

Standard-Setting Study for the Biological Sciences Tests for BIO 211, 212,  
213, and 214 for Use in Credit by Examination in Biology 211, 212, 213,  
and 214 at The University of Texas at Austin:  
Fall 2000 and Spring 2001

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Standard-Setting Study for the Biological Sciences Tests for Use in Course Placement  
and Credit by Examination in Biology 211, 212, 213, and 214 at  
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At the request of the School of Biological Sciences at The University of Texas at Austin, the Measurement and Evaluation Center (MEC) conducted a standard setting study in the fall semester of 2000 and the spring semester of 2001 for the Biological Sciences tests for Biology 211, 212, 213, and 214, in order to assist the School in choosing decision scores to be used for the award of credit by examination. The tests were adopted by the School for use beginning in the fall 2001 semester.

## Method

### Materials

Beginning with the fall semester of 2000, the School of Biological Sciences implemented a revised introductory course sequence, consisting of one course for each of four major biology content areas: cells and molecules (BIO 211); genetics and evolution (BIO 212); diversity and ecology (BIO 213); and structure and function (BIO 214). At the same time, faculty in the School of Biological Sciences developed four tests, each with two forms A and B, to be used for credit-by-examination for the four courses in that sequence. Each test form was a one-hour objective measure, covering the appropriate biology content area for the course for which it would be used.

Following the standard-setting study, the School of Biological Sciences packaged the test forms so as to create two Biological Sciences tests, one test for Biology 211 and 212 and the other test for Biology 213 and 214. Beginning in fall 2001, therefore, each test from the standard-setting study became one section of a two-hour objective measure with two sections, each section covering one of the major biology content areas. Students may choose to take one or both sections when they sit for a test, and they receive a separate score for each section. Therefore, depending upon which tests and which sections students choose to take, they may attempt to earn credit by examination in as few as one or as many as four of the courses. Students may qualify for separate letter grades of *A*, *B*, or *C* (or choose the *credit only* option) in each course for which they earn a qualifying test score in the corresponding test section.

### Subjects

During the fall semester of 2000, the appropriate Biological Sciences test--with a random assignment of form A or form B--was given to all students enrolled in each of the courses Biology 211 and Biology 212 as part of the students' course requirements. During the spring semester of 2001, the appropriate Biological Sciences test--with a random assignment of form A or form B--was given to all students enrolled in each of the courses Biology 213 and Biology 214 as part of the students' course requirements. For each test, forms A and B contained a subset of common items to be used to facilitate equating the two forms. A total of 2069 students took tests: 791 students enrolled in BIO 211 took the cells and molecules test; 430 students enrolled in BIO 212 took the genetics and evolution test; 332 students enrolled in BIO 213 took the diversity and ecology test; and 516 students enrolled in BIO 214 took the structure and function test.

To ensure that students would put forth serious effort on the tests, course instructors agreed that the test score would be used as a basis for their final grade. However, to avoid in the validity study spurious correlations between the test scores and the course grades reported for students, instructors were asked to report to MEC staff students' preliminary course grades, which were based on all grading criteria from the course except for the score on the Biological Sciences test.

## Procedure

The preliminary course grades were obtained for students enrolled in BIO 211 and BIO 212 during the fall semester of 2000 and for students enrolled in BIO 213 and BIO 214 during the spring semester of 2001. The grades were reported by instructors as *A*, *B*, *C*, *D*, or *F*, and coded by MEC staff on a 5-point scale, on which a 4 designated a grade of *A* at one extreme and a 0 designated an *F* at the other extreme. The two forms of each test were equated to a common score scale using the random groups design described by Angoff (1984)<sup>1</sup>. MEC staff then assembled data pairs consisting of preliminary course grade and equated placement test score for each of the 2069 students participating in the study.

MEC staff calculated two summary statistics for each of four sets of data pairs, one set for each of the four courses in the introductory biology sequence: the mean and standard deviation of the preliminary course grades, and the mean and standard deviation of the test scores. For each set of data pairs, MEC staff calculated the coefficient of correlation between the preliminary course grades and the test scores, and produced two versions of two-way frequency tables: one version shows preliminary course grades by test scores, and the other collapses the preliminary course grades into two categories describing course outcome--Unsatisfactory (preliminary course grades *F* and *D*) and Satisfactory (preliminary course grades *C*, *B*, and *A*)--to show course outcomes by test scores. MEC staff then used linear regression equations to calculate for each set of data pairs expected grades and expected test scores for inclusion in the frequency tables.

For each set of data MEC staff also prepared a table to summarize, for test scores that were candidates for use as decision scores, the accuracy with which the students who participated in the study would have been placed in the course they took, if they had been placed based on their test scores. The test scores that were candidates to be decision scores were determined based on six guidelines for establishing decision scores. The table indicates the numbers and percentages of students, for the given test scores, whose placement would have been Correct, Too High, and Too Low, as determined by the students' course outcomes as indicated by their preliminary course grade.

