionally, I recommend that DLIFLC review the Arabic and Persian program tests for content and the testing of skill progression. This will ensure students are being exposed to questions specifically related to course material. More importantly, it will ensure students are exposed to questions that will increasingly assess their proficiency within the language and the three skills with each successive test. I also recommend that complete student records, including semester GPAs, program test raw scores, and cumulative skills GPAs, be retained for a period of at least two years to facilitate further analysis.

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APPENDIX A. PERSIAN TEST NUMERICAL SUMMARIES

Numerical summaries provide a statistical synopsis of the data. From Tables A.1 though A.4, it is obvious that for listening, phase tests one and five have the lowest standard deviation of the six. For reading, phase tests one, two, and four have the lowest standard deviation, and for speaking, phase tests four, five, and six have the lowest standard deviation of the six. Typically, tests with lower standard deviations are loaded on more heavily in the regression model. The sample size for each test is 233 students. Due to missing test scores, the sample size is reduced by the number included in the column labeled "Missing." The "Missing" values are the same for the phase tests for each skill because these students are missing data for all the skill portions of those particular tests.

Table A.1: Persian Listening Phase Test Numerical Summaries

	MIN	MAX	MEAN	MEDIAN	MISSING	STD DEV
LPHASE1	46.0	100.0	90.3	91.5	21	7.87
LPHASE2	58.0	100.0	84.2	86.0	2	10.1
LPHASE3	10.0	100.0	83.4	84.0	3	12.7
LPHASE4	44.0	100.0	84.8	86.0	46	11.2
LPHASE5	58.0	100.0	89.2	91.0	46	7.94
LPHASE6	40.0	100.0	84.9	86.0	46	10.3

Table A.2: Persian Reading Phase Test Numerical Summaries

	MIN	MAX	MEAN	MEDIAN	MISSING	STD DEV
RPHASE1	10.0	100.0	92.7	94.0	21	8.38
RPHASE2	57.0	100.0	87.8	88.0	2	8.13
RPHASE3	10.0	100.0	83.9	86.0	3	11.9
RPHASE4	65.0	100.0	86.5	86.0	46	8.05
RPHASE5	40.0	100.0	87.9	90.0	46	10.4
RPHASE6	28.0	100.0	85.0	85.0	46	9.76

Table A.3: Persian Speaking Phase Test Numerical Summaries

	MIN	MAX	MEAN	MEDIAN	MISSING	STD DEV
SPHASE1	63.0	100.0	92.9	95.8	21	7.85
SPHASE2	68.0	100.0	91.3	93.0	2	7.22
SPHASE3	68.0	100.0	93.0	95.0	3	6.61
SPHASE4	68.0	100.0	93.4	95.0	46	6.13
SPHASE5	72.0	100.0	92.5	94.0	46	6.26
SPHASE6	74.0	100.0	93.5	95.0	46	5.84

Table A.4: Persian GPA and Proficiency Numerical Summaries

	MIN	MAX	MEAN	MEDIAN	MISSING	STD DEV
DLPT.L	23.0	59.0	45.2	45.0	0	4.38
DLPT.R	24.0	60.0	45.8	46.0	0	5.84
DLPT.S	10.0	36.0	20.6	20.0	0	3.59
SEM1.GPA	1.60	4.00	3.21	3.20	2	.479
SEM2.GPA	1.70	4.00	3.07	3.10	0	.529
SEM3.GPA	1.00	4.00	3.18	3.20	0	.525

APPENDIX B. PERSIAN PAIRWISE CORRELATIONS

The correlation matrix is a numerical summary used to understand the relationship of pairs of variables. We define the correlation to be low, moderate or high if the correlation coefficient meets the following criteria: low if coefficient is between 0.01 and 0.400, moderate if correlation coefficient is between 0.401 and 0.699, and high if the coefficient is between 0.700 and 1.0. All moderate and high correlations are in bold.

Table B.1: Persian DLPT-Program Test Correlations

	DLPT.L	DLPT.R	DLPT.S
LPHASE1	.305	.186	.365
LPHASE2	**.471**	.311	**.426**
LPHASE3	.296	.125	.338
LPHASE4	**.422**	.233	.392
LPHASE5	**.466**	.343	**.484**
LPHASE6	**.546**	.378	**.489**
RPHASE1	.144	.193	.154
RPHASE2	.303	.250	**.425**
RPHASE3	.184	.186	.359
RPHASE4	.294	.184	.361
RPHASE5	.400	**.421**	**.479**
RPHASE6	**.442**	**.443**	**.467**
SPHASE1	.297	.227	.248
SPHASE2	.351	.305	.334
SPHASE3	.282	.226	.398
SPHASE4	.271	.175	.368
SPHASE5	.331	.247	.353
SPHASE6	**.402**	.334	**.459**

Table B.2: Persian DLPT-Semester GPA Correlations

	SEM1.GPA	SEM2.GPA	SEM3.GPA
DLPT.L	**.476**	.366	**.477**
DLPT.R	.373	.267	**.408**
DLPT.S	**.486**	**.493**	**.561**

Table B.3: Persian Listening Phase Test-Phase Test Correlations

	LPHASE1	LPHASE2	LPHASE3	LPHASE4	LPHASE5	LPHASE6
LPHASE1	**1.000**	**0.463**	**0.417**	0.306	0.307	0.400
LPHASE2	**0.463**	**1.000**	**0.516**	**0.600**	**0.498**	**0.556**
LPHASE3	**0.417**	**0.516**	**1.000**	**0.466**	0.365	**0.444**
LPHASE4	0.306	**0.600**	**0.466**	**1.000**	**0.567**	**0.649**
LPHASE5	0.307	**0.498**	0.365	**0.567**	**1.000**	**0.585**
LPHASE6	0.400	**0.556**	**0.444**	**0.649**	**0.585**	**1.000**
RPHASE1	0.175	0.132	0.091	0.114	0.118	0.085
RPHASE2	0.392	**0.507**	**0.488**	0.400	**0.457**	**0.502**
RPHASE3	0.299	0.294	**0.500**	0.364	0.329	0.296
RPHASE4	0.225	**0.455**	0.375	**0.527**	0.327	**0.422**
RPHASE5	0.283	**0.402**	0.372	**0.504**	**0.499**	**0.579**
RPHASE6	0.246	**0.402**	0.327	0.367	**0.470**	**0.521**
SPHASE1	0.192	0.309	0.078	0.086	0.105	0.155
SPHASE2	0.386	**0.446**	0.353	0.340	**0.429**	0.394
SPHASE3	0.218	0.361	0.293	0.273	0.277	0.234
SPHASE4	0.205	0.368	0.323	0.344	0.338	0.326
SPHASE5	0.225	0.396	0.295	**0.432**	**0.449**	**0.419**
SPHASE6	0.238	**0.468**	0.354	**0.515**	**0.504**	**0.559**

Table B.4: Persian Reading Phase Test-Phase Test Correlations

	RPHASE1	RPHASE2	RPHASE3	RPHASE4	RPHASE5	RPHASE6
LPHASE1	0.175	0.392	0.299	0.225	0.283	0.246
LPHASE2	0.132	**0.507**	0.294	**0.455**	**0.402**	**0.402**
LPHASE3	0.091	**0.488**	**0.500**	0.375	0.372	0.327
LPHASE4	0.114	0.400	0.364	**0.527**	**0.504**	0.367
LPHASE5	0.118	**0.457**	0.329	0.327	**0.499**	**0.470**
LPHASE6	0.085	**0.502**	0.296	**0.422**	**0.579**	**0.521**
RPHASE1	**1.000**	0.179	0.117	0.213	0.140	0.189
RPHASE2	0.179	**1.000**	0.375	**0.497**	**0.487**	**0.504**
RPHASE3	0.117	0.375	**1.000**	0.318	0.397	0.360
RPHASE4	0.213	**0.497**	0.318	**1.000**	**0.457**	**0.494**
RPHASE5	0.140	**0.487**	0.397	**0.457**	**1.000**	**0.675**
RPHASE6	0.189	**0.504**	0.360	**0.494**	**0.675**	**1.000**
SPHASE1	0.285	0.270	0.047	0.311	0.162	0.170
SPHASE2	0.209	**0.553**	0.330	**0.481**	**0.454**	**0.471**
SPHASE3	0.257	0.353	0.334	**0.420**	0.337	0.313
SPHASE4	0.108	0.383	0.337	**0.477**	**0.422**	0.398
SPHASE5	0.145	0.393	0.268	**0.462**	**0.487**	0.399
SPHASE6	0.140	**0.424**	0.265	**0.428**	**0.480**	**0.503**

Table B.5: Persian Speaking Phase Test-Phase Test Correlations

	SPHASE1	SPHASE2	SPHASE3	SPHASE4	SPHASE5	SPHASE6
LPHASE1	0.192	0.386	0.218	0.205	0.225	0.238
LPHASE2	0.309	**0.446**	0.361	0.368	0.396	**0.468**
LPHASE3	0.078	0.353	0.293	0.323	0.295	0.354
LPHASE4	0.086	0.340	0.273	0.344	**0.432**	**0.515**
LPHASE5	0.105	**0.429**	0.277	0.338	**0.449**	**0.504**
LPHASE6	0.155	0.394	0.234	0.326	**0.419**	**0.559**
RPHASE1	0.285	0.209	0.257	0.108	0.145	0.140
RPHASE2	0.270	**0.553**	0.353	0.383	0.393	**0.424**
RPHASE3	0.047	0.330	0.334	0.337	0.268	0.265
RPHASE4	0.311	**0.481**	**0.420**	**0.477**	**0.462**	**0.428**
RPHASE5	0.162	**0.454**	0.337	**0.422**	**0.487**	**0.480**
RPHASE6	0.170	**0.471**	0.313	0.398	0.399	**0.503**
SPHASE1	**1.000**	0.373	**0.613**	0.372	0.322	0.295
SPHASE2	0.373	**1.000**	**0.458**	0.339	**0.415**	0.325
SPHASE3	**0.613**	**0.458**	**1.000**	**0.474**	**0.491**	**0.455**
SPHASE4	0.372	0.339	**0.474**	**1.000**	**0.574**	**0.478**
SPHASE5	0.322	**0.415**	**0.491**	**0.574**	**1.000**	**0.553**
SPHASE6	0.295	0.325	**0.455**	**0.478**	**0.553**	**1.000**

Table B.6: Persian Semester GPA Correlations

	SEM1.GPA	SEM2.GPA	SEM3.GPA
SEM1.GPA	1.000	.708	.706
SEM2.GPA	.708	1.000	.793
SEM3.GPA	.706	.793	1.000

APPENDIX C. PREDICT PERSIAN SUSTAINED STUDENT PERFORMANCE

Table C.1: Predicting Sustained Performance on Persian Phase Tests

Model	RSE*	d.o.f. *	R^2	Tests with p-value < 0.05
LISTENING				
(1) LPHASE6 ~ LPHASE5 + LPHASE4 + LPHASE3 + LPHASE2 + LPHASE1	7.354	159	0.532	LPHASE1, LPHASE4, LPHASE5
(2) LPHASE5 ~ LPHASE4 + LPHASE3 + LPHASE2 + LPHASE1	6.399	160	0.367	LPHASE2, LPHASE4
(3) LPHASE4 ~ LPHASE3 + LPHASE2 + LPHASE1	8.94	161	0.393	LPHASE2, LPHASE3
(4) LPHASE3 ~ LPHASE2 + LPHASE1	10.46	207	0.338	LPHASE1, LPHASE2
(5) LPHASE2 ~ LPHASE1	8.975	209	0.209	LPHASE1
READING				
(6) RPHASE6 ~ RPHASE5 + RPHASE4 + RPHASE3 + RPHASE2 + RPHASE1	6.935	159	0.522	RPHASE2, RPHASE4, RPHASE5
(7) RPHASE5 ~ RPHASE4 + RPHASE3 + RPHASE2 + RPHASE1	8.69	160	0.336	RPHASE2, RPHASE3, RPHASE4
(8) RPHASE4 ~ RPHASE3 + RPHASE2 + RPHASE1	6.939	161	0.281	RPHASE2, RPHASE3
(9) RPHASE3 ~ RPHASE2 + RPHASE1	11.07	207	0.162	RPHASE2
(10) RPHASE2 ~ RPHASE1	8.052	209	0.047	RPHASE1
SPEAKING				
(11) SPHASE6 ~ SPHASE5 + SPHASE4 + SPHASE3 + SPHASE2 + SPHASE1	4.501	159	0.373	SPHASE3, SPHASE4, SPHASE5
(12) SPHASE5 ~ SPHASE4 + SPHASE3 + SPHASE2 + SPHASE1	4.745	160	0.417	SPHASE2, SPHASE3, SPHASE4
(13) SPHASE4 ~ SPHASE3 + SPHASE2 + SPHASE1	4.671	161	0.251	SPHASE3
(14) SPHASE3 ~ SPHASE2 + SPHASE1	5.108	207	0.420	SPHASE2, SPHASE3
(15) SPHASE2 ~ SPHASE1	6.182	209	0.250	SPHASE1

***RSE**: Residual Standard Error
***d.o.f.**: degrees of freedom

Table C.2: Predicting Sustained Performance with Persian Semester GPAs

Model	RSE	d.o.f.	R^2	GPAs with p-value < 0.05
(1) SEM3.GPA ~ SEM1.GPA + SEM2.GPA	0.295	227	0.684	SEM1.GPA, SEM2.GPA
(2) SEM2.GPA ~ SEM1.GPA	0.380	228	0.485	SEM1.GPA

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APPENDIX D. PERSIAN SEMESTER GPA CROSSTABULATIONS

The crosstabulations show semester GPA intervals, one GPA at a time, that correspond to attaining minimum DLPT scores. The categories are defined as follows: 2 - at least a 2/2/2, 1 - either a 2/2/1 or 2/2/1+, 0 - not achieving at least a 2/2/1. The cell of each semester GPA interval contains the number of students falling within a particular GPA range and the percentage within that row.