Therefore, for a given possible decision score, counted in the category Correct were students whose preliminary course grade placed them in the Satisfactory category, and who would have been placed, correctly, in that course based on their test score. Counted in the category Too High were students whose preliminary course grade placed them in the Unsatisfactory category, and yet who would have been placed in that course based on their test score. Counted in the category Too Low were students whose preliminary course grade placed them in the Satisfactory category, and yet who would not have been placed in that course based on their test score.

Finally, for each set of data, MEC staff prepared a fourth table to show, for each of the six guidelines for establishing decision scores, which test score should be chosen if that guideline were used as the basis for the choice. In this way, for each course in the introductory biology sequence, MEC staff prepared for the School's consideration a table of possible decision scores as suggested by the six guidelines.

## Results

For each of the four courses in the introductory biology sequence, four tables summarize the findings of the validity study. The first table presents the two-way frequency distribution for preliminary course grades by test scores, with summary statistics and correlation information. The second table presents the two-way frequency distribution for course outcome by test scores. The third table presents the information concerning the accuracy of placement for possible decision scores. The fourth table presents the possible decision scores based on the six guidelines.

### BIO 211

Table 1.1 shows a two-way frequency distribution for test scores (indicated down the first column, ranging from 10 to 55) by preliminary course grades (indicated across the third through the seventh

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<sup>1</sup> Angoff, W. (1984). Scales, norms, and equivalent scores. Princeton, NJ: Educational Testing Service.

columns, ranging from 0 to 4). The expected grades, calculated by substituting the test scores into the expected grade regression equation shown below the table, are indicated in the second column next to the respective test scores. The totals for the row frequencies are shown in the last column, thus constituting a one-way frequency distribution of the test scores.

The five rows at the bottom of Table 1.1 present summary statistics. The totals for the column frequencies are shown in the row labeled Total, thus constituting a one-way frequency distribution of the preliminary course grades, with the total number of students enrolled in Biology 211 who participated in the study indicated in the last cell. The four rows following show, for each group of students earning a particular preliminary course grade, the percentage of students earning that grade (with the last cell totaling 100%), their group's mean placement test score (and the total group's mean placement test score in the last cell), the standard deviation of that mean score (and the standard deviation for the total group's test score mean in the last cell), and the expected placement test score for that grade as calculated by substituting the preliminary course grade into the expected score regression equation shown below the table.

The boxes below the table present the two regression equations, and summary information for the total group. The mean preliminary course grade for the students who took Biology 211 is 2.44--approximately a C+ average--with standard deviation 1.08. The coefficient of correlation between preliminary course grades and test scores is .72.

The data concerning expected grades and expected scores are included in view of UT Austin's policy concerning the award of credit by examination. The policy provides that the criterion for the award of credit is that the same standard of performance must be demonstrated by students who take an examination as by students who complete course work. That standard is taken to be the minimally satisfactory grade of C. The data concerning expected grades and expected scores may be used, therefore, to determine that the minimally satisfactory grade of C may be expected for students with a test score of 29, or that for students receiving the minimally satisfactory grade of C the expected test score is 31.

Table 1.2 shows a two-way frequency distribution for test scores (indicated down the first column, ranging from 10 to 55) by course outcomes (indicated across the second and third columns, 0-1 Unsatisfactory and 2-4 Satisfactory). The totals for the row frequencies are shown in the last column, and are the same as those shown in Table 1.1, thus constituting the same one-way frequency distribution of the test scores as shown in Table 1.1.

The four rows at the bottom of Table 1.2 present summary statistics. The totals for the column frequencies are shown in the row labeled Total, thus constituting a one-way frequency distribution of the course outcomes, with the total number of students enrolled in Biology 211 who participated in the study indicated in the last cell. The three rows following show, for each of the two possible course outcomes, the percentage of students with that outcome (with the last cell totaling 100%), their group's mean placement test score (and, as in Table 1.1, the total group's mean placement test score in the last cell), and the standard deviation of that mean score (and, as in Table 1.1, the standard deviation for the total group's test score mean in the last cell). The boxes to the right of the table present the same summary information for the total group as shown in Table 1.1.

Table 1.3 shows the accuracy, for each of several possible decision scores, with which the students who took Biology 211 would have been placed in Biology 211 if their placement in the course had been on the basis of their test scores. For each possible decision score in the first column, the second and third columns, as a pair, show the cumulative numbers of students who would be placed correctly, too high, or too low if that decision score were used as the criterion for the award of credit.

The second column shows the frequency of the two possible placement outcomes for students whose performance in Biology 211, as indicated by their actual preliminary course grades, was Unsatisfactory (grades of 0-1). They would be placed too high if their test scores were at least as high as the possible decision score in the first column, or they would be placed correctly if their test scores were below that decision score. The third column shows the frequency of the two possible placement outcomes for students whose performance in Biology 211, as indicated by their actual preliminary course grades, was Satisfactory (grades of 2-4). They would be placed correctly if their test scores were at least as high as the possible decision score in the first column, or they would be placed too low if their test scores were below that decision score.