Table D.1: Persian DLPT and First Semester GPA Crosstabulations

First Semester GPA Intervals		Category		
		0 (less than 2/2/1)	1 (2/2/1 or 2/2/1+)	2 (2/2/2 or better)
1.0 – 2.8	n	16	10	12
	%	.421	.263	.316
2.8 – 2.9	n	10	7	11
	%	.357	.250	.393
2.9 – 3.0	n	0	2	10
	%		.167	.833
3.0 – 3.2	n	5	3	33
	%	.122	.073	.805
3.2 – 3.5	n	4	3	40
	%	.085	.064	.851
3.5 – 3.7	n	4	4	25
	%	.121	.121	.758
3.7 – 4.0	n	4	0	27
	%	.129		.871
Column Totals		43	29	158

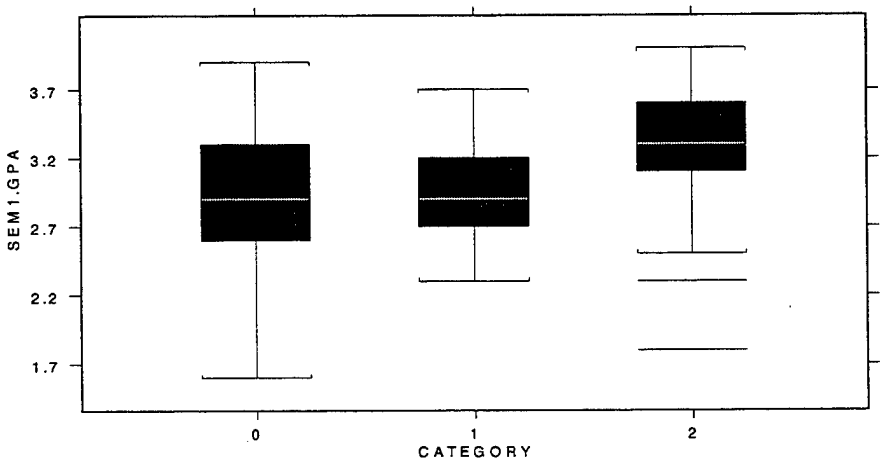

Figure 16: Persian Boxplot of Category versus First Semester GPA

Table D.2: Persian DLPT and Second Semester GPA Crosstabulations

Second Semester GPA Intervals		Category		
		0 (less than 2/2/1)	1 (2/2/1 or 2/2/1+)	2 (2/2/2 or better)
1.0 – 2.3	n	7	4	7
	%	.389	.222	.389
2.3 – 2.8	n	13	7	26
	%	.283	.152	.565
2.8 – 2.9	n	7	8	14
	%	.241	.276	.483
2.9 – 3.0	n	5	1	10
	%	.313	.063	.625
3.0 – 3.2	n	5	5	22
	%	.156	.156	.688
3.2 – 3.5	n	6	4	35
	%	.133	.089	.778
3.5 – 3.7	n	1	0	19
	%	.050		.950
3.7 – 4.0	n	1	0	25
	%	.039		.962
Column Totals		43	29	158

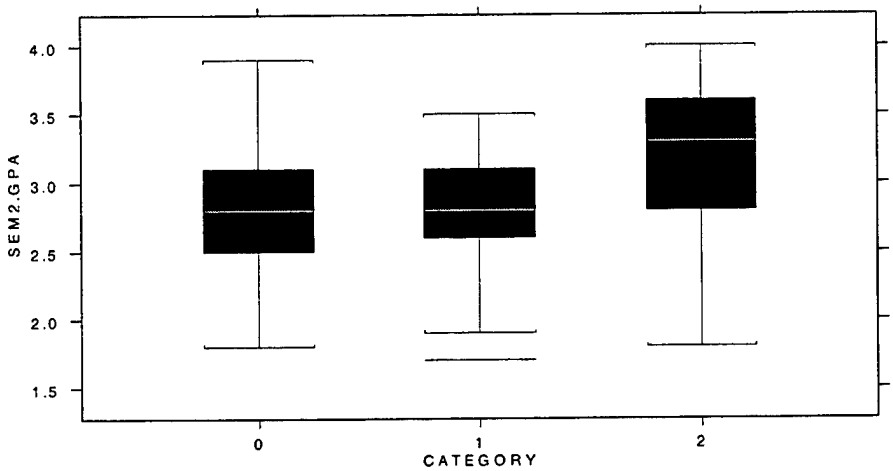

Figure 17: Persian Boxplot of Category versus Second Semester GPA

Table D.3: Persian DLPT and Third Semester GPA Crosstabulations

Third Semester GPA Intervals		Category		
		0 (less than 2/2/1)	1 (2/2/1 or 2/2/1+)	2 (2/2/2 or better)
1.5 – 2.3	n	4	3	3
	%	.400	.300	.300
2.3 – 2.8	n	12	7	18
	%	.514	.189	.487
2.8 – 2.9	n	10	1	8
	%	.526	.053	.421
2.9 – 3.0	n	4	6	6
	%	.250	.375	.375
3.0 – 3.2	n	6	6	26
	%	.158	.158	.684
3.2 – 3.5	n	6	5	43
	%	.111	.093	.796
3.5 – 3.7	n	1	1	20
	%	.046	.046	.910
3.7 – 4.0	n	1	0	34
	%	.029		.971
Column Totals		44	29	158

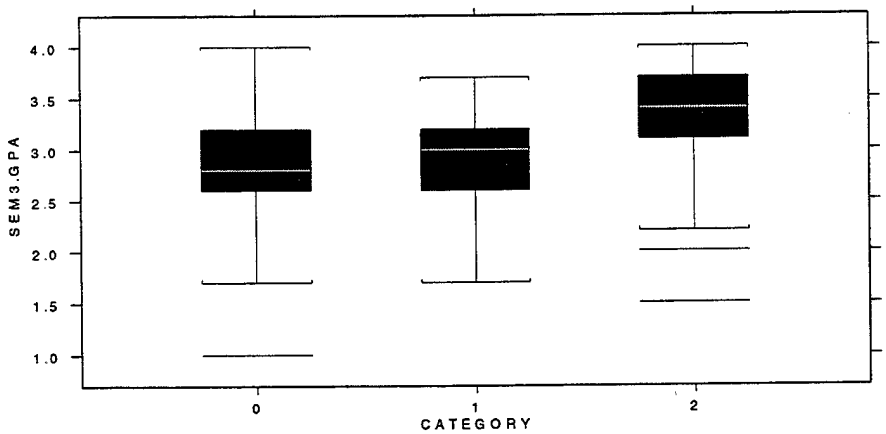

Figure 18: Persian Boxplot of Category versus Third Semester GPA

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APPENDIX E. IDENTIFYING POTENTIAL DECISION POINTS FOR PERSIAN ATTRITION BASED ON MAJOR PROGRAM TESTS

Particular tests should be looked at more carefully before a decision is made to drop a student. To identify an appropriate point for recycling or dropping students, multiple linear regression is used to determine if there is a critical program test with a significant F-statistic and change in R^2. The simple model is the DLPT test regressed against the first phase test. Further models are formed by sequentially adding successive phase tests to the initial model.

Table E.1: Identifying Potential Decision Points For Persian Attrition

Model	RSE	d.o.f.	R^2	Change in R^2
LISTENING				
DLPT.L ~ LPHASE1	4.10	209	0.112	0.112
DLPT.L ~ LPHASE1 + LPHASE2	3.73	208	0.266	0.154
DLPT.L ~ LPHASE1 + LPHASE2 + LPHASE3	3.71	206	0.269	0.003
DLPT.L ~ LPHASE1 + LPHASE2 + LPHASE3 + LPHASE4	3.61	160	0.262	-0.007
DLPT.L ~ LPHASE1 + LPHASE2 + LPHASE3 + LPHASE4 + LPHASE5	3.52	159	0.302	0.040
DLPT.L ~ LPHASE1 + LPHASE2 + LPHASE3 + LPHASE4 + LPHASE5 + LPHASE6	3.40	158	0.353	0.051
READING				
DLPT.R ~ RPHASE1	5.56	209	0.074	0.074
DLPT.R ~ RPHASE1 + RPHASE2	5.39	208	0.135	0.061
DLPT.R ~ RPHASE1 + RPHASE2 + RPHASE3	5.30	206	0.158	0.023
DLPT.R ~ RPHASE1 + RPHASE2 + RPHASE3 + RPHASE4	5.42	160	0.094	-0.064
DLPT.R ~ RPHASE1 + RPHASE2 + RPHASE3 + RPHASE4 + RPHASE5	5.11	159	0.199	0.105
DLPT.R ~ RPHASE1 + RPHASE2 + RPHASE3 + RPHASE4 + RPHASE5 + RPHASE6	4.99	158	0.242	0.043
SPEAKING				
DLPT.S ~ SPHASE1	3.55	209	0.064	0.064
DLPT.S ~ SPHASE1 + SPHASE2	3.45	208	0.122	0.058
DLPT.S ~ SPHASE1 + SPHASE2 + SPHASE3	3.33	206	0.192	0.070
DLPT.S ~ SPHASE1 + SPHASE2 + SPHASE3 + SPHASE4	3.28	160	0.222	0.030
DLPT.S ~ SPHASE1 + SPHASE2 + SPHASE3 + SPHASE4 + SPHASE5	3.28	159	0.227	0.005
DLPT.S ~ SPHASE1 + SPHASE2 + SPHASE3 + SPHASE4 + SPHASE5 + SPHASE6	3.17	158	0.284	0.057

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APPENDIX F. PERSIAN S-PLUS LOGISTIC REGRESSION RESULTS

LOGISTIC REGRESSION SUB-MODEL (1)

```
Call: glm(formula = Y1 ~ SEM1.GPA + SEM2.GPA + SEM3.GPA,
          family = binomial, data = progdlpt, na.action
          = na.omit, control = list(epsilon = 0.001,
          maxit = 50, trace = F))
Deviance Residuals:
   Min     1Q     Median   3Q     Max
 -2.48   0.305   0.455    0.621  1.57

Coefficients:
                 Value   Std. Error  t value
(Intercept)      -4.72   1.32        -3.58
  SEM1.GPA        1.34   0.508        2.65
  SEM2.GPA       -0.920  0.614       -1.50
  SEM3.GPA        1.56   0.584        2.66

(Dispersion Parameter for Binomial family taken to be 1 )

   Null Deviance: 222.0 on 230 degrees of freedom

Residual Deviance: 191.8 on 227 degrees of freedom

Number of Fisher Scoring Iterations: 4
```

LOGISTIC REGRESSION SUB-MODEL (2)

```
Call: glm(formula = Z1 ~ SEM1.GPA + SEM2.GPA + SEM3.GPA,
          family = binomial, data = progdlpt, na.action
          = na.omit, control = list(epsilon = 0.001,
          maxit = 50, trace = F))
Deviance Residuals:
   Min     1Q     Median   3Q     Max
 -2.48   0.255   0.418    0.602  1.54

Coefficients:
                 Value   Std. Error  t value
(Intercept)      -5.84   1.73        -3.36
  SEM1.GPA        1.48   0.735        2.01
  SEM2.GPA        0.561  0.692        0.810
  SEM3.GPA        0.384  0.757        0.507

(Dispersion Parameter for Binomial family taken to be 1 )

   Null Deviance: 161.7 on 187 degrees of freedom

Residual Deviance: 139.6 on 184 degrees of freedom

Number of Fisher Scoring Iterations: 4
```

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APPENDIX G. ARABIC TEST NUMERICAL SUMMARIES

The original sample size for each test is 409 students. Due to missing test scores, the sample size is reduced by the number included in the column labeled "MISSING."

Table G.1: Arabic Listening C-Test Numerical Summaries

	MIN	MEAN	MEDIAN	MAX	MISSING	STD DEV
LC01.NUM	0.700	2.96	3.00	4.00	75.0	0.890
LC02.NUM	0.700	2.60	2.70	4.00	19.0	0.869
LC03.NUM	0.700	2.22	2.30	4.00	50.0	0.867
LC04.NUM	0.000	2.54	2.70	4.00	29.0	0.884
LC05.NUM	0.700	2.51	2.30	4.00	41.0	0.858
LC06.NUM	0.700	2.58	2.30	4.00	49.0	0.848
LC07.NUM	0.700	2.67	2.70	4.00	64.0	0.748
LS01.NUM	0.700	2.38	2.30	4.00	65.0	0.991
LC08.NUM	0.700	2.54	2.30	4.00	127.0	0.683
LC09.NUM	0.700	2.48	2.50	4.00	77.0	0.812
LC10.NUM	0.700	2.87	2.85	4.00	79.0	0.775
LC11.NUM	0.700	2.35	2.30	4.00	82.0	0.811
LC12.NUM	0.700	2.91	3.00	4.00	86.0	0.715
LS02.NUM	0.700	2.69	2.70	4.00	134.0	0.764
LC13.NUM	1.00	2.63	2.70	4.00	92.0	0.706
LC14.NUM	0.700	2.64	2.70	4.00	97.0	0.841
LC15.NUM	0.700	2.85	3.00	4.00	136.0	0.823
LS03.NUM	0.700	2.54	2.70	4.00	173.0	0.874

Table G.2: Arabic Reading C-Test Numerical Summaries

	MIN	MEAN	MEDIAN	MAX	MISSING	STD DEV
RC01.NUM	0.700	2.99	3.30	4.00	75.0	0.901
RC02.NUM	0.700	2.70	2.70	4.00	19.0	0.924
RC03.NUM	0.700	2.57	2.70	4.00	50.0	0.992
RC04.NUM	0.700	2.85	3.00	4.00	30.0	0.918
RC05.NUM	0.700	2.75	2.70	4.00	41.0	0.823
RC06.NUM	0.700	2.66	2.70	4.00	49.0	0.777
RC07.NUM	0.700	2.62	2.70	4.00	64.0	0.855
RS01.NUM	0.700	2.68	3.00	4.00	65.0	0.923
RC08.NUM	1.70	2.77	2.70	4.00	127.0	0.631
RC09.NUM	0.700	2.65	2.70	4.00	77.0	0.933
RC10.NUM	0.700	2.74	2.70	4.00	79.0	0.732
RC11.NUM	0.700	2.72	2.70	4.00	82.0	0.764
RC12.NUM	0.700	2.84	3.00	4.00	86.0	0.778
RS02.NUM	0.700	3.04	3.00	4.00	134.0	0.686
RC13.NUM	0.700	2.92	3.00	4.00	92.0	0.808
RC14.NUM	0.700	2.80	3.00	4.00	97.0	0.869
RC15.NUM	1.00	2.96	3.00	4.00	136.0	0.782
RS03.NUM	1.00	3.21	3.30	4.00	173.0	0.729

Table G.3: Arabic Speaking C-Test Numerical Summaries

	MIN	MEAN	MEDIAN	MAX	MISSING	STD DEV
SC01.NUM	0.000	2.68	3.00	4.00	73.0	0.711
SC02.NUM	0.700	2.65	3.00	4.00	19.0	0.686
SC03.NUM	0.700	2.62	2.70	4.00	79.0	0.719
SC04.NUM	0.700	2.66	2.70	3.70	30.0	0.697
SC05.NUM	0.700	2.42	2.70	4.00	41.0	0.964
SC06.NUM	1.30	2.72	2.70	4.00	50.0	0.611
SC07.NUM	1.30	2.79	3.00	4.00	91.0	0.560
SS01.NUM	1.30	2.84	3.00	4.00	65.0	0.543
SC08.NUM	1.30	2.76	3.00	4.00	127.0	0.566
SC09.NUM	1.70	2.83	3.00	4.00	77.0	0.541
SC10.NUM	0.700	2.79	3.00	4.00	79.0	0.587
SC11.NUM	1.30	2.81	3.00	4.00	82.0	0.552
SC12.NUM	1.30	2.84	3.00	4.00	86.0	0.566
SS02.NUM	1.30	2.91	3.00	4.00	134.0	0.536
SC13.NUM	1.00	2.82	3.00	4.00	92.0	0.568
SC14.NUM	1.30	2.85	3.00	4.00	97.0	0.579
SC15.NUM	1.30	2.96	3.00	4.00	136.0	0.545
SS03.NUM	1.00	2.93	3.00	4.00	173.0	0.567

Table G.4: Arabic GPA Numerical Summaries

	MIN	MEAN	MEDIAN	MAX	MISSING	STD DEV
SEM1.GPA	1.00	2.67	2.70	4.00	41.0	0.577
SEM2.GPA	1.50	2.77	2.80	3.90	77.0	0.513
SEM3.GPA	1.40	2.93	2.90	4.00	88.0	0.531
LCSK1.GPA	1.32	2.54	2.47	4.00	120.0	0.623
LCSK2.GPA	1.18	2.66	2.65	3.87	135.0	0.626
LCSK3.GPA	1.10	2.61	2.62	4.00	174.0	0.699
RCSK1.GPA	1.11	2.77	2.74	4.00	120.0	0.639
RCSK2.GPA	1.16	2.90	2.95	4.00	135.0	0.560
RCSK3.GPA	1.12	3.04	3.07	4.00	174.0	0.638
SCSK1.GPA	1.61	2.78	2.78	3.85	120.0	0.466
SCSK2.GPA	1.55	2.87	2.90	3.94	135.0	0.471
SCSK3.GPA	1.38	2.89	2.95	4.00	174.0	0.501

Table G.5: Arabic DLPT Numerical Summaries

	MIN	MEAN	MEDIAN	MAX	MISSING	STD DEV
DLPT.L	4.00	43.1	43.0	59.0	90.0	5.86
DLPT.R	36.0	46.0	45.0	60.0	90.0	4.20
DLPT.S	6.00	16.5	16.0	26.0	90.0	3.85

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APPENDIX H. ARABIC PAIRWISE CORRELATIONS

We define the correlation to be low, moderate or high if the correlation coefficient meets the following criteria: low if coefficient is between 0.01 and 0.400, moderate if correlation coefficient is between 0.401 and 0.699, and high if the coefficient is between 0.700 and 1.0. All correlations above 0.500 are in bold.