The fourth and fifth columns indicate the associated percentages for the numbers of students indicated in the second and third columns. The last two columns of data indicate, for the total group of

Table 1.1  
 End-of-Course Test Scores on the Biological Sciences Test for BIO 211 in Relation to  
 Student Performance in Biology 211: Frequency Distributions, Descriptive Statistics,  
 Regression Equations, Expected Grades, and Expected Scores for the  
 Biology Validity Study of Fall 2000  
 (N = 791)

Test Scores	Expected Grades	Preliminary BIO 211 Grades (0-4)					Total N
		0 <i>F</i>	1 <i>D</i>	2 <i>C</i>	3 <i>B</i>	4 <i>A</i>	
52 - 55	4.00					8	8
51	3.95					8	8
50	3.86				2	4	6
49	3.77			1	2	6	9
48	3.68			1	1	10	12
47	3.59				6	14	20
46	3.51			1	6	10	17
45	3.42			2	4	12	18
44	3.33			3	9	17	29
43	3.24			3	13	6	22
42	3.15			8	13	8	29
41	3.06		1	7	11	8	27
40	2.97		1	4	17	7	29
39	2.88		2	4	16	4	26
38	2.79			6	14	6	26
37	2.70			15	13	3	31
36	2.61		1	18	15	6	40
35	2.53		2	14	12		28
34	2.44		3	28	11	3	45
33	2.35	1	1	15	9	2	28
32	2.26	1	2	17	9	1	30
31	2.17	1	3	15	6	2	27
30	2.08		3	12	11	1	27
29	1.99		7	21	8	2	38
28	1.90		9	14	6		29
27	1.81		4	8	1		13
26	1.72	3	4	14	3		24
25	1.63	3	10	10	2		25
24	1.55	3	1	7	2		13
23	1.46	5	8	12	3		28
22	1.37	3	3	6			12
21	1.28	2	5	6	1	1	15
20	1.19	1	7	1			9
19	1.10	4	3	4	1		12
18	1.01	4	2	2			8
10 - 17	0.30 - 0.92	10	10	3			23
Total		41	92	282	227	149	791
Percent		5.2%	11.6%	35.7%	28.7%	18.8%	100.0%
Mean Score		20.9	25.3	31.5	37	43.6	34.1
Standard Deviation		5.09	6.22	6.30	6.04	5.72	8.74
Expected Score		20	26	31	37	43	

$\text{Expected Grade} = (\text{Test Score} \times 0.08906) - 0.5916$
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$\text{Expected Score} = (\text{Preliminary Grade} \times 5.8312) + 19.8311$
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Mean Grade 2.44	Standard Deviation 1.08	Coefficient of Correlation $r = .72$
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Table 1.2  
 End-of-Course Test Scores on the Biological Sciences Test for BIO 211 in Relation to  
 Student Performance in Biology 211: Combined Frequency Distributions and  
 Descriptive Statistics for the Biology Validity Study of Fall 2000  
 (N = 791)

Test Scores	Preliminary BIO 211 Grades		Total N
	Unsatisfactory 0-1	Satisfactory 2-4	
52 - 55		8	8
51		8	8
50		6	6
49		9	9
48		12	12
47		20	20
46		17	17
45		18	18
44		29	29
43		22	22
42		29	29
41	1	26	27
40	1	28	29
39	2	24	26
38		26	26
37		31	31
36	1	39	40
35	2	26	28
34	3	42	45
33	2	26	28
32	3	27	30
31	4	23	27
30	3	24	27
29	7	31	38
28	9	20	29
27	4	9	13
26	7	17	24
25	13	12	25
24	4	9	13
23	13	15	28
22	6	6	12
21	7	8	15
20	8	1	9
19	7	5	12
18	6	2	8
10 - 17	20	3	23
Total	133	658	791
Percent	16.8%	83.2%	100.0%
Mean Score	23.9	36.1	34.1
Standard Deviation	6.23	7.68	8.74

Mean Grade	Standard Deviation
2.44	1.08

Coefficient of Correlation
r = .72

Table 1.3  
 End-of-Course Test Scores on the Biological Sciences Test for BIO 211 in  
 Relation to Performance in Biology 211: Possible Decision Scores and  
 Corresponding Accuracies of Placement for the  
 Biology Validity Study of Fall 2000  
 (N = 791)