Table H.1: Arabic DLPT-DLPT Correlations

	DLPT.L	DLPT.R	DLPT.S
DLPT.L	**1.000**	**0.660**	0.443
DLPT.R	**0.660**	**1.000**	0.445
DLPT.S	0.443	0.445	**1.000**

Table H.2: Arabic DLPT and Listening C-Test Correlations

	DLPT.L	DLPT.R	DLPT.S
LC01	0.172	0.198	0.190
LC02	0.290	0.285	0.220
LC03	0.338	0.317	0.333
LC04	0.397	0.334	0.346
LC05	0.423	0.426	0.388
LC06	0.390	0.425	0.404
LC07	0.414	0.338	0.379
LS01	0.496	0.456	0.476
LC08	**0.511**	0.431	0.420
LC09	0.454	0.457	0.469
LC10	**0.514**	**0.526**	0.477
LC11	**0.603**	**0.584**	0.485
LC12	0.470	0.384	0.448
LS02	**0.531**	**0.547**	**0.511**
LC13	**0.528**	**0.555**	0.409
LC14	**0.507**	**0.516**	0.391
LC15	**0.563**	**0.549**	0.483
LS03	**0.534**	0.488	0.416

Table H.3: Arabic DLPT and Reading C-Test Correlations

	DLPT.L	DLPT.R	DLPT.S
RC01	0.062	0.154	0.096
RC02	0.222	0.386	0.221
RC03	0.169	0.270	0.158
RC04	0.314	0.406	0.269
RC05	0.368	0.410	0.306
RC06	0.363	0.457	0.290
RC07	0.417	0.484	0.439
RS01	0.468	**0.502**	0.408
RC08	0.385	0.491	0.408
RC09	0.466	**0.520**	0.395
RC10	0.436	**0.518**	0.436
RC11	**0.546**	**0.576**	0.466
RC12	**0.502**	**0.604**	0.465
RS02	0.262	0.354	0.152
RC13	0.468	**0.563**	0.454
RC14	0.449	**0.560**	0.404
RC15	**0.518**	**0.624**	0.426
RS03	0.490	0.529	0.280

Table H.4: Arabic DLPT and Speaking C-Test Correlations

	DLPT.L	DLPT.R	DLPT.S
SC01	0.175	0.157	0.206
SC02	0.173	0.139	0.187
SC03	0.152	0.088	0.109
SC04	0.263	0.273	0.280
SC05	0.303	0.273	0.245
SC06	0.257	0.224	0.280
SC07	0.356	0.284	0.333
SS01	0.346	0.324	0.425
SC08	0.384	0.332	0.322
SC09	0.367	0.366	0.388
SC10	0.380	0.377	0.383
SC11	0.373	0.360	0.401
SC12	0.386	0.432	0.460
SS02	0.393	0.336	0.488
SC13	0.393	0.383	0.374
SC14	0.450	0.454	0.427
SC15	0.470	0.481	0.457
SS03	0.439	0.470	0.469

Table H.5: Arabic DLPT and Semester GPA Correlations

	DLPT.L	DLPT.R	DLPT.S
SEM1.GPA	**0.550**	**0.551**	**0.502**
SEM2.GPA	**0.622**	**0.659**	**0.594**
SEM3.GPA	**0.657**	**0.679**	**0.538**

Table H.6: Arabic DLPT and Cumulative Skills GPA Correlations

	DLPT.L	DLPT.R	DLPT.S
LCSK1.GPA	**0.550**	**0.519**	**0.520**
LCSK2.GPA	**0.628**	**0.620**	**0.587**
LCSK3.GPA	**0.632**	**0.606**	0.499
RCSK1.GPA	0.459	**0.560**	0.415
RCSK2.GPA	0.476	**0.582**	0.382
RCSK3.GPA	**0.587**	**0.676**	0.435
SCSK1.GPA	0.357	0.316	0.381
SCSK2.GPA	0.447	0.412	**0.507**
SCSK3.GPA	0.494	**0.512**	**0.501**

Table H.7.1: Arabic Listening C-Test Correlations

	LC01	LC02	LC03	LC04	LC05	LC06	LC07	LS01
LC01	**1.00**	0.48	0.44	0.39	0.22	0.27	0.33	0.31
LC02	0.48	**1.00**	**0.51**	**0.53**	0.48	0.43	0.37	0.40
LC03	0.44	**0.51**	**1.00**	**0.55**	0.41	0.49	0.37	0.31
LC04	0.39	**0.53**	**0.55**	**1.00**	**0.51**	**0.54**	0.49	**0.51**
LC05	0.22	0.48	0.41	**0.51**	**1.00**	**0.63**	**0.50**	0.35
LC06	0.27	0.43	0.49	**0.54**	**0.63**	**1.00**	**0.53**	0.37
LC07	0.33	0.37	0.37	0.49	**0.50**	**0.53**	**1.00**	0.44
LS01	0.31	0.40	0.31	**0.51**	0.35	0.37	0.44	**1.00**
LC08	0.29	0.41	0.36	0.49	**0.55**	0.47	**0.52**	0.40
LC09	0.32	0.39	0.35	0.44	**0.50**	0.48	0.46	0.47
LC10	0.29	0.41	0.42	0.46	**0.51**	**0.54**	0.46	0.49
LC11	0.27	0.39	0.37	**0.50**	0.47	**0.50**	0.49	**0.60**
LC12	0.15	0.30	0.35	0.36	0.36	0.47	0.45	0.39
LS02	0.24	0.36	0.33	0.43	0.41	0.41	0.39	**0.61**
LC13	0.21	0.35	0.35	0.47	**0.50**	**0.51**	0.43	0.43
LC14	0.15	0.32	0.27	0.39	0.44	0.44	0.32	0.40
LC15	0.21	0.25	0.25	0.41	0.46	0.39	0.41	**0.54**
LS03	0.26	0.25	0.18	0.34	0.31	0.37	0.33	**0.56**
RC01	0.35	0.28	0.28	0.30	0.11	0.16	0.21	0.18
RC02	0.40	0.48	0.42	0.40	0.26	0.27	0.33	0.41
RC03	0.32	0.42	**0.53**	0.40	0.29	0.34	0.25	0.14
RC04	0.26	0.43	0.46	**0.60**	**0.53**	0.48	0.43	0.39
RC05	0.21	0.34	0.40	0.45	**0.59**	0.49	0.41	0.36
RC06	0.24	0.36	0.41	**0.50**	**0.59**	0.47	0.47	0.32
RC07	0.20	0.35	0.38	0.44	**0.56**	**0.56**	**0.54**	0.49
RS01	0.21	0.33	0.28	0.45	0.41	0.42	0.35	0.66
RC08	0.18	0.29	0.28	0.37	0.43	0.42	0.39	0.36
RC09	0.22	0.29	0.28	0.36	0.41	0.42	0.39	0.38
RC10	0.23	0.28	0.33	0.39	0.46	0.45	0.41	0.44
RC11	0.18	0.32	0.34	0.37	0.43	0.42	0.44	**0.50**
RC12	0.15	0.29	0.31	0.41	0.48	0.44	0.40	0.47
RS02	0.19	0.17	0.08	0.26	0.20	0.13	0.24	0.36
RC13	0.11	0.29	0.29	0.40	0.39	0.41	0.34	0.40
RC14	0.08	0.21	0.24	0.29	0.36	0.38	0.35	0.29
RC15	0.15	0.28	0.29	0.28	0.32	0.34	0.31	0.49
RS03	0.16	0.17	0.16	0.24	0.26	0.24	0.29	**0.51**
SC01	0.25	0.24	0.35	0.29	0.26	0.22	0.30	0.09
SC02	0.33	0.37	0.42	0.32	0.30	0.33	0.30	0.08
SC03	0.29	0.31	0.48	0.30	0.22	0.28	0.35	0.00
SC04	0.28	0.36	0.42	0.45	0.35	0.39	0.33	0.17
SC05	0.26	0.29	0.37	0.37	0.46	0.42	0.41	0.18
SC06	0.23	0.26	0.35	0.35	0.35	0.39	0.40	0.26
SC07	0.27	0.37	0.36	0.43	**0.53**	0.47	**0.53**	0.37
SS01	0.31	0.36	0.42	0.42	**0.50**	0.46	**0.53**	0.30
SC08	0.34	0.42	0.43	0.45	**0.53**	0.46	0.50	0.37
SC09	0.25	0.31	0.36	0.34	0.33	0.36	0.38	0.34
SC10	0.20	0.31	0.35	0.35	0.38	0.37	0.40	0.39
SC11	0.28	0.36	0.39	0.35	0.42	0.38	0.43	0.37
SC12	0.24	0.38	0.33	0.35	0.47	0.41	0.49	0.49
SS02	0.19	0.35	0.30	0.35	0.39	0.35	0.43	0.39
SC13	0.19	0.35	0.27	0.34	0.42	0.44	0.47	0.44
SC14	0.16	0.29	0.25	0.31	0.40	0.38	0.46	0.41
SC15	0.20	0.28	0.25	0.30	0.40	0.43	0.43	0.36
SS03	0.17	0.25	0.28	0.31	0.37	0.36	0.35	0.39

Table H.7.2: Arabic Listening C-Test Correlations

	LC08	LC09	LC10	LC11	LC12	LS02	LC13	LC14	LC15	LS03
LC01	0.29	0.32	0.29	0.27	0.15	0.24	0.21	0.15	0.21	0.26
LC02	0.41	0.39	0.41	0.39	0.30	0.36	0.35	0.32	0.25	0.25
LC03	0.36	0.35	0.42	0.37	0.35	0.33	0.35	0.27	0.25	0.18
LC04	0.49	0.44	0.46	**0.50**	0.36	0.43	0.47	0.39	0.41	0.34
LC05	**0.55**	**0.50**	**0.51**	0.47	0.36	0.41	**0.50**	0.44	0.46	0.31
LC06	0.47	0.48	**0.54**	**0.50**	0.47	0.41	**0.51**	0.44	0.39	0.37
LC07	**0.52**	0.46	0.46	0.49	0.45	0.39	0.43	0.32	0.41	0.33
LS01	0.40	0.47	0.49	**0.60**	0.39	**0.61**	0.43	0.40	**0.54**	**0.56**
LC08	**1.00**	**0.55**	**0.51**	**0.51**	0.44	0.44	**0.56**	0.47	**0.54**	0.42
LC09	**0.55**	**1.00**	**0.59**	**0.54**	**0.52**	**0.55**	**0.50**	**0.54**	0.49	0.46
LC10	**0.51**	**0.59**	**1.00**	**0.62**	0.49	**0.59**	**0.66**	**0.59**	**0.51**	0.44
LC11	**0.51**	**0.54**	**0.62**	**1.00**	**0.56**	**0.61**	**0.63**	**0.55**	**0.60**	**0.56**
LC12	0.44	**0.52**	0.49	**0.56**	**1.00**	**0.54**	**0.52**	0.48	0.42	0.36
LS02	0.44	**0.55**	**0.59**	**0.61**	**0.54**	**1.00**	**0.54**	**0.52**	**0.59**	**0.57**
LC13	**0.56**	**0.50**	**0.66**	**0.63**	**0.52**	**0.54**	**1.00**	**0.69**	**0.54**	0.46
LC14	0.47	**0.54**	**0.59**	**0.55**	0.48	**0.52**	**0.69**	**1.00**	**0.60**	**0.52**
LC15	**0.54**	0.49	**0.51**	**0.60**	0.42	**0.59**	**0.54**	**0.60**	**1.00**	**0.63**
LS03	0.42	0.46	0.44	**0.56**	0.36	**0.57**	0.46	**0.52**	**0.63**	**1.00**
RC01	0.21	0.20	0.16	0.14	0.08	0.26	0.08	0.10	0.10	0.09
RC02	0.30	0.35	0.36	0.35	0.22	0.41	0.25	0.18	0.22	0.25
RC03	0.26	0.26	0.33	0.27	0.23	0.18	0.22	0.24	0.11	0.07
RC04	0.40	0.40	0.40	0.45	0.28	0.37	0.40	0.39	0.35	0.32
RC05	0.36	0.46	0.47	0.41	0.33	0.36	0.39	0.34	0.31	0.34
RC06	0.49	0.45	0.47	0.49	0.34	0.38	0.43	0.40	0.41	0.36
RC07	0.43	**0.52**	**0.51**	**0.55**	0.45	**0.54**	0.46	0.41	0.42	0.45
RS01	0.34	0.49	0.47	**0.51**	0.32	**0.58**	0.34	0.41	0.47	0.48
RC08	0.44	0.45	0.41	**0.55**	0.46	0.42	0.44	0.39	0.39	0.39
RC09	0.48	**0.61**	**0.50**	**0.51**	0.45	0.49	0.45	0.53	0.46	0.42
RC10	0.44	**0.51**	**0.64**	**0.56**	0.49	**0.54**	**0.56**	0.47	0.46	0.41
RC11	0.49	**0.57**	**0.58**	**0.58**	**0.52**	**0.59**	**0.58**	**0.56**	**0.57**	0.48
RC12	0.44	**0.54**	**0.60**	**0.60**	**0.56**	**0.56**	**0.59**	**0.58**	**0.51**	0.45
RS02	0.21	0.30	0.35	0.31	0.23	0.34	0.37	0.41	0.32	0.32
RC13	0.45	**0.53**	**0.58**	**0.58**	**0.57**	**0.57**	**0.67**	**0.65**	**0.55**	0.45
RC14	0.44	**0.50**	**0.57**	**0.55**	**0.52**	0.45	**0.61**	**0.61**	0.42	0.41
RC15	0.36	**0.53**	0.46	**0.55**	0.44	**0.52**	**0.50**	**0.54**	0.49	**0.50**
RS03	0.29	0.36	0.47	**0.51**	0.30	**0.56**	0.45	**0.51**	**0.51**	**0.53**
SC01	0.17	0.14	0.16	0.26	0.25	0.16	0.20	0.15	0.09	0.08
SC02	0.27	0.16	0.24	0.25	0.17	0.20	0.24	0.12	0.15	0.05
SC03	0.24	0.18	0.16	0.22	0.23	0.18	0.16	0.11	0.10	0.08
SC04	0.37	0.25	0.29	0.34	0.24	0.24	0.26	0.21	0.20	0.20
SC05	0.34	0.29	0.33	0.40	0.34	0.32	0.36	0.24	0.25	0.18
SC06	0.33	0.25	0.28	0.39	0.33	0.30	0.32	0.24	0.29	0.26
SC07	**0.50**	0.42	0.45	0.45	0.41	0.37	0.42	0.42	0.38	0.34
SS01	0.44	0.45	0.39	0.44	0.42	0.39	0.34	0.34	0.34	0.28
SC08	0.47	0.43	0.43	0.46	0.39	0.37	0.38	0.32	0.37	0.26
SC09	0.44	0.44	0.35	0.44	0.43	0.36	0.35	0.35	0.34	0.33
SC10	0.41	**0.50**	0.46	**0.52**	0.45	0.44	0.42	0.38	0.42	0.32
SC11	0.40	0.46	0.43	0.49	0.42	0.40	0.43	0.43	0.38	0.34
SC12	0.43	**0.53**	0.49	**0.52**	0.38	0.48	0.40	0.43	0.42	0.36
SS02	0.44	0.49	0.46	**0.51**	0.42	0.44	0.44	0.45	0.39	0.37
SC13	0.38	**0.56**	**0.50**	**0.50**	0.43	0.46	**0.51**	**0.50**	0.38	0.38
SC14	0.43	**0.55**	**0.52**	**0.55**	0.46	0.48	**0.53**	**0.52**	0.43	0.39
SC15	0.44	0.49	**0.53**	**0.50**	0.47	0.47	**0.52**	**0.54**	0.47	0.44
SS03	0.40	**0.54**	**0.52**	**0.51**	0.47	0.47	**0.54**	**0.56**	0.45	0.44

Table H.8.1: Arabic Reading C-Test Correlations

	RC01	RC02	RC03	RC04	RC05	RC06	RC07	RS01
LC01	0.35	0.40	0.32	0.26	0.21	0.24	0.20	0.21
LC02	0.28	0.48	0.42	0.43	0.34	0.36	0.35	0.33
LC03	0.28	0.42	**0.53**	0.46	0.40	0.41	0.38	0.28
LC04	0.30	0.40	0.40	**0.60**	0.45	0.50	0.44	0.45
LC05	0.11	0.26	0.29	**0.53**	**0.59**	**0.59**	**0.56**	0.41
LC06	0.16	0.27	0.34	0.48	0.49	0.47	**0.56**	0.42
LC07	0.21	0.33	0.25	0.43	0.41	0.47	**0.54**	0.35
LS01	0.18	0.41	0.14	0.39	0.36	0.32	0.49	**0.66**
LC08	0.21	0.30	0.26	0.40	0.36	0.49	0.43	0.34
LC09	0.20	0.35	0.26	0.40	0.46	0.45	**0.52**	0.49
LC10	0.16	0.36	0.33	0.40	0.47	0.47	**0.51**	0.47
LC11	0.14	0.35	0.27	0.45	0.41	0.49	**0.55**	**0.51**
LC12	0.08	0.22	0.23	0.28	0.33	0.34	0.45	0.32
LS02	0.26	0.41	0.18	0.37	0.36	0.38	**0.54**	**0.58**
LC13	0.08	0.25	0.22	0.40	0.39	0.43	0.46	0.34
LC14	0.10	0.18	0.24	0.39	0.34	0.40	0.41	0.41
LC15	0.10	0.22	0.11	0.35	0.31	0.41	0.42	0.47
LS03	0.09	0.25	0.07	0.32	0.34	0.36	0.45	0.48
RC01	**1.00**	**0.57**	0.45	0.35	0.23	0.24	0.25	0.20
RC02	**0.57**	**1.00**	**0.55**	0.49	0.43	0.42	0.48	0.44
RC03	0.45	**0.55**	**1.00**	**0.52**	0.43	0.46	0.40	0.21
RC04	0.35	0.49	**0.52**	**1.00**	**0.65**	**0.61**	**0.57**	**0.51**
RC05	0.23	0.43	0.43	**0.65**	**1.00**	**0.64**	**0.60**	0.47
RC06	0.24	0.42	0.46	**0.61**	**0.64**	**1.00**	**0.65**	0.48
RC07	0.25	0.48	0.40	**0.57**	**0.60**	**0.65**	**1.00**	**0.58**
RS01	0.20	0.44	0.21	**0.51**	0.47	0.48	**0.58**	**1.00**
RC08	0.26	0.42	0.36	**0.53**	0.49	**0.60**	**0.61**	**0.50**
RC09	0.22	0.38	0.35	0.48	0.48	**0.57**	**0.55**	0.47
RC10	0.22	0.48	0.41	0.41	**0.53**	**0.57**	**0.64**	0.48
RC11	0.19	0.47	0.34	0.46	0.45	**0.56**	**0.61**	**0.53**
RC12	0.20	0.41	0.36	**0.51**	**0.53**	**0.55**	**0.56**	**0.51**
RS02	0.08	0.29	0.15	0.35	0.28	0.23	0.33	0.40
RC13	0.10	0.30	0.32	0.45	0.40	0.49	**0.53**	0.46
RC14	0.11	0.36	0.35	0.40	0.44	**0.51**	0.49	0.33
RC15	0.14	0.40	0.22	0.39	0.38	0.42	**0.51**	**0.56**
RS03	0.12	0.31	0.09	0.30	0.26	0.28	0.41	0.49
SC01	0.33	0.35	0.32	0.30	0.30	0.27	0.37	0.15
SC02	0.42	0.42	0.40	0.33	0.29	0.28	0.27	0.13
SC03	0.32	0.32	0.42	0.26	0.25	0.30	0.23	0.03
SC04	0.31	0.37	0.44	0.47	0.37	0.45	0.40	0.23
SC05	0.25	0.37	0.27	0.48	0.46	0.39	0.46	0.24
SC06	0.24	0.22	0.23	0.39	0.34	0.39	0.38	0.20
SC07	0.18	0.26	0.34	0.48	0.44	0.48	0.49	0.34
SS01	0.19	0.30	0.37	0.43	0.42	0.43	**0.50**	0.29
SC08	0.22	0.35	0.34	0.39	0.41	0.43	0.45	0.30
SC09	0.16	0.32	0.24	0.33	0.32	0.38	0.35	0.32
SC10	0.07	0.26	0.18	0.30	0.31	0.35	0.34	0.36
SC11	0.09	0.29	0.28	0.33	0.39	0.42	0.40	0.38
SC12	0.15	0.39	0.27	0.43	0.44	0.40	**0.51**	0.44
SS02	0.08	0.27	0.27	0.39	0.42	0.38	0.42	0.34
SC13	0.04	0.26	0.24	0.35	0.37	0.36	0.44	0.40
SC14	0.05	0.30	0.24	0.37	0.37	0.38	0.45	0.35
SC15	0.07	0.26	0.28	0.37	0.39	0.41	0.44	0.33
SS03	0.14	0.28	0.22	0.38	0.38	0.38	0.45	0.32

Table H.8.2: Arabic Reading C-Test Correlations

	RC08	RC09	RC10	RC11	RC12	RS02	RC13	RC14	RC15	RS03
LC01	0.18	0.22	0.23	0.18	0.15	0.19	0.11	0.08	0.15	0.16
LC02	0.29	0.29	0.28	0.32	0.29	0.17	0.29	0.21	0.28	0.17
LC03	0.28	0.28	0.33	0.34	0.31	0.08	0.29	0.24	0.29	0.16
LC04	0.37	0.36	0.39	0.37	0.41	0.26	0.40	0.29	0.28	0.24
LC05	0.43	0.41	0.46	0.43	0.48	0.20	0.39	0.36	0.32	0.26
LC06	0.42	0.42	0.45	0.42	0.44	0.13	0.41	0.38	0.34	0.24
LC07	0.39	0.39	0.41	0.44	0.40	0.24	0.34	0.35	0.31	0.29
LS01	0.36	0.38	0.44	**0.50**	0.47	0.36	0.40	0.29	0.49	**0.51**
LC08	0.44	0.48	0.44	0.49	0.44	0.21	0.45	0.44	0.36	0.29
LC09	0.45	**0.61**	**0.51**	**0.57**	**0.54**	0.30	**0.53**	**0.50**	**0.53**	0.36
LC10	0.41	**0.50**	**0.64**	**0.58**	**0.60**	0.35	**0.58**	**0.57**	0.46	0.47
LC11	**0.55**	**0.51**	**0.56**	**0.58**	**0.60**	0.31	**0.58**	**0.55**	**0.55**	**0.51**
LC12	0.46	0.45	0.49	**0.52**	**0.56**	0.23	**0.57**	**0.52**	0.44	0.30
LS02	0.42	0.49	**0.54**	**0.59**	**0.56**	0.34	**0.57**	0.45	**0.52**	**0.56**
LC13	0.44	0.45	**0.56**	**0.58**	**0.59**	0.37	**0.67**	**0.61**	**0.50**	0.45
LC14	0.39	**0.53**	0.47	**0.56**	**0.58**	0.41	**0.65**	**0.61**	**0.54**	**0.51**
LC15	0.39	0.46	0.46	**0.57**	**0.51**	0.32	**0.55**	0.42	0.49	**0.51**
LS03	0.39	0.42	0.41	0.48	0.45	0.32	0.45	0.41	**0.50**	**0.53**
RC01	0.26	0.22	0.22	0.19	0.20	0.08	0.10	0.11	0.14	0.12
RC02	0.42	0.38	0.48	0.47	0.41	0.29	0.30	0.36	0.40	0.31
RC03	0.36	0.35	0.41	0.34	0.36	0.15	0.32	0.35	0.22	0.09
RC04	**0.53**	0.48	0.41	0.46	**0.51**	0.35	0.45	0.40	0.39	0.30
RC05	0.49	0.48	**0.53**	0.45	**0.53**	0.28	0.40	0.44	0.38	0.26
RC06	**0.60**	**0.57**	**0.57**	**0.56**	**0.55**	0.23	0.49	**0.51**	0.42	0.28
RC07	**0.61**	**0.55**	**0.64**	**0.61**	**0.56**	0.33	**0.53**	0.49	**0.51**	0.41
RS01	**0.50**	0.47	0.48	**0.53**	**0.51**	0.40	0.46	0.33	**0.56**	0.49
RC08	**1.00**	**0.57**	**0.55**	**0.55**	**0.55**	0.30	**0.54**	**0.52**	0.48	0.36
RC09	**0.57**	**1.00**	**0.56**	**0.61**	**0.63**	0.35	**0.60**	**0.59**	**0.54**	0.43
RC10	**0.55**	**0.56**	**1.00**	**0.68**	**0.65**	0.36	**0.63**	**0.64**	**0.51**	0.47
RC11	**0.55**	**0.61**	**0.68**	**1.00**	**0.68**	0.42	**0.68**	**0.65**	**0.61**	**0.59**
RC12	**0.55**	**0.63**	**0.65**	**0.68**	**1.00**	0.40	**0.72**	**0.70**	**0.58**	**0.51**
RS02	0.30	0.35	0.36	0.42	0.40	**1.00**	0.48	0.42	0.40	**0.52**
RC13	**0.54**	**0.60**	**0.63**	**0.68**	**0.72**	0.48	**1.00**	**0.70**	**0.55**	0.48
RC14	**0.52**	**0.59**	**0.64**	**0.65**	**0.70**	0.42	0.70	**1.00**	**0.57**	0.46
RC15	0.48	**0.54**	**0.51**	**0.61**	**0.58**	0.40	**0.55**	**0.57**	**1.00**	**0.55**
RS03	0.36	0.43	0.47	**0.59**	**0.51**	**0.52**	0.48	0.46	**0.55**	**1.00**
SC01	0.27	0.17	0.25	0.20	0.28	0.11	0.19	0.24	0.20	0.11
SC02	0.20	0.19	0.27	0.25	0.25	0.07	0.18	0.16	0.12	0.05
SC03	0.18	0.21	0.15	0.16	0.16	0.07	0.16	0.19	0.12	−0.01
SC04	0.40	0.32	0.34	0.25	0.34	0.06	0.24	0.26	0.26	0.09
SC05	0.36	0.30	0.30	0.31	0.38	0.14	0.25	0.29	0.23	0.13
SC06	0.29	0.32	0.26	0.30	0.37	0.13	0.28	0.29	0.29	0.14
SC07	0.41	0.44	0.43	0.40	0.45	0.22	0.41	0.40	0.32	0.20
SS01	0.37	0.42	0.44	0.42	0.45	0.12	0.35	0.36	0.36	0.24
SC08	0.36	0.39	0.41	0.37	0.43	0.16	0.32	0.32	0.29	0.20
SC09	0.40	0.41	0.39	0.39	0.41	0.19	0.37	0.41	0.39	0.25
SC10	0.32	0.39	0.45	0.49	0.48	0.29	0.47	0.41	0.43	0.36
SC11	0.40	0.41	0.42	0.41	0.47	0.23	0.45	0.35	0.42	0.25
SC12	0.37	0.46	0.48	0.48	**0.52**	0.35	**0.50**	0.44	0.47	0.40
SS02	0.36	0.43	0.43	0.42	**0.51**	0.19	0.44	0.40	0.41	0.28
SC13	0.32	0.47	0.44	0.47	**0.52**	0.31	0.48	0.43	0.43	0.37
SC14	0.37	0.48	0.46	**0.50**	**0.56**	0.31	**0.52**	**0.51**	0.46	0.38
SC15	0.37	0.49	0.48	**0.53**	**0.58**	0.28	**0.54**	**0.54**	**0.51**	0.36
SS03	0.39	**0.52**	0.49	**0.50**	**0.63**	0.33	**0.58**	**0.51**	**0.53**	0.41

Table H.9.1: Arabic Speaking C-Test Correlations

	SC01	SC02	SC03	SC04	SC05	SC06	SC07	SS01
LC01	0.25	0.33	0.29	0.28	0.26	0.23	0.27	0.31
LC02	0.24	0.37	0.31	0.36	0.29	0.26	0.37	0.36
LC03	0.35	0.42	0.48	0.42	0.37	0.35	0.36	0.42
LC04	0.29	0.32	0.30	0.45	0.37	0.35	0.43	0.42
LC05	0.26	0.30	0.22	0.35	0.46	0.35	**0.53**	**0.50**
LC06	0.22	0.33	0.28	0.39	0.42	0.39	0.47	0.46
LC07	0.30	0.30	0.35	0.33	0.41	0.40	**0.53**	**0.53**
LS01	0.09	0.08	0.00	0.17	0.18	0.26	0.37	0.30
LC08	0.17	0.27	0.24	0.37	0.34	0.33	**0.50**	0.44
LC09	0.14	0.16	0.18	0.25	0.29	0.25	0.42	0.45
LC10	0.16	0.24	0.16	0.29	0.33	0.28	0.45	0.39
LC11	0.26	0.25	0.22	0.34	0.40	0.39	0.45	0.44
LC12	0.25	0.17	0.23	0.24	0.34	0.33	0.41	0.42
LS02	0.16	0.20	0.18	0.24	0.32	0.30	0.37	0.39
LC13	0.20	0.24	0.16	0.26	0.36	0.32	0.42	0.34
LC14	0.15	0.12	0.11	0.21	0.24	0.24	0.42	0.34
LC15	0.09	0.15	0.10	0.20	0.25	0.29	0.38	0.34
LS03	0.08	0.05	0.08	0.20	0.18	0.26	0.34	0.28
RC01	0.33	0.42	0.32	0.31	0.25	0.24	0.18	0.19
RC02	0.35	0.42	0.32	0.37	0.37	0.22	0.26	0.30
RC03	0.32	0.40	0.42	0.44	0.27	0.23	0.34	0.37
RC04	0.30	0.33	0.26	0.47	0.48	0.39	0.48	0.43
RC05	0.30	0.29	0.25	0.37	0.46	0.34	0.44	0.42
RC06	0.27	0.28	0.30	0.45	0.39	0.39	0.48	0.43
RC07	0.37	0.27	0.23	0.40	0.46	0.38	0.49	0.50
RS01	0.15	0.13	0.03	0.23	0.24	0.20	0.34	0.29
RC08	0.27	0.20	0.18	0.40	0.36	0.29	0.41	0.37
RC09	0.17	0.19	0.21	0.32	0.30	0.32	0.44	0.42
RC10	0.25	0.27	0.15	0.34	0.30	0.26	0.43	0.44
RC11	0.20	0.25	0.16	0.25	0.31	0.30	0.40	0.42
RC12	0.28	0.25	0.16	0.34	0.38	0.37	0.45	0.45
RS02	0.11	0.07	0.07	0.06	0.14	0.13	0.22	0.12
RC13	0.19	0.18	0.16	0.24	0.25	0.28	0.41	0.35
RC14	0.24	0.16	0.19	0.26	0.29	0.29	0.40	0.36
RC15	0.20	0.12	0.12	0.26	0.23	0.29	0.32	0.36
RS03	0.11	0.05	−0.01	0.09	0.13	0.14	0.20	0.24
SC01	**1.00**	**0.61**	0.48	**0.51**	0.48	0.45	0.30	0.42
SC02	**0.61**	**1.00**	**0.59**	**0.57**	**0.53**	0.40	0.33	0.40
SC03	0.48	**0.59**	**1.00**	**0.50**	0.42	0.42	0.39	0.42
SC04	**0.51**	**0.57**	**0.50**	**1.00**	**0.55**	**0.50**	**0.51**	0.49
SC05	0.48	**0.53**	0.42	**0.55**	**1.00**	**0.55**	**0.54**	**0.56**
SC06	0.45	0.40	0.42	**0.50**	**0.55**	**1.00**	**0.56**	**0.50**
SC07	0.30	0.33	0.39	**0.51**	**0.54**	**0.56**	**1.00**	**0.70**
SS01	0.42	0.40	0.42	0.49	**0.56**	**0.50**	**0.70**	**1.00**
SC08	0.32	0.40	0.39	0.48	**0.51**	**0.52**	**0.59**	**0.64**
SC09	0.30	0.28	0.34	0.46	0.36	0.43	**0.55**	**0.57**
SC10	0.24	0.27	0.33	0.34	0.36	0.35	0.48	**0.56**
SC11	0.30	0.27	0.36	0.46	0.43	0.43	**0.57**	**0.62**
SC12	0.28	0.27	0.30	0.38	0.44	0.45	**0.55**	**0.58**
SS02	0.23	0.25	0.28	0.38	0.44	0.40	**0.56**	**0.55**
SC13	0.15	0.22	0.21	0.31	0.36	0.35	**0.57**	**0.52**
SC14	0.24	0.24	0.22	0.41	0.39	0.38	**0.54**	**0.53**
SC15	0.23	0.24	0.24	0.39	0.37	0.44	**0.54**	**0.52**
SS03	0.25	0.23	0.20	0.40	0.37	0.39	0.47	0.49