Place- ment Category	Cumulative Number of Students		Placement of Students in Each Placement Category		Overall Accuracy of Placement		
	Unsatisfactory 0-1 (N=133)	Satisfactory 2-4 (N = 658)	Unsatisfactory	Satisfactory	Placement Accuracy	Number of Students	% of Students
34 - up	Too High 10	420 Correct	Too High 8%	64% Correct	Too High	10	1%
Below 34	Correct 123	238 Too Low	Correct 92%	36% Too Low	Correct	543	69%
33 - up	Too High 12	446 Correct	Too High 9%	68% Correct	Too High	12	2%
Below 33	Correct 121	212 Too Low	Correct 91%	32% Too Low	Correct	567	72%
32 - up	Too High 15	473 Correct	Too High 11%	72% Correct	Too High	15	2%
Below 32	Correct 118	185 Too Low	Correct 89%	28% Too Low	Correct	591	75%
31 - up	Too High 19	496 Correct	Too High 14%	75% Correct	Too High	19	2%
Below 31	Correct 114	162 Too Low	Correct 86%	25% Too Low	Correct	610	77%
30 - up	Too High 22	520 Correct	Too High 17%	79% Correct	Too High	22	3%
Below 30	Correct 111	138 Too Low	Correct 83%	21% Too Low	Correct	631	80%
29 - up	Too High 29	551 Correct	Too High 22%	84% Correct	Too High	29	4%
Below 29	Correct 104	107 Too Low	Correct 78%	16% Too Low	Correct	655	83%
25 - up	Too High 62	609 Correct	Too High 47%	93% Correct	Too High	62	8%
Below 25	Correct 71	49 Too Low	Correct 53%	7% Too Low	Correct	680	86%
24 - up	Too High 66	618 Correct	Too High 50%	94% Correct	Too High	66	8%
Below 24	Correct 67	40 Too Low	Correct 50%	6% Too Low	Correct	685	87%
23 - up	Too High 79	633 Correct	Too High 59%	96% Correct	Too High	79	10%
Below 23	Correct 54	25 Too Low	Correct 41%	4% Too Low	Correct	687	87%
22 - up	Too High 85	639 Correct	Too High 64%	97% Correct	Too High	85	11%
Below 22	Correct 49	19 Too Low	Correct 37%	3% Too Low	Correct	688	87%
21 - up	Too High 92	647 Correct	Too High 69%	98% Correct	Too High	92	12%
Below 21	Correct 41	11 Too Low	Correct 31%	2% Too Low	Correct	688	87%
20 - up	Too High 100	648 Correct	Too High 75%	98% Correct	Too High	100	13%
Below 20	Correct 33	10 Too Low	Correct 25%	2% Too Low	Correct	681	86%
					Too Low	10	1%

students, the numbers and percentages of students who would be placed too high, correctly, and too low by the respective possible decision score.

Table 1.4 lists six guidelines for choosing a decision score, and indicates to the right of each guideline the placement test score that would be chosen as the decision score if that guideline were used. Included with the statement of the rationale for each guideline is a reference to a location in one of the Tables 1.1, 1.2, or 1.3 where the decision score may be determined based on that rationale. The range of possible decision scores is from 21 to 31.

## BIO 212

Table 2.1 shows a two-way frequency distribution for test scores (indicated down the first column, ranging from 13 to 52) by preliminary course grades (indicated across the third through the seventh columns, ranging from 0 to 4). The expected grades, calculated by substituting the test scores into the expected grade regression equation shown below the table, are indicated in the second column next to the respective test scores. The totals for the row frequencies are shown in the last column, thus constituting a one-way frequency distribution of the test scores.

The five rows at the bottom of Table 2.1 present summary statistics. The totals for the column frequencies are shown in the row labeled Total, thus constituting a one-way frequency distribution of the preliminary course grades, with the total number of students enrolled in Biology 212 who participated in the study indicated in the last cell. The four rows following show, for each group of students earning a particular preliminary course grade, the percentage of students earning that grade (with the last cell totaling 100%), their group's mean placement test score (and the total group's mean placement test score in the last cell), the standard deviation of that mean score (and the standard deviation for the total group's test score mean in the last cell), and the expected placement test score for that grade as calculated by substituting the preliminary course grade into the expected score regression equation shown below the table.

The boxes below the table present the two regression equations, and summary information for the total group. The mean preliminary course grade for the students who took Biology 212 is 2.43--approximately a C+ average--with standard deviation 1.03. The coefficient of correlation between preliminary course grades and test scores is .74.

The data concerning expected grades and expected scores are included in view of UT Austin's policy concerning the award of credit by examination. The policy provides that the criterion for the award of credit is that the same standard of performance must be demonstrated by students who take an examination as by students who complete course work. That standard is taken to be the minimally satisfactory grade of C. The data concerning expected grades and expected scores may be used, therefore, to determine that the minimally satisfactory grade of C may be expected for students with a test score of 33, or that for students receiving the minimally satisfactory grade of C the expected test score is 35.

Table 2.2 shows a two-way frequency distribution for test scores (indicated down the first column, ranging from 13 to 52) by course outcomes (indicated across the second and third columns, 0-1 Unsatisfactory and 2-4 Satisfactory). The totals for the row frequencies are shown in the last column, and are the same as those shown in Table 2.1, thus constituting the same one-way frequency distribution of the test scores as shown in Table 2.1.

The four rows at the bottom of Table 2.2 present summary statistics. The totals for the column frequencies are shown in the row labeled Total, thus constituting a one-way frequency distribution of the course outcomes, with the total number of students enrolled in Biology 212 who participated in the study indicated in the last cell. The three rows following show, for each of the two possible course outcomes, the percentage of students with that outcome (with the last cell totaling 100%), their group's mean placement test score (and, as in Table 2.1, the total group's mean placement test score in the last cell), and the standard deviation of that mean score (and, as in Table 2.1, the standard deviation for the total group's test score mean in the last cell). The boxes to the right of the table present the same summary information for the total group as shown in Table 2.1.

Table 2.3 shows the accuracy, for each of several possible decision scores, with which the students who took Biology 212 would have been placed in Biology 212 if their placement in the course had been on the basis of their test scores. For each possible decision score in the first column, the second and third columns, as a pair, show the cumulative numbers of students who would be placed correctly, too high, or too low if that decision score were used as the criterion for the award of credit.

Table 1.4  
 Scores of the Biological Sciences Test in Relation to Student Performance in  
 Biology 211: Scores Suggested by Six Guidelines for Use in Selecting  
 Decision Scores for the Biology Validity Study of Fall 2000  
 (N=795)

Guideline	Biological Sciences Test Score
1. Expected Score for students whose performance in the course was just minimally satisfactory (i.e., students with preliminary grades of C-; see the Expected Score row at the bottom of Table 1.1).	31
2. Score for which the Expected Grade is just minimally satisfactory (i.e., C- or 7.01; see the Expected Grade column of Table 1.1).	29
3. Score for which the percents of errors of students in each academic performance category (Unsatisfactory, Satisfactory) are most nearly equal. (See the values for % Too High and % Too Low in the middle columns of Table 1.3.)	29
4. Score for which the overall percents of errors are most nearly equal. (See the values for % Too High and % Too Low in the last column of Table 1.3.)	25
5. Scores that would cut off (or hold back) approximately the same number of students as were in the Unsatisfactory performance group. (See Table 1.2 for the number of students in the Unsatisfactory group, and note the test score that would hold back most nearly that number of low-scoring students.)	24
6. Score that would maximize the overall accuracy of placement. (See the Number Correct in the next-to-last column of Table 1.3.)	23

Table 2.1  
 End-of-Course Test Scores on the Biological Sciences Test for BIO 212 in Relation to  
 Student Performance in Biology 212: Frequency Distributions, Descriptive Statistics,  
 Regression Equations, Expected Grades, and Expected Scores for the  
 Biology Validity Study of Fall 2000  
 (N = 430)

Test Scores	Expected Grades	Preliminary BIO 212 Grades (0-4)					Total N
		0 <i>F</i>	1 <i>D</i>	2 <i>C</i>	3 <i>B</i>	4 <i>A</i>	
52	4.00				1	2	3
51	3.91					2	2
50	3.81				1	4	5
49	3.71				2	3	5
48	3.60				3	3	6
47	3.50			1	2	7	10
46	3.39			1	8	11	20
45	3.29			1	4	7	12
44	3.18			3	10	11	24
43	3.08				7	2	9
42	2.97		1	5	11	3	20
41	2.87			4	11	6	21
40	2.76		2	9	18	2	31
39	2.66		1	14	17	1	33
38	2.55		2	9	13		24
37	2.45		2	13	6	1	22
36	2.35		2	5	7	2	16
35	2.24	1	1	13	4		19
34	2.14	1	2	8	4		15
33	2.03		1	11	4		16
32	1.93		1	4	1		6
31	1.82		2	7	3		12
30	1.72	1	4	9	1		15
29	1.61		10	8	1		19
28	1.51		7	7	1		15
27	1.40	2	5	4			11
26	1.30	1	3	6			10
25	1.19	1	5	2			8
24	1.09	1	1	2	1		5
23	0.99	1					1
22	0.88	3	1	1			5
21	0.78	2		2			4
20	0.67		1				1
19	0.57						
18	0.46	2					2
13 - 17	0.00 - 0.36	1	2				3
Total		17	56	149	141	67	430
Percent		4.0%	13.0%	34.7%	32.8%	15.6%	100.0%
Mean Score		24.2	29.5	34.3	40.0	45.0	36.8
Standard Deviation		5.04	5.50	5.38	4.59	3.54	7.28
Expected Score		24	29	35	40	45	

$\text{Expected Grade} = (\text{Test Score} \times 0.1046) - 1.4201$
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$\text{Expected Score} = (\text{Preliminary Grade} \times 5.2532) + 24.0451$
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Mean Grade 2.43	Standard Deviation 1.03	Coefficient of Correlation $r = .74$
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Table 2.2  
 End-of-Course Test Scores on the Biological Sciences Test for BIO 212 in Relation to  
 Student Performance in Biology 212: Combined Frequency Distributions and  
 Descriptive Statistics for the Biology Validity Study of Fall 2000  
 (N = 430)