Table H.9.2: Arabic Speaking C-Test Correlations

	SC08	SC09	SC10	SC11	SC12	SS02	SC13	SC14	SC15	SS03
LC01	0.34	0.25	0.20	0.28	0.24	0.19	0.19	0.16	0.20	0.17
LC02	0.42	0.31	0.31	0.36	0.38	0.35	0.35	0.29	0.28	0.25
LC03	0.43	0.36	0.35	0.39	0.33	0.30	0.27	0.25	0.25	0.28
LC04	0.45	0.34	0.35	0.35	0.35	0.35	0.34	0.31	0.30	0.31
LC05	**0.53**	0.33	0.38	0.42	0.47	0.39	0.42	0.40	0.40	0.37
LC06	0.46	0.36	0.37	0.38	0.41	0.35	0.44	0.38	0.43	0.36
LC07	**0.50**	0.38	0.40	0.43	0.49	0.43	0.47	0.46	0.43	0.35
LS01	0.37	0.34	0.39	0.37	0.49	0.39	0.44	0.41	0.36	0.39
LC08	0.47	0.44	0.41	0.40	0.43	0.44	0.38	0.43	0.44	0.40
LC09	0.43	0.44	**0.50**	0.46	0.53	0.49	**0.56**	**0.55**	0.49	**0.54**
LC10	0.43	0.35	0.46	0.43	0.49	0.46	**0.50**	**0.52**	**0.53**	**0.52**
LC11	0.46	0.44	**0.52**	0.49	**0.52**	**0.51**	**0.50**	**0.55**	**0.50**	**0.51**
LC12	0.39	0.43	0.45	0.42	0.38	0.42	0.43	0.46	0.47	0.47
LS02	0.37	0.36	0.44	0.40	0.48	0.44	0.46	0.48	0.47	0.47
LC13	0.38	0.35	0.42	0.43	0.40	0.44	**0.51**	**0.53**	**0.52**	**0.54**
LC14	0.32	0.35	0.38	0.43	0.43	0.45	**0.50**	**0.52**	**0.54**	**0.56**
LC15	0.37	0.34	0.42	0.38	0.42	0.39	0.38	0.43	0.47	0.45
LS03	0.26	0.33	0.32	0.34	0.36	0.37	0.38	0.39	0.44	0.44
RC01	0.22	0.16	0.07	0.09	0.15	0.08	0.04	0.05	0.07	0.14
RC02	0.35	0.32	0.26	0.29	0.39	0.27	0.26	0.30	0.26	0.28
RC03	0.34	0.24	0.18	0.28	0.27	0.27	0.24	0.24	0.28	0.22
RC04	0.39	0.33	0.30	0.33	0.43	0.39	0.35	0.37	0.37	0.38
RC05	0.41	0.32	0.31	0.39	0.44	0.42	0.37	0.37	0.39	0.38
RC06	0.43	0.38	0.35	0.42	0.40	0.38	0.36	0.38	0.41	0.38
RC07	0.45	0.35	0.34	0.40	**0.51**	0.42	0.44	0.45	0.44	0.45
RS01	0.30	0.32	0.36	0.38	0.44	0.34	0.40	0.35	0.33	0.32
RC08	0.36	0.40	0.32	0.40	0.37	0.36	0.32	0.37	0.37	0.39
RC09	0.39	0.41	0.39	0.41	0.46	0.43	0.47	0.48	0.49	**0.52**
RC10	0.41	0.39	0.45	0.42	0.48	0.43	0.44	0.46	0.48	0.49
RC11	0.37	0.39	0.49	0.41	0.48	0.42	0.47	**0.50**	**0.53**	**0.50**
RC12	0.43	0.41	0.48	0.47	**0.52**	**0.51**	**0.52**	**0.56**	**0.58**	**0.63**
RS02	0.16	0.19	0.29	0.23	0.35	0.19	0.31	0.31	0.28	0.33
RC13	0.32	0.37	0.47	0.45	**0.50**	0.44	0.48	**0.52**	**0.54**	**0.58**
RC14	0.32	0.41	0.41	0.35	0.44	0.40	0.43	**0.51**	**0.54**	**0.51**
RC15	0.29	0.39	0.43	0.42	0.47	0.41	0.43	0.46	**0.51**	**0.53**
RS03	0.20	0.25	0.36	0.25	0.40	0.28	0.37	0.38	0.36	0.41
SC01	0.32	0.30	0.24	0.30	0.28	0.23	0.15	0.24	0.23	0.25
SC02	0.40	0.28	0.27	0.27	0.27	0.25	0.22	0.24	0.24	0.23
SC03	0.39	0.34	0.33	0.36	0.30	0.28	0.21	0.22	0.24	0.20
SC04	0.48	0.46	0.34	0.46	0.38	0.38	0.31	0.41	0.39	0.40
SC05	**0.51**	0.36	0.36	0.43	0.44	0.44	0.36	0.39	0.37	0.37
SC06	**0.52**	0.43	0.35	0.43	0.45	0.40	0.35	0.38	0.44	0.39
SC07	**0.59**	**0.55**	0.48	**0.57**	**0.55**	**0.56**	**0.57**	**0.54**	**0.54**	0.47
SS01	**0.64**	**0.57**	**0.56**	**0.62**	**0.58**	**0.55**	**0.52**	**0.53**	**0.52**	0.49
SC08	**1.00**	**0.62**	**0.58**	**0.66**	**0.62**	**0.57**	**0.55**	**0.53**	**0.54**	0.44
SC09	**0.62**	**1.00**	**0.66**	**0.72**	**0.62**	**0.60**	**0.55**	**0.58**	**0.55**	**0.53**
SC10	**0.58**	**0.66**	**1.00**	**0.67**	**0.68**	**0.59**	**0.57**	**0.61**	**0.57**	**0.56**
SC11	**0.66**	**0.72**	**0.67**	**1.00**	**0.69**	**0.67**	**0.61**	**0.63**	**0.55**	**0.59**
SC12	**0.62**	**0.62**	**0.68**	**0.69**	**1.00**	**0.75**	**0.66**	**0.67**	**0.64**	**0.63**
SS02	**0.57**	**0.60**	**0.59**	**0.67**	**0.75**	**1.00**	**0.61**	**0.65**	**0.59**	**0.61**
SC13	**0.55**	**0.55**	**0.57**	**0.61**	**0.66**	**0.61**	**1.00**	**0.71**	**0.61**	**0.62**
SC14	**0.53**	**0.58**	**0.61**	**0.63**	**0.67**	**0.65**	**0.71**	**1.00**	**0.71**	**0.70**
SC15	**0.54**	**0.55**	**0.57**	**0.55**	**0.64**	**0.59**	**0.61**	**0.71**	**1.00**	**0.72**
SS03	0.44	**0.53**	**0.56**	**0.59**	**0.63**	**0.61**	**0.62**	**0.70**	**0.72**	**1.00**

Table H.10: Arabic Semester GPA Correlations

	SEM1.GPA	SEM2.GPA	SEM3.GPA
SEM1.GPA	1.00	0.81	0.68
SEM2.GPA	0.81	1.00	0.83
SEM3.GPA	0.68	0.83	1.00

Table H.11: Arabic Cumulative Skills Semester GPA Correlations

	LCSK1	LCSK2	LCSK3	RCSK1	RCSK2	RCSK3	SCSK1	SCSK2	SCSK3
LCSK1	1.00	0.74	0.64	0.75	0.56	0.54	0.57	0.59	0.54
LCSK2	0.74	1.00	0.75	0.67	0.65	0.73	0.49	0.62	0.65
LCSK3	0.64	0.75	1.00	0.54	0.62	0.73	0.36	0.51	0.61
RCSK1	0.75	0.67	0.54	1.00	0.67	0.60	0.56	0.52	0.49
RCSK2	0.56	0.65	0.62	0.67	1.00	0.80	0.38	0.49	0.59
RCSK3	0.54	0.73	0.73	0.60	0.80	1.00	0.34	0.50	0.62
SCSK1	0.57	0.49	0.36	0.56	0.38	0.34	1.00	0.67	0.57
SCSK2	0.59	0.62	0.51	0.52	0.49	0.50	0.67	1.00	0.77
SCSK3	0.54	0.65	0.61	0.49	0.59	0.62	0.57	0.77	1.00

APPENDIX I. PREDICTING ARABIC SUSTAINED STUDENT PERFORMANCE

Table I.1: Predicting Sustained Performance on Arabic Listening C-Tests

Model	RSE*	d.o.f.*	R^2	Tests with p-value < 0.05
LISTENING				
(1) LSO3 ~ LC15 + LC14 + LC13 + LS02 + LC12 + LC11 + LC10 + LC09 + LC08 + LS01 + LC07 + LC06 + LC05 + LC04 + LC03 + LC02 + LC01	0.630	215	0.524	LC01, LS01, LS02, LC14, LC15
(2) LC15 ~ LC14 + LC13 + LS02 + LC12 + LC11 + LC10 + LC09 + LC08 + LS01 + LC07 + LC06 + LC05 + LC04 + LC03 + LC02 + LC01	0.584	250	0.532	LC08, LC11, LS02, LC14
(3) LC14 ~ LC13 + LS02 + LC12 + LC11 + LC10 + LC09 + LC08 + LS01 + LC07 + LC06 + LC05 + LC04 + LC03 + LC02 + LC01	0.581	252	0.561	LC09, LC13
(4) LC13 ~ LS02 + LC12 + LC11 + LC10 + LC09 + LC08 + LS01 + LC07 + LC06 + LC05 + LC04 + LC03 + LC02 + LC01	0.455	255	0.587	LC08, LC10, LC11, LC12
(5) LS02 ~ LC12 + LC11 + LC10 + LC09 + LC08 + LS01 + LC07 + LC06 + LC05 + LC04 + LC03 + LC02 + LC01	0.541	257	0.525	LS01, LC09, LC10, LC11, LC12
(6) LC12 ~ LC11 + LC10 + LC09 + LC08 + LS01 + LC07 + LC06 + LC05 + LC04 + LC03 + LC02 + LC01	0.543	261	0.437	LC06, LC07, LC08, LC09, LC11
(7) LC11 ~ LC10 + LC09 + LC08 + LS01 + LC07 + LC06 + LC05 + LC04 + LC03 + LC02 + LC01	0.545	264	0.551	LS01, LC08, LC09, LC10
(8) LC10 ~ LC09 + LC08 + LS01 + LC07 + LC06 + LC05 + LC04 + LC03 + LC02 + LC01	0.541	267	0.505	LC06, LS01, LC08, LC09
(9) LC09 ~ LC08 + LS01 + LC07 + LC06 + LC05 + LC04 + LC03 + LC02 + LC01	0.607	269	0.469	LC06, LS01, LC08
(10) LC08 ~ LS01 + LC07 + LC06 + LC05 + LC04 + LC03 + LC02 + LC01	0.519	270	0.444	LC05, LC07
(11) LS01 ~ LC07 + LC06 + LC05 + LC04 + LC03 + LC02 + LC01	0.811	281	0.351	LC02, LC04, LC07
(12) LC07 ~ LC06 + LC05 + LC04 + LC03 + LC02 + LC01	0.561	283	0.414	LC01, LC04, LC05, LC06
(13) LC06 ~ LC05 + LC04 + LC03 + LC02 + LC01	0.585	297	0.527	LC04, LC05
(14) LC05 ~ LC04 + LC03 + LC02 + LC01	0.629	308	0.450	LC02, LC03, LC04
(15) LC04 ~ LC03 + LC02 + LC01	0.655	317	0.433	LC01, LC02, LC03
(16) LC03 ~ LC02 + LC01	0.670	326	0.382	LC01, LC02
(17) LC02 ~ LC01	0.721	331	0.295	LC01

***RSE**: Residual Standard Error
***d.o.f.**: degrees of freedom

Table I.2: Predicting Sustained Performance on Arabic Reading C-Tests

Model	RSE	d.o.f.	R^2	Tests with p-value < 0.05
READING				
(1) RSO3 ~ RC15 + RC14 + RC13 + RS02 + RC12 + RC11 + RC10 + RC09 + RC08 + RS01 + RC07 + RC06 + RC05 + RC04 + RC03 + RC02 + RC01	0.526	215	0.522	RC03, RS01, RC11, RS02, RC15
(2) RC15 ~ RC14 + RC13 + RS02 + RC12 + RC11 + RC10 + RC09 + RC08 + RS01 + RC07 + RC06 + RC05 + RC04 + RC03 + RC02 + RC01	0.548	250	0.537	RS01, RC11, RC14
(3) RC14 ~ RC13 + RS02 + RC12 + RC11 + RC10 + RC09 + RC08 + RS01 + RC07 + RC06 + RC05 + RC04 + RC03 + RC02 + RC01	0.533	252	0.645	RS01, RC09, RC10, RC12, RS02, RC13
(4) RC13 ~ RS02 + RC12 + RC11 + RC10 + RC09 + RC08 + RS01 + RC07 + RC06 + RC05 + RC04 + RC03 + RC02 + RC01	0.498	255	0.650	RC02, RC05, RC10, RC11, RC12, RS02
(5) RS02 ~ RC12 + RC11 + RC10 + RC09 + RC08 + RS01 + RC07 + RC06 + RC05 + RC04 + RC03 + RC02 + RC01	0.597	257	0.282	RC04, RC06, RS01
(6) RC12 ~ RC11 + RC10 + RC09 + RC08 + RS01 + RC07 + RC06 + RC05 + RC04 + RC03 + RC02 + RC01	0.487	261	0.608	RC05, RC09, RC10, RC11
(7) RC11 ~ RC10 + RC09 + RC08 + RS01 + RC07 + RC06 + RC05 + RC04 + RC03 + RC02 + RC01	0.482	264	0.599	RS01, RC09, RC10
(8) RC10 ~ RC09 + RC08 + RS01 + RC07 + RC06 + RC05 + RC04 + RC03 + RC02 + RC01	0.481	267	0.553	RC04, RC05, RC07, RC08, RC09
(9) RC09 ~ RC08 + RS01 + RC07 + RC06 + RC05 + RC04 + RC03 + RC02 + RC01	0.681	269	0.456	RC06, RS01, RC08
(10) RC08 ~ RS01 + RC07 + RC06 + RC05 + RC04 + RC03 + RC02 + RC01	0.467	270	0.47	RC06, RC07, RS01
(11) RS01 ~ RC07 + RC06 + RC05 + RC04 + RC03 + RC02 + RC01	0.696	281	0.474	RC02, RC03, RC04, RC07
(12) RC07 ~ RC06 + RC05 + RC04 + RC03 + RC02 + RC01	0.584	283	0.536	RC02, RC05, RC06
(13) RC06 ~ RC05 + RC04 + RC03 + RC02 + RC01	0.522	297	0.549	RC04, RC05
(14) RC05 ~ RC04 + RC03 + RC02 + RC01	0.551	308	0.557	RC02, RC03, RC04
(15) RC04 ~ RC03 + RC02 + RC01	0.641	317	0.479	RC01, RC02, RC03
(16) RC03 ~ RC02 + RC01	0.753	326	0.437	RC01, RC02
(17) RC02 ~ RC01	0.722	331	0.385	RC01