Test Scores	Preliminary BIO 212 Grades		Total N
	Unsatisfactory 0-1	Satisfactory 2-4	
52		3	3
51		2	2
50		5	5
49		5	5
48		6	6
47		10	10
46		20	20
45		12	12
44		24	24
43		9	9
42	1	19	20
41		21	21
40	2	29	31
39	1	32	33
38	2	22	24
37	2	20	22
36	2	14	16
35	2	17	19
34	3	12	15
33	1	15	16
32	1	5	6
31	2	10	12
30	5	10	15
29	10	9	19
28	7	8	15
27	7	4	11
26	4	6	10
25	6	2	8
24	2	3	5
23	1		1
22	4	1	5
21	2	2	4
20	1		1
19			
18	2		2
13 - 17	3		3
Total	73	357	430
Percent	17.0%	83.0%	100.0%
Mean Score	28.3	38.6	36.8
Standard Deviation	5.84	6.24	7.28

Mean Grade	Standard Deviation
2.43	1.03

Coefficient of Correlation
$r = .74$

Table 2.3  
 End-of-Course Test Scores on the Biological Sciences Test for BIO 212 in  
 Relation to Performance in Biology 212: Possible Decision Scores and  
 Corresponding Accuracies of Placement for the  
 Biology Validity Study of Fall 2000  
 (N = 430)

Place- ment Category	Cumulative Number of Students		Placement of Students in Each Placement Category		Overall Accuracy of Placement		
	Unsatisfactory 0-1 (N=73)	Satisfactory 2-4 (N = 357)	Unsatisfactory	Satisfactory	Placement Accuracy	Number of Students	% of Students
38 - up	Too High 6	219 Correct	Too High 8%	61% Correct	Too High	6	1%
Below 38	Correct 67	138 Too Low	Correct 92%	39% Too Low	Correct	286	67%
37 - up	Too High 8	239 Correct	Too High 11%	67% Correct	Too High	8	2%
Below 37	Correct 65	118 Too Low	Correct 89%	33% Too Low	Correct	304	71%
36 - up	Too High 10	253 Correct	Too High 14%	71% Correct	Too High	10	2%
Below 36	Correct 63	104 Too Low	Correct 86%	29% Too Low	Correct	316	73%
35 - up	Too High 12	270 Correct	Too High 16%	76% Correct	Too High	12	3%
Below 35	Correct 61	87 Too Low	Correct 84%	24% Too Low	Correct	331	77%
34 - up	Too High 15	282 Correct	Too High 21%	79% Correct	Too High	15	3%
Below 34	Correct 58	75 Too Low	Correct 79%	21% Too Low	Correct	340	79%
33 - up	Too High 16	297 Correct	Too High 22%	83% Correct	Too High	16	4%
Below 33	Correct 57	60 Too Low	Correct 78%	17% Too Low	Correct	354	82%
32 - up	Too High 17	302 Correct	Too High 23%	85% Correct	Too High	17	4%
Below 32	Correct 56	55 Too Low	Correct 77%	15% Too Low	Correct	358	83%
31 - up	Too High 19	312 Correct	Too High 26%	87% Correct	Too High	19	4%
Below 31	Correct 54	45 Too Low	Correct 74%	13% Too Low	Correct	366	85%
30 - up	Too High 24	322 Correct	Too High 33%	90% Correct	Too High	24	6%
Below 30	Correct 49	35 Too Low	Correct 67%	10% Too Low	Correct	371	86%
29 - up	Too High 34	331 Correct	Too High 47%	93% Correct	Too High	34	8%
Below 29	Correct 39	26 Too Low	Correct 53%	7% Too Low	Correct	370	86%
28 - up	Too High 41	339 Correct	Too High 56%	95% Correct	Too High	41	10%
Below 28	Correct 32	18 Too Low	Correct 44%	5% Too Low	Correct	371	86%
27 - up	Too High 48	343 Correct	Too High 66%	96% Correct	Too High	48	11%
Below 27	Correct 25	14 Too Low	Correct 34%	4% Too Low	Correct	368	86%

The second column shows the frequency of the two possible placement outcomes for students whose performance in Biology 212, as indicated by their actual preliminary course grades, was Unsatisfactory (grades of 0-1). They would be placed too high if their test scores were at least as high as the possible decision score in the first column, or they would be placed correctly if their test scores were below that decision score. The third column shows the frequency of the two possible placement outcomes for students whose performance in Biology 212, as indicated by their actual preliminary course grades, was Satisfactory (grades of 2-4). They would be placed correctly if their test scores were at least as high as the possible decision score in the first column, or they would be placed too low if their test scores were below that decision score.