Table I.3: Predicting Sustained Performance on Arabic Speaking C-Tests

Model	RSE	d.o.f.	R^2	Tests with p-value < 0.05
SPEAKING				
(1) SSO3 ~ SC15 + SC14 + SC13 + SS02 + SC12 + SC11 + SC10 + SC09 + SC08 + SS01 + SC07 + SC06 + SC05 + SC04 + SC03 + SC02 + SC01	0.353	215	0.645	SC08, SC13, SC14, SC15
(2) SC15 ~ SC14 + SC13 + SS02 + SC12 + SC11 + SC10 + SC09 + SC08 + SS01 + SC07 + SC06 + SC05 + SC04 + SC03 + SC02 + SC01	0.366	250	0.582	SC11, SC12, SC14
(3) SC14 ~ SC13 + SS02 + SC12 + SC11 + SC10 + SC09 + SC08 + SS01 + SC07 + SC06 + SC05 + SC04 + SC03 + SC02 + SC01	0.369	252	0.616	SC04, SC10, SS02, SC13
(4) SC13 ~ SS02 + SC12 + SC11 + SC10 + SC09 + SC08 + SS01 + SC07 + SC06 + SC05 + SC04 + SC03 + SC02 + SC01	0.383	255	0.560	SC07, SC12
(5) SS02 ~ SC12 + SC11 + SC10 + SC09 + SC08 + SS01 + SC07 + SC06 + SC05 + SC04 + SC03 + SC02 + SC01	0.337	257	0.626	SC01, SC05, SC11, SC12
(6) SC12 ~ SC11 + SC10 + SC09 + SC08 + SS01 + SC07 + SC06 + SC05 + SC04 + SC03 + SC02 + SC01	0.360	261	0.610	SC10, SC11
(7) SC11 ~ SC10 + SC09 + SC08 + SS01 + SC07 + SC06 + SC05 + SC04 + SC03 + SC02 + SC01	0.339	264	0.637	SC08, SC09, SC10
(8) SC10 ~ SC09 + SC08 + SS01 + SC07 + SC06 + SC05 + SC04 + SC03 + SC02 + SC01	0.410	267	0.531	SC01, SC08, SC09
(9) SC09 ~ SC08 + SS01 + SC07 + SC06 + SC05 + SC04 + SC03 + SC02 + SC01	0.399	269	0.488	SC04, SC07, SS01, SC08
(10) SC08 ~ SS01 + SC07 + SC06 + SC05 + SC04 + SC03 + SC02 + SC01	0.412	270	0.489	SC06, SC07, SS01
(11) SS01 ~ SC07 + SC06 + SC05 + SC04 + SC03 + SC02 + SC01	0.373	281	0.583	SC01, SC05, SC07
(12) SC07 ~ SC06 + SC05 + SC04 + SC03 + SC02 + SC01	0.431	283	0.441	SC04, SC05, SC06
(13) SC06 ~ SC05 + SC04 + SC03 + SC02 + SC01	0.470	297	0.450	SC03, SC04, SC05
(14) SC05 ~ SC04 + SC03 + SC02 + SC01	0.497	308	0.513	SC02, SC04
(15) SC04 ~ SC03 + SC02 + SC01	0.492	317	0.525	SC01, SC02, SC03
(16) SC03 ~ SC02 + SC01	0.519	326	0.481	SC01, SC02
(17) SC02 ~ SC01	0.506	331	0.467	SC01

Table I.4: Predicting Sustained Performance with Arabic Semester GPAs

Model	RSE	d.o.f.	R^2	GPAs with p-value < 0.05
(1) SEM3.GPA ~ SEM1.GPA + SEM2.GPA	0.286	310	0.718	SEM2.GPA
(2) SEM2.GPA ~ SEM1.GPA	0.310	321	0.640	SEM1.GPA

Table I.5: Predicting Sustained Performance with Arabic Cumulative Skills Semester GPAs

Model	RSE	d.o.f.	R^2	GPAs with p-value < 0.05
LISTENING				
(1) LCSK3.GPA ~ LCSK1.GPA + LCSK2.GPA	0.462	230	0.569	LCSK1.GPA, LCSK2.GPA
(2) LCSK2.GPA ~ LCSK1.GPA	0.429	269	0.534	LCSK1.GPA
READING				
(3) RCSK3.GPA ~ RCSK1.GPA + RCSK2.GPA	0.382	230	0.647	RCSK1.GPA, RCSK2.GPA
(4) RCSK2.GPA ~ RCSK1.GPA	0.417	269	0.449	RCSK1.GPA
SPEAKING				
(5) SCSK3.GPA ~ SCSK1.GPA + SCSK2.GPA	0.318	230	0.603	SCSK1.GPA
(6) SCSK2.GPA ~ SCSK1.GPA	0.347	269	0.466	SCSK1.GPA

APPENDIX J. ARABIC SEMESTER GPA CROSSTABULATIONS

The crosstabulations of the semester GPAs are presented in the same manner as the Persian semester GPA crosstabulations.

Table J.1: Arabic DLPT and First Semester GPA Crosstabulations

First Semester GPA Intervals		Category		
		0 (less than 2/2/1)	1 (2/2/1 or 2/2/1+)	2 (2/2/2 or better)
1.0 – 2.0	n	18	8	5
	%	.581	.258	.161
2.0 – 2.5	n	34	46	13
	%	.366	.495	.140
2.5 – 2.9	n	22	37	32
	%	.242	.407	.352
2.9 – 3.2	n	5	15	21
	%	.122	.366	.512
3.2 – 3.5	n	1	10	17
	%	.036	.357	.607
3.5 – 3.7	n	0	1	17
	%		.056	.944
3.7 – 4.0	n	0	0	9
	%			1.00
Column Totals		80	117	114

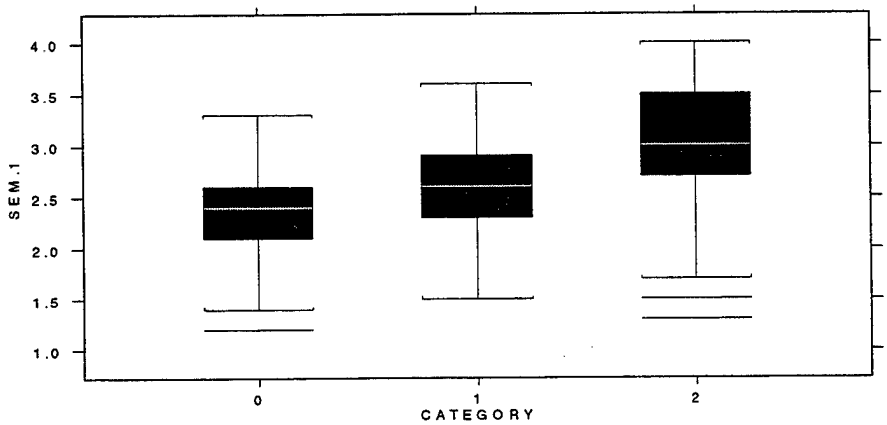

Figure 19: Arabic Boxplot of Category versus First Semester GPA

Table J.2: Arabic DLPT and Second Semester GPA Crosstabulations

Second Semester GPA Intervals		Category		
		0 (less than 2/2/1)	1 (2/2/1 or 2/2/1+)	2 (2/2/2 or better)
1.0 – 2.0	n	16	4	3
	%	.696	.174	.130
2.0 – 2.5	n	36	39	10
	%	.424	.459	.118
2.5 – 2.9	n	21	47	26
	%	.223	.500	.277
2.9 – 3.2	n	8	25	29
	%	.129	.403	.468
3.2 – 3.5	n	0	4	19
	%		.174	.826
3.5 – 3.7	n	0	2	17
	%		.105	.895
3.7 – 4.0	n	0	0	12
	%			1.00
Column Totals		81	121	116

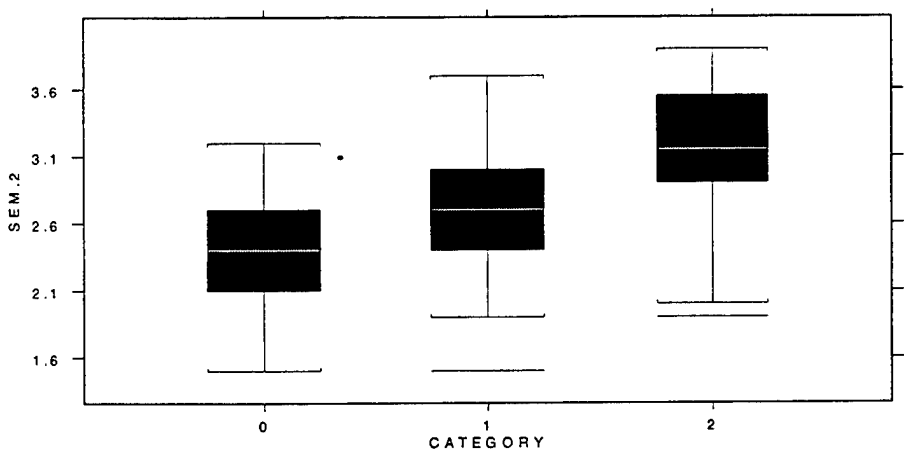

Figure 20: Arabic Boxplot of Category versus Second Semester GPA

Table J.3: Arabic DLPT and Third Semester GPA Crosstabulations

Third Semester GPA Intervals		Category		
		0 (less than 2/2/1)	1 (2/2/1 or 2/2/1+)	2 (2/2/2 or better)
1.0 – 2.0	n	8	2	0
	%	.800	.200	
2.0 – 2.5	n	40	18	10
	%	.588	.265	.147
2.5 – 2.9	n	20	43	18
	%	.247	.531	.222
2.9 – 3.2	n	9	40	22
	%	.127	.563	.310
3.2 – 3.5	n	4	12	27
	%	.093	.279	.628
3.5 – 3.7	n	0	5	13
	%		.278	.722
3.7 – 4.0	n	0	1	27
	%		.036	.964
Column Totals		81	121	117

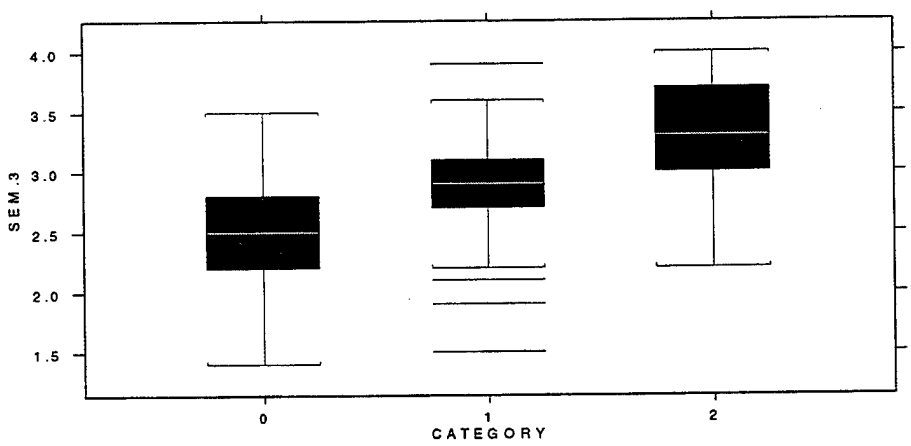

Figure 21: Arabic Boxplot of Category versus Third Semester GPA

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APPENDIX K. ARABIC CUMULATIVE SKILLS SEMESTER GPA CROSSTABULATIONS

The crosstabulations show cumulative skills semester GPA intervals, one GPA per skill at a time, that correspond to attaining minimum DLPT scores. Appendix J details the crosstabulations of cumulative skills semester GPAs by skill to achieving at least a level 2 in that particular skill and to achieving either a level 1 or 1+ in that particular skill. The categories for each skill are defined as follows: 2 - at least a level 2, 1 - either a level 1 or 1+, 0 - not achieving at least a 1.

Table K .1: Arabic DLPT.L and Listening Cumulative Skills First Semester GPA Crosstabulations

Listening First Semester GPA Intervals		Category		
		0 (less than 1)	1 (1 or 1+)	2 (2 or better)
1.0 – 2.0	n	0	24	31
	%		.436	.564
2.0 – 2.5	n	0	29	52
	%		.358	.642
2.5 – 2.9	n	0	8	41
	%		.163	.837
2.9 – 3.2	n	0	6	32
	%		.158	.842
3.2 – 3.5	n	0	0	19
	%			1.00
3.5 – 3.7	n	0	0	17
	%			1.00
3.7 – 4.0	n	0	0	10
	%			1.00
Column Totals		0	67	202

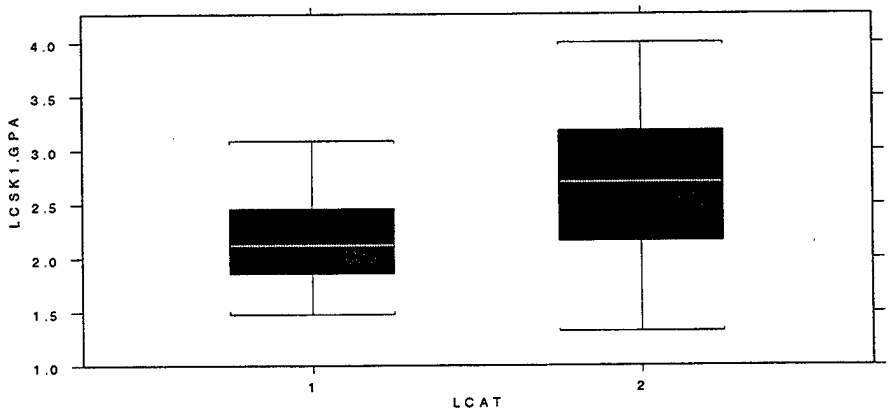

Figure 22: Boxplot of Listening Category versus First Semester Cumulative Skills GPA

Table K.2: Arabic DLPT.L and Listening Cumulative Skills Second Semester GPA Crosstabulations

Listening Second Semester GPA Intervals		Category		
		0 (less than 1)	1 (1 or 1+)	2 (2 or better)
1.0 – 2.0	n	0	27	14
	%		.659	.341
2.0 – 2.5	n	0	23	50
	%		.315	.685
2.5 – 2.9	n	0	14	40
	%		.259	.741
2.9 – 3.2	n	0	3	39
	%		.071	.929
3.2 – 3.5	n	0	1	29
	%		.033	.967
3.5 – 3.7	n	0	0	22
	%			1.00
3.7 – 4.0	n	0	0	10
	%			1.00
Column Totals		0	68	204

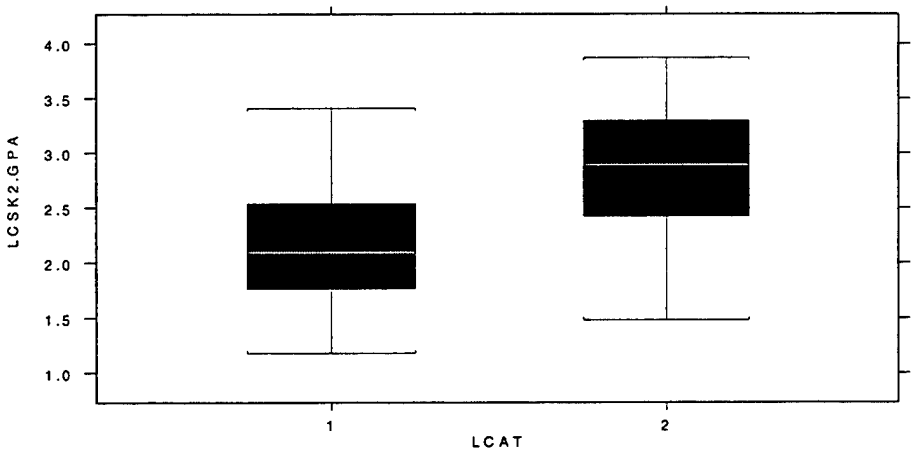

Figure 23: Boxplot of Listening Category versus Second Semester Cumulative Skills GPA

Table K.3: Arabic DLPT.L and Listening Cumulative Skills Third Semester GPA Crosstabulations

Listening Third Semester GPA Intervals		Category		
		0 (less than 1)	1 (1 or 1+)	2 (2 or better)
1.0 – 2.0	n	0	32	21
	%		.604	.396
2.0 – 2.5	n	0	16	40
	%		.286	.714
2.5 – 2.9	n	0	6	32
	%		.158	.842
2.9 – 3.2	n	0	2	37
	%		.051	.949
3.2 – 3.5	n	0	1	23
	%		.042	.958
3.5 – 3.7	n	0	1	8
	%		.111	.889
3.7 – 4.0	n	0	0	16
	%			1.00
Column Totals		0	58	177