The fourth and fifth columns indicate the associated percentages for the numbers of students indicated in the second and third columns. The last two columns of data indicate, for the total group of students, the numbers and percentages of students who would be placed too high, correctly, and too low by the respective possible decision score.

Table 2.4 lists six guidelines for choosing a decision score, and indicates to the right of each guideline the placement test score that would be chosen as the decision score if that guideline were used. Included with the statement of the rationale for each guideline is a reference to a location in one of the Tables 2.1, 2.2, or 2.3 where the decision score may be determined based on that rationale. The range of possible decision scores is from 28 to 35.

### BIO 213

Table 3.1 shows a two-way frequency distribution for test scores (indicated down the first column, ranging from 12 to 42) by preliminary course grades (indicated across the third through the seventh columns, ranging from 0 to 4). The expected grades, calculated by substituting the test scores into the expected grade regression equation shown below the table, are indicated in the second column next to the respective test scores. The totals for the row frequencies are shown in the last column, thus constituting a one-way frequency distribution of the test scores.

The five rows at the bottom of Table 3.1 present summary statistics. The totals for the column frequencies are shown in the row labeled Total, thus constituting a one-way frequency distribution of the preliminary course grades, with the total number of students enrolled in Biology 213 who participated in the study indicated in the last cell. The four rows following show, for each group of students earning a particular preliminary course grade, the percentage of students earning that grade (with the last cell totaling 100%), their group's mean placement test score (and the total group's mean placement test score in the last cell), the standard deviation of that mean score (and the standard deviation for the total group's test score mean in the last cell), and the expected placement test score for that grade as calculated by substituting the preliminary course grade into the expected score regression equation shown below the table.

The boxes below the table present the two regression equations, and summary information for the total group. The mean preliminary course grade for the students who took Biology 213 is 2.75--approximately a *B-* average--with standard deviation 1.10. The coefficient of correlation between preliminary course grades and test scores is .42.

The data concerning expected grades and expected scores are included in view of UT Austin's policy concerning the award of credit by examination. The policy provides that the criterion for the award of credit is that the same standard of performance must be demonstrated by students who take an examination as by students who complete course work. That standard is taken to be the minimally satisfactory grade of *C*. The data concerning expected grades and expected scores may be used, therefore, to determine that the minimally satisfactory grade of *C* may be expected for students with a test score of 23, or that for students receiving the minimally satisfactory grade of *C* the expected test score is 30.

Table 3.2 shows a two-way frequency distribution for test scores (indicated down the first column, ranging from 12 to 42) by course outcomes (indicated across the second and third columns, 0-1 Unsatisfactory and 2-4 Satisfactory). The totals for the row frequencies are shown in the last column, and are the same as those shown in Table 3.1, thus constituting the same one-way frequency distribution of the test scores as shown in Table 3.1.

The four rows at the bottom of Table 3.2 present summary statistics. The totals for the column frequencies are shown in the row labeled Total, thus constituting a one-way frequency distribution of the

Table 2.4  
 Scores on the Biological Sciences Test in Relation to Student Performance in  
 Biology 212: Scores Suggested by Six Guidelines for Use in Selecting  
 Decision Scores for the Biology Validity Study of Fall 2000  
 (N=430)

Guideline	Biological Sciences Test Score
1. Expected Score for students whose performance in the course was just minimally satisfactory (i.e., students with preliminary grades of C -; see the Expected Score row at the bottom of Table 2.1).	35
2. Score for which the Expected Grade is just minimally satisfactory (i.e., C - or 7.01; see the Expected Grade column in Table 2.1).	33
3. Score for which the percents of errors of students in each academic performance category (Unsatisfactory, Satisfactory) are most nearly equal. (See the values for % Too High and % Too Low in the middle columns of Table 2.3.)	34
4. Score for which the overall percents of errors are most nearly equal. (See the values for % Too High and % Too Low in the last column of Table 2.3.)	29
5. Scores that would cut off (or hold back) approximately the same number of students as were in the Unsatisfactory performance group. (See Table 2.2 for the number of students in the Unsatisfactory group, and note the test score that would hold back most nearly that number of low-scoring students.)	28
6. Score that would maximize the overall accuracy of placement. (See the Number Correct in the next-to-last column of Table 2.3.)	30

Table 3.1  
 End-of-Course Test Scores on the Biological Sciences Test for BIO 213 in Relation to  
 Student Performance in Biology 213: Frequency Distributions, Descriptive Statistics,  
 Regression Equations, Expected Grades, and Expected Scores for the  
 Biology Validity Study of Fall 2000  
 (N = 332)