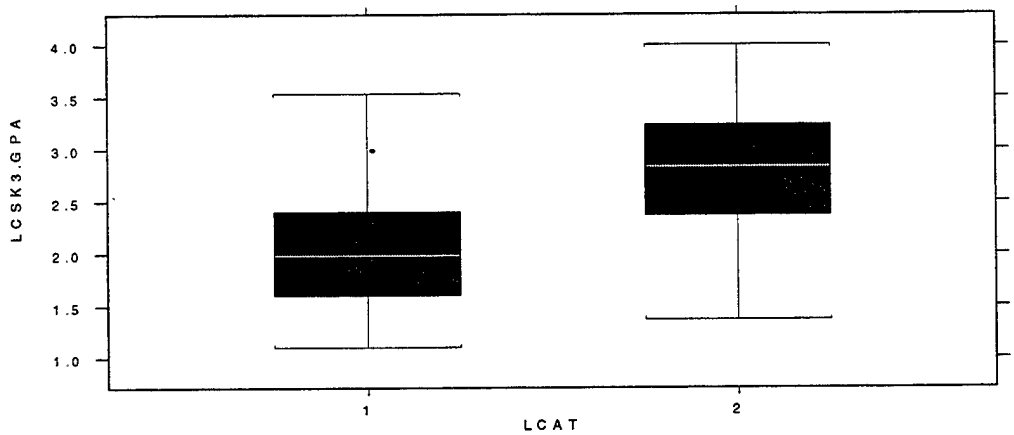

Figure 24: Boxplot of Listening Category versus Third Semester Cumulative Skills GPA

Table K.4: Arabic DLPT.R and Reading Cumulative Skills First Semester GPA Crosstabulations

Reading First Semester GPA Intervals		Category		
		0 (less than 1)	1 (1 or 1+)	2 (2 or better)
1.0 – 2.0	n	0	2	24
	%		.077	.923
2.0 – 2.5	n	0	1	62
	%		.016	.984
2.5 – 2.9	n	0	4	55
	%		.068	.932
2.9 – 3.2	n	0	1	36
	%		.027	.973
3.2 – 3.5	n	0	0	42
	%			1.00
3.5 – 3.7	n	0	0	21
	%			1.00
3.7 – 4.0	n	0	0	21
	%			1.00
Column Totals		0	8	261

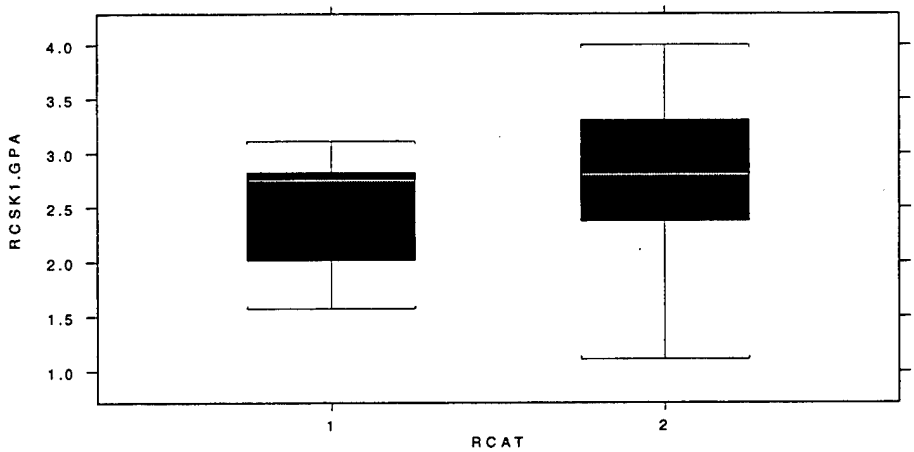

Figure 25: Boxplot of Reading Category versus First Semester Cumulative Skills GPA

Table K.5: Arabic DLPT.R and Reading Cumulative Skills Second Semester GPA Crosstabulations

Reading Second Semester GPA Intervals		Category		
		0 (less than 1)	1 (1 or 1+)	2 (2 or better)
1.0 – 2.0	n	0	1	16
	%		.059	.941
2.0 – 2.5	n	0	3	37
	%		.075	.925
2.5 – 2.9	n	0	3	68
	%		.042	.958
2.9 – 3.2	n	0	1	57
	%		.017	.983
3.2 – 3.5	n	0	0	41
	%			1.00
3.5 – 3.7	n	0	0	27
	%			1.00
3.7 – 4.0	n	0	0	18
	%			1.00
Column Totals		0	8	264

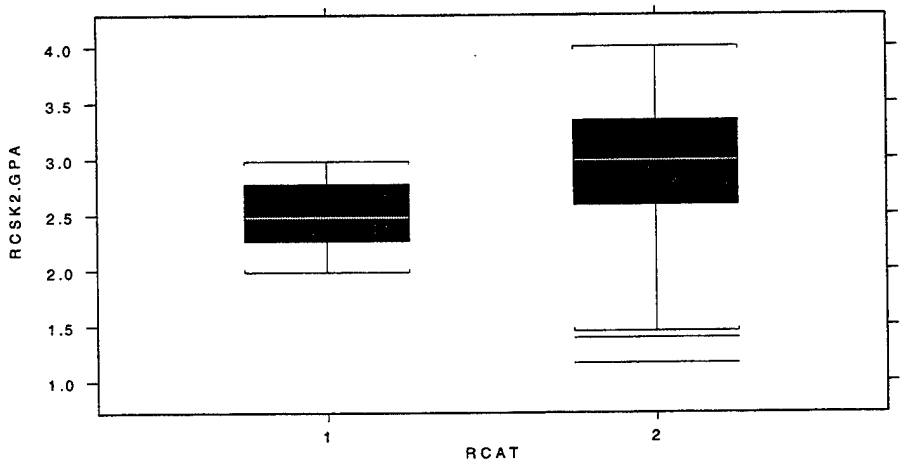

Figure 26: Boxplot of Reading Category versus Second Semester Cumulative Skills GPA

Table K.6: Arabic DLPT.R and Reading Cumulative Skills Third Semester GPA Crosstabulations

Reading Third Semester GPA Intervals		Category		
		0 (less than 1)	1 (1 or 1+)	2 (2 or better)
1.0 – 2.0	n	0	3	13
	%		.188	.812
2.0 – 2.5	n	0	4	24
	%		.143	.857
2.5 – 2.9	n	0	0	51
	%			1.00
2.9 – 3.2	n	0	0	40
	%			1.00
3.2 – 3.5	n	0	0	35
	%			1.00
3.5 – 3.7	n	0	0	20
	%			1.00
3.7 – 4.0	n	0	0	45
	%			1.00
Column Totals		0	7	228

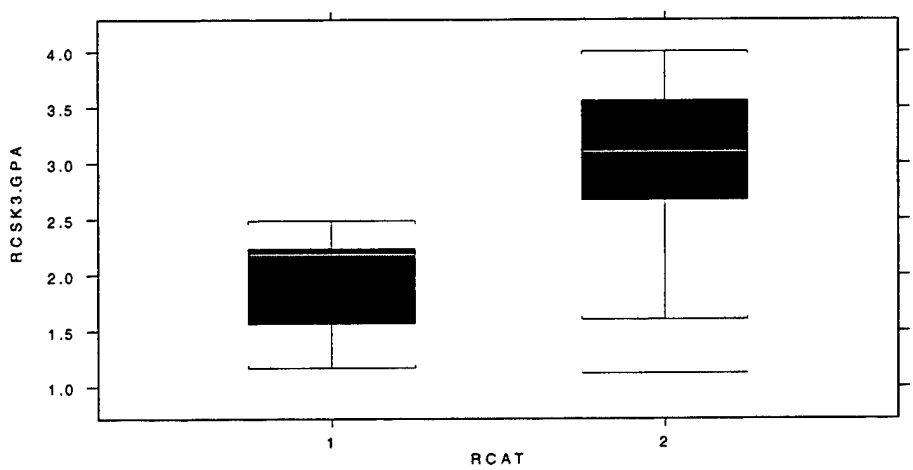

Figure 27: Boxplot of Reading Category versus Third Semester Cumulative Skills GPA

Table K.7: Arabic DLPT.S and Speaking Cumulative Skills First Semester GPA Crosstabulations

Speaking First Semester GPA Intervals		Category		
		0 (less than 1)	1 (1 or 1+)	2 (2 or better)
1.0 – 2.0	n	1	10	1
	%	.083	.833	.083
2.0 – 2.5	n	0	44	16
	%		.733	.267
2.5 – 2.9	n	0	61	20
	%		.753	.247
2.9 – 3.2	n	0	37	23
	%		.617	.383
3.2 – 3.5	n	0	18	22
	%		.450	.550
3.5 – 3.7	n	0	2	9
	%		.182	.818
3.7 – 4.0	n	0	0	5
	%			1.00
Column Totals		1	172	96

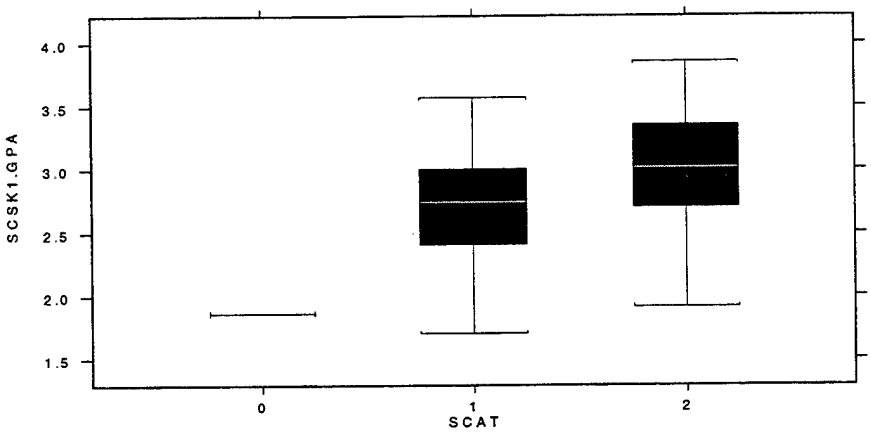

Figure 28: Boxplot of Speaking Category versus First Semester Cumulative Skills GPA

Table K.8: Arabic DLPT.S and Speaking Cumulative Skills Second Semester GPA Crosstabulations

Speaking Second Semester GPA Intervals		Category		
		0 (less than 1)	1 (1 or 1+)	2 (2 or better)
1.0 – 2.0	n	1	9	0
	%	.100	.900	
2.0 – 2.5	n	0	42	4
	%		.913	.087
2.5 – 2.9	n	0	60	20
	%		.750	.250
2.9 – 3.2	n	0	48	31
	%		.608	.392
3.2 – 3.5	n	0	9	21
	%		.300	.700
3.5 – 3.7	n	0	6	11
	%		.353	.647
3.7 – 4.0	n	0	0	10
	.%			1.00
Column Totals		1	174	97

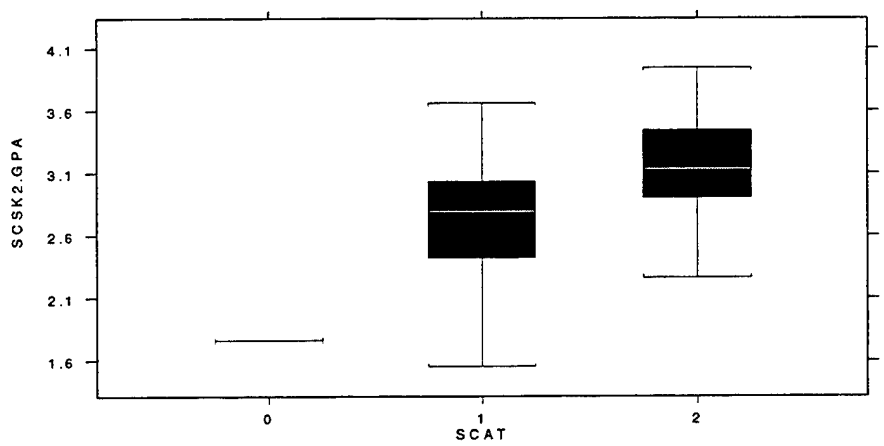

Figure 29: Boxplot of Speaking Category versus Second Semester Cumulative Skills GPA

Table K.9: Arabic DLPT.S and Speaking Cumulative Skills Third Semester GPA Crosstabulations

Speaking Third Semester GPA Intervals		Category		
		0 (less than 1)	1 (1 or 1+)	2 (2 or better)
1.0 – 2.0	n	0	10	0
	%		1.00	
2.0 – 2.5	n	1	43	3
	%	.021	.915	.064
2.5 – 2.9	n	0	33	15
	%		.688	.312
2.9 – 3.2	n	0	43	24
	%		.642	.358
3.2 – 3.5	n	0	18	21
	%		.462	.539
3.5 – 3.7	n	0	4	13
	%		.235	.765
3.7 – 4.0	n	0	1	6
	%		.143	.857
Column Totals		1	152	82

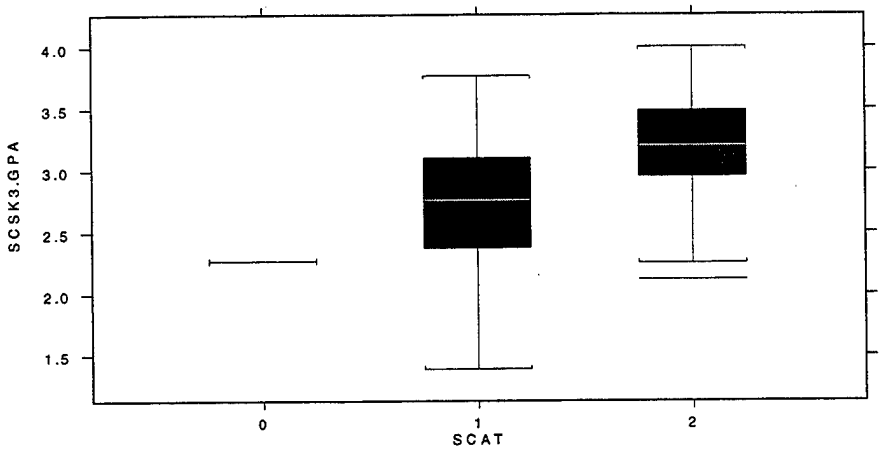

Figure 30: Boxplot of Speaking Category versus Third Semester Cumulative Skills GPA

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APPENDIX L. IDENTIFYING POTENTIAL DECISION POINTS FOR ARABIC ATTRITION BASED ON MAJOR PROGRAM TESTS

Table L.1: Identifying Potential Decision Points for Arabic Attrition in Listening

Model	RSE	d.o.f.	R^2	Change in R^2
LISTENING				
DLPT.L ~ LC-TEST1	5.88	268	0.032	0.032
DLPT.L ~ LC-TEST1 + LC-TEST2	5.66	267	0.107	0.075
DLPT.L ~ LC-TEST1 + LC-TEST2 + LC-TEST3	5.52	266	0.155	0.048
DLPT.L ~ LC-TEST1 + LC-TEST2 + LC-TEST3 + LC-TEST4	5.37	264	0.206	0.051
DLPT.L ~ LC-TEST1 + LC-TEST2 + LC-TEST3 + LC-TEST4 + LC-TEST5	5.19	263	0.261	0.055
DLPT.L ~ LC-TEST1 + LC-TEST2 + LC-TEST3 + LC-TEST4 + LC-TEST5 + LC-TEST6	5.18	262	0.265	0.004
DLPT.L ~ LC-TEST1 + LC-TEST2 + LC-TEST3 + LC-TEST4 + LC-TEST5 + LC-TEST6 + LC-TEST7	5.12	261	0.287	0.022
DLPT.L ~ LC-TEST1 + LC-TEST2 + LC-TEST3 + LC-TEST4 + LC-TEST5 + LC-TEST6 + LC-TEST7 + LS01	4.88	260	0.354	0.067
DLPT.L ~ LC-TEST1 + LC-TEST2 + LC-TEST3 + LC-TEST4 + LC-TEST5 + LC-TEST6 + LC-TEST7 + LS01 + LC-TEST8	4.72	259	0.400	0.046
DLPT.L ~ LC-TEST1 + LC-TEST2 + LC-TEST3 + LC-TEST4 + LC-TEST5 + LC-TEST6 + LC-TEST7 + LS01 + LC-TEST8 + LC-TEST9	4.69	258	0.407	0.007
DLPT.L ~ LC-TEST1 + LC-TEST2 + LC-TEST3 + LC-TEST4 + LC-TEST5 + LC-TEST6 + LC-TEST7 + LS01 + LC-TEST8 + LC-TEST9 + LC-TEST10	4.62	257	0.426	0.019
DLPT.L ~ LC-TEST1 + LC-TEST2 + LC-TEST3 + LC-TEST4 + LC-TEST5 + LC-TEST6 + LC-TEST7 + LS01 + LC-TEST8 + LC-TEST9 + LC-TEST10 + LC-TEST11	4.46	256	0.468	0.042
DLPT.L ~ LC-TEST1 + LC-TEST2 + LC-TEST3 + LC-TEST4 + LC-TEST5 + LC-TEST6 + LC-TEST7 + LS01 + LC-TEST8 + LC-TEST9 + LC-TEST10 + LC-TEST11 + LC-TEST12	4.44	255	0.475	0.007
DLPT.L ~ LC-TEST1 + LC-TEST2 + LC-TEST3 + LC-TEST4 + LC-TEST5 + LC-TEST6 + LC-TEST7 + LS01 + LC-TEST8 + LC-TEST9 + LC-TEST10 + LC-TEST11 + LC-TEST12 + LS02	4.42	253	0.484	0.009
DLPT.L ~ LC-TEST1 + LC-TEST2 + LC-TEST3 + LC-TEST4 + LC-TEST5 + LC-TEST6 + LC-TEST7 + LS01 + LC-TEST8 + LC-TEST9 + LC-TEST10 + LC-TEST11 + LC-TEST12 + LS02 + LC-TEST13	4.40	252	0.490	0.006
DLPT.L ~ LC-TEST1 + LC-TEST2 + LC-TEST3 + LC-TEST4 + LC-TEST5 + LC-TEST6 + LC-TEST7 + LS01 + LC-TEST8 + LC-TEST9 + LC-TEST10 + LC-TEST11 + LC-TEST12 + LS02 + LC-TEST13 + LC-TEST14	4.37	250	0.501	0.011
DLPT.L ~ LC-TEST1 + LC-TEST2 + LC-TEST3 + LC-TEST4 + LC-TEST5 + LC-TEST6 + LC-TEST7 + LS01 + LC-TEST8 + LC-TEST9 + LC-TEST10 + LC-TEST11 + LC-TEST12 + LS02 + LC-TEST13 + LC-TEST14 + LC-TEST15	4.31	249	0.515	0.014
DLPT.L ~ LC-TEST1 + LC-TEST2 + LC-TEST3 + LC-TEST4 + LC-TEST5 + LC-TEST6 + LC-TEST7 + LS01 + LC-TEST8 + LC-TEST9 + LC-TEST10 + LC-TEST11 + LC-TEST12 + LS02 + LC-TEST13 + LC-TEST14 + LC-TEST15 + LS03	4.47	214	0.503	-0.012

Table L.2: Identifying Potential Decision Points for Arabic Attrition in Reading

Model	RSE	d.o.f.	R^2	Change in R^2
READING				
DLPT.R ~ RC-TEST1	4.14	268	0.029	0.029
DLPT.R ~ RC-TEST1 + RC-TEST2	3.95	267	0.121	0.092
DLPT.R ~ RC-TEST1 + RC-TEST2 + RC-TEST3	3.93	266	0.133	0.012
DLPT.R ~ RC-TEST1 + RC-TEST2 + RC-TEST3 + RC-TEST4	3.78	264	0.199	0.066
DLPT.R ~ RC-TEST1 + RC-TEST2 + RC-TEST3 + RC-TEST4 + RC-TEST5	3.74	263	0.221	0.022
DLPT.R ~ RC-TEST1 + RC-TEST2 + RC-TEST3 + RC-TEST4 + RC-TEST5 + RC-TEST6	3.62	262	0.273	0.052
DLPT.R ~ RC-TEST1 + RC-TEST2 + RC-TEST3 + RC-TEST4 + RC-TEST5 + RC-TEST6 + RC-TEST7	3.58	261	0.293	0.020
DLPT.R ~ RC-TEST1 + RC-TEST2 + RC-TEST3 + RC-TEST4 + RC-TEST5 + RC-TEST6 + RC-TEST7 + RS01	3.49	260	0.331	0.038
DLPT.R ~ RC-TEST1 + RC-TEST2 + RC-TEST3 + RC-TEST4 + RC-TEST5 + RC-TEST6 + RC-TEST7 + RS01 + RC-TEST8	3.38	259	0.375	0.044
DLPT.R ~ RC-TEST1 + RC-TEST2 + RC-TEST3 + RC-TEST4 + RC-TEST5 + RC-TEST6 + RC-TEST7 + RS01 + RC-TEST8 + RC-TEST9	3.30	258	0.403	0.028
DLPT.R ~ RC-TEST1 + RC-TEST2 + RC-TEST3 + RC-TEST4 + RC-TEST5 + RC-TEST6 + RC-TEST7 + RS01 + RC-TEST8 + RC-TEST9 + RC-TEST10	3.25	257	0.426	0.023
DLPT.R ~ RC-TEST1 + RC-TEST2 + RC-TEST3 + RC-TEST4 + RC-TEST5 + RC-TEST6 + RC-TEST7 + RS01 + RC-TEST8 + RC-TEST9 + RC-TEST10 + RC-TEST11	3.18	256	0.453	0.027
DLPT.R ~ RC-TEST1 + RC-TEST2 + RC-TEST3 + RC-TEST4 + RC-TEST5 + RC-TEST6 + RC-TEST7 + RS01 + RC-TEST8 + RC-TEST9 + RC-TEST10 + RC-TEST11 + RC-TEST12	3.11	255	0.477	0.024
DLPT.R ~ RC-TEST1 + RC-TEST2 + RC-TEST3 + RC-TEST4 + RC-TEST5 + RC-TEST6 + RC-TEST7 + RS01 + RC-TEST8 + RC-TEST9 + RC-TEST10 + RC-TEST11 + RC-TEST12 + RS02	3.12	253	0.479	0.002
DLPT.R ~ RC-TEST1 + RC-TEST2 + RC-TEST3 + RC-TEST4 + RC-TEST5 + RC-TEST6 + RC-TEST7 + RS01 + RC-TEST8 + RC-TEST9 + RC-TEST10 + RC-TEST11 + RC-TEST12 + RS02 + RC-TEST13	3.11	252	0.485	0.006
DLPT.R ~ RC-TEST1 + RC-TEST2 + RC-TEST3 + RC-TEST4 + RC-TEST5 + RC-TEST6 + RC-TEST7 + RS01 + RC-TEST8 + RC-TEST9 + RC-TEST10 + RC-TEST11 + RC-TEST12 + RS02 + RC-TEST13 + RC-TEST14	3.07	250	0.501	0.016
DLPT.R ~ RC-TEST1 + RC-TEST2 + RC-TEST3 + RC-TEST4 + RC-TEST5 + RC-TEST6 + RC-TEST7 + RS01 + RC-TEST8 + RC-TEST9 + RC-TEST10 + RC-TEST11 + RC-TEST12 + RS02 + RC-TEST13 + RC-TEST14 + RC-TEST15	2.98	249	0.532	0.031
DLPT.R ~ RC-TEST1 + RC-TEST2 + RC-TEST3 + RC-TEST4 + RC-TEST5 + RC-TEST6 + RC-TEST7 + RS01 + RC-TEST8 + RC-TEST9 + RC-TEST10 + RC-TEST11 + RC-TEST12 + RS02 + RC-TEST13 + RC-TEST14 + RC-TEST15 + RS03	2.89	214	0.525	-0.007

Table L.3: Identifying Potential Decision Points for Arabic Attrition in Speaking

Model	RSE	d.o.f.	R^2	Change in R^2
SPEAKING				
DLPT.S ~ SC-TEST1	3.87	268	0.040	0.040
DLPT.S ~ SC-TEST1 + SC-TEST2	3.86	267	0.049	0.009
DLPT.S ~ SC-TEST1 + SC-TEST2 + SC-TEST3	3.87	266	0.049	0
DLPT.S ~ SC-TEST1 + SC-TEST2 + SC-TEST3 + SC-TEST4	3.81	264	0.080	0.031
DLPT.S ~ SC-TEST1 + SC-TEST2 + SC-TEST3 + SC-TEST4 + SC-TEST5	3.80	263	0.092	0.012
DLPT.S ~ SC-TEST1 + SC-TEST2 + SC-TEST3 + SC-TEST4 + SC-TEST5 + SC-TEST6	3.77	262	0.107	0.015
DLPT.S ~ SC-TEST1 + SC-TEST2 + SC-TEST3 + SC-TEST4 + SC-TEST5 + SC-TEST6 + SC-TEST7	3.73	261	0.133	0.026
DLPT.S ~ SC-TEST1 + SC-TEST2 + SC-TEST3 + SC-TEST4 + SC-TEST5 + SC-TEST6 + SC-TEST7 + SS01	3.63	260	0.180	0.047
DLPT.S ~ SC-TEST1 + SC-TEST2 + SC-TEST3 + SC-TEST4 + SC-TEST5 + SC-TEST6 + SC-TEST7 + SS01 + SC-TEST8	3.62	259	0.185	0.005
DLPT.S ~ SC-TEST1 + SC-TEST2 + SC-TEST3 + SC-TEST4 + SC-TEST5 + SC-TEST6 + SC-TEST7 + SS01 + SC-TEST8 + SC-TEST9	3.59	258	0.218	0.033
DLPT.S ~ SC-TEST1 + SC-TEST2 + SC-TEST3 + SC-TEST4 + SC-TEST5 + SC-TEST6 + SC-TEST7 + SS01 + SC-TEST8 + SC-TEST9 + SC-TEST10	3.53	257	0.232	0.014
DLPT.S ~ SC-TEST1 + SC-TEST2 + SC-TEST3 + SC-TEST4 + SC-TEST5 + SC-TEST6 + SC-TEST7 + SS01 + SC-TEST8 + SC-TEST9 + SC-TEST10 + SC-TEST11	3.53	256	0.236	0.004
DLPT.S ~ SC-TEST1 + SC-TEST2 + SC-TEST3 + SC-TEST4 + SC-TEST5 + SC-TEST6 + SC-TEST7 + SS01 + SC-TEST8 + SC-TEST9 + SC-TEST10 + SC-TEST11 + SC-TEST12	3.49	255	0.257	0.021
DLPT.S ~ SC-TEST1 + SC-TEST2 + SC-TEST3 + SC-TEST4 + SC-TEST5 + SC-TEST6 + SC-TEST7 + SS01 + SC-TEST8 + SC-TEST9 + SC-TEST10 + SC-TEST11 + SC-TEST12 + SS02	3.41	253	0.296	0.039
DLPT.S ~ SC-TEST1 + SC-TEST2 + SC-TEST3 + SC-TEST4 + SC-TEST5 + SC-TEST6 + SC-TEST7 + SS01 + SC-TEST8 + SC-TEST9 + SC-TEST10 + SC-TEST11 + SC-TEST12 + SS02 + SC-TEST13	3.41	252	0.297	0.001
DLPT.S ~ SC-TEST1 + SC-TEST2 + SC-TEST3 + SC-TEST4 + SC-TEST5 + SC-TEST6 + SC-TEST7 + SS01 + SC-TEST8 + SC-TEST9 + SC-TEST10 + SC-TEST11 + SC-TEST12 + SS02 + SC-TEST13 + SC-TEST14	3.42	250	0.298	0.001
DLPT.S ~ SC-TEST1 + SC-TEST2 + SC-TEST3 + SC-TEST4 + SC-TEST5 + SC-TEST6 + SC-TEST7 + SS01 + SC-TEST8 + SC-TEST9 + SC-TEST10 + SC-TEST11 + SC-TEST12 + SS02 + SC-TEST13 + SC-TEST14 + SC-TEST15	3.42	249	0.301	0.003
DLPT.S ~ SC-TEST1 + SC-TEST2 + SC-TEST3 + SC-TEST4 + SC-TEST5 + SC-TEST6 + SC-TEST7 + SS01 + SC-TEST8 + SC-TEST9 + SC-TEST10 + SC-TEST11 + SC-TEST12 + SS02 + SC-TEST13 + SC-TEST14 + SC-TEST15 + SS03	3.30	214	0.334	0.033

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APPENDIX M. ARABIC S-PLUS LOGISTIC REGRESSION RESULTS

LOGISTIC REGRESSION SUB-MODEL (1)

```
Call: glm(formula = Y1 ~ SEM.1 + SEM.2 + SEM.3, family =
          binomial, data = arabdlpt, na.action = na.omit,
          control = list(epsilon = 0.001, maxit = 50,
          trace = F))
Deviance Residuals:
    Min      1Q      Median    3Q      Max
 -2.43    -0.629    0.355     0.707   2.26

Coefficients:
                 Value    Std. Error  t value
(Intercept)      -7.36    1.16        -6.35
    SEM.1        0.154    0.473        0.324
    SEM.2        0.477    0.686        0.695
    SEM.3        2.43     0.570        4.25

(Dispersion Parameter for Binomial family taken to be 1 )

   Null Deviance: 319.0 on 272 degrees of freedom

Residual Deviance: 237.9 on 269 degrees of freedom

Number of Fisher Scoring Iterations: 4
```

LOGISTIC REGRESSION SUB-MODEL (2)

```
Call: glm(formula = Z1 ~ SEM.1 + SEM.2 + SEM.3, family =
          binomial, data = arabdlpt, na.action = na.omit,
          control = list(epsilon = 0.001, maxit = 50,
          trace = F))
Deviance Residuals:
    Min      1Q      Median    3Q      Max
 -2.00    -0.910   -0.478     0.924   2.28

Coefficients:
                 Value    Std. Error  t value
(Intercept)      -7.48    1.25        -5.97
    SEM.1        0.019    0.519        0.036
    SEM.2        2.28     0.803        2.84
    SEM.3        0.211    0.626        0.337

(Dispersion Parameter for Binomial family taken to be 1 )

   Null Deviance: 274.7 on 198 degrees of freedom

Residual Deviance: 223.6 on 195 degrees of freedom

Number of Fisher Scoring Iterations: 3
```

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INDEX OF TERMS

1. ***attrit:*** a student is disenrolled or dropped from DLI; a student is disenrolled or dropped from one language program and enrolled in another less difficult language.

2. ***basic program:*** an intensive program for beginner linguists designed to take the student up to a Level 2 in listening comprehension, reading comprehension, and speaking ability.

3. ***course*:** one of several components of a language program normally made up of a group of lessons, units or modules arranged around one or more functional themes within a language program.

4. ***C-Test:*** see program test.

5. ***department*:** organization of teaching teams aligned under a language school for management purposes.

6. ***disenrollment or dropped:*** students who encounter academic or administrative difficulties which cannot be resolved to enable them to continue in their assigned language training programs will be disenrolled from DLI.

7. ***Final Learning Objectives(FLOs)*:** the skills and knowledge students should possess at the end of their language training programs.

8. ***ILR descriptions*:** characterize six base levels of language proficiency (levels 0-5) with additional plus level descriptions for levels 0-4.

9. ***major program test:*** see program test.

10. ***minimum successful grade*:** a grade of C- on any single test.

11. ***phase test:*** see program test.

12. ***proficiency testing*:** way of assessing how well an examinee performs in a language regardless of where or how the language was acquired; test material covered and questions asked typically exceed what may have been studied in any training program.

13. ***program*:** the entire set of training courses included in an enrollment option, such as Basic, Intermediate, Advanced, etc.

14. ***program test*:** a standardized test developed by the language department given to all students; sometimes referred to as a unit, C-Test, or phase test.

15. ***recycle*:** students who encounter academic or administrative difficulties may be considered for recycle to another class within the same language. Students will be recycled to a point in the program no later than when they first experienced academic difficulty.

16. ***school*:** seven schools carry out all foreign language instruction and training; a school is composed of departments, in which instruction of individual foreign languages takes place.

17. ***standardized test*:** a test consistently given to all students within the same class or language program within a predetermined testing timeframe; does not refer to statistical evaluation.

18. ***teaching team*:** group of language teachers assigned to train a specific group of students.

19. ***test*:** assessment of a student, created at the department, School, or Institute level and given during a course or program of instruction; may be in a variety of formats such as constructed-response, fill-in-the blank, multiple-choice, etc.

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