Test Scores	Expected Grades	Preliminary BIO 213 Grades (0-4)					Total N
		0 <i>F</i>	1 <i>D</i>	2 <i>C</i>	3 <i>B</i>	4 <i>A</i>	
42	3.68					1	1
41	3.59				2	2	4
40	3.51				1	8	9
39	3.42				1	10	11
38	3.33		1		2	9	12
37	3.25		1		7	5	13
36	3.16	1	1	2	11	10	25
35	3.07		2	9	11	3	25
34	2.98			4	6	12	22
33	2.90	1		7	18	8	34
32	2.81	1	1	6	5	3	16
31	2.72	5	1	9	13	5	33
30	2.64	1	1	6	11	4	23
29	2.55	1	1	4	7	2	15
28	2.46	1	1	1	4	1	8
27	2.38		3	5	5	3	16
26	2.29	1		7	4	1	13
25	2.20	1	1	3	5	2	12
24	2.11	4	3	4	3	1	15
23	2.03		1		5		6
22	1.94		2	2	5	1	10
21	1.85						
20	1.77			3			3
19	1.68			1			1
18	1.59	1					1
17	1.50		1				1
16	1.42			1			1
15	1.33						
14	1.24	1					1
13	1.16						
12	1.07				1		1
Total		19	21	74	127	91	332
Percent		5.7%	6.3%	22.3%	38.3%	27.4%	100.0%
Mean Score		27.5	28.2	29.4	31.1	34.7	31.3
Standard Deviation		5.25	5.56	4.59	4.81	4.35	5.26
Expected Score		26	29	35	40	45	

Expected Grade = (Test Score x 0.08704) + 0.02527
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Expected Score = (Preliminary Grade x 2.001) + 25.8315
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Mean Grade 2.75	Standard Deviation 1.10	Coefficient of Correlation r = .42
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Table 3.2  
 End-of-Course Test Scores on the Biological Sciences Test for BIO 213 in Relation to  
 Student Performance in Biology 213: Combined Frequency Distributions and  
 Descriptive Statistics for the Biology Validity Study of Fall 2000  
 (N = 332)

Test Scores	Preliminary BIO 213 Grades		Total N
	Unsatisfactory 0-1	Satisfactory 2-4	
42		1	1
41		4	4
40		9	9
39		11	11
38	1	11	12
37	1	12	13
36	2	23	25
35	2	23	25
34		22	22
33	1	33	34
32	2	14	16
31	6	27	33
30	2	21	23
29	2	13	15
28	2	6	8
27	3	13	16
26	1	12	13
25	2	10	12
24	7	8	15
23	1	5	6
22	2	8	10
21			
20		3	3
19		1	1
18	1		1
17	1		1
16		1	1
15			
14	1		1
13			
12		1	1
Total	40	292	332
Percent	12.0%	88.0%	77.2%
Mean Score	27.9	31.8	31.3
Standard Deviation	5.43	5.06	5.26

Mean Grade	Standard Deviation
2.75	1.1

Coefficient of Correlation
$r = .42$

course outcomes, with the total number of students enrolled in Biology 213 who participated in the study indicated in the last cell. The three rows following show, for each of the two possible course outcomes, the percentage of students with that outcome (with the last cell totaling 100%), their group's mean placement test score (and, as in Table 3.1, the total group's mean placement test score in the last cell), and the standard deviation of that mean score (and, as in Table 3.1, the standard deviation for the total group's test score mean in the last cell). The boxes to the right of the table present the same summary information for the total group as shown in Table 3.1.

Table 3.3 shows the accuracy, for each of several possible decision scores, with which the students who took Biology 213 would have been placed in Biology 213 if their placement in the course had been on the basis of their test scores. For each possible decision score in the first column, the second and third columns, as a pair, show the cumulative numbers of students who would be placed correctly, too high, or too low if that decision score were used as the criterion for the award of credit.

The second column shows the frequency of the two possible placement outcomes for students whose performance in Biology 213, as indicated by their actual preliminary course grades, was Unsatisfactory (grades of 0-1). They would be placed too high if their test scores were at least as high as the possible decision score in the first column, or they would be placed correctly if their test scores were below that decision score. The third column shows the frequency of the two possible placement outcomes for students whose performance in Biology 213, as indicated by their actual preliminary course grades, was Satisfactory (grades of 2-4). They would be placed correctly if their test scores were at least as high as the possible decision score in the first column, or they would be placed too low if their test scores were below that decision score.

The fourth and fifth columns indicate the associated percentages for the numbers of students indicated in the second and third columns. The last two columns of data indicate, for the total group of students, the numbers and percentages of students who would be placed too high, correctly, and too low by the respective possible decision score.

Table 3.4 lists six guidelines for choosing a decision score, and indicates to the right of each guideline the placement test score that would be chosen as the decision score if that guideline were used. Included with the statement of the rationale for each guideline is a reference to a location in one of the Tables 3.1, 3.2, or 3.3 where the decision score may be determined based on that rationale. The range of possible decision scores is from 19 to 31.

## BIO 214

Table 4.1 shows a two-way frequency distribution for test scores (indicated down the first column, ranging from 9 to 49) by preliminary course grades (indicated across the third through the seventh columns, ranging from 0 to 4). The expected grades, calculated by substituting the test scores into the expected grade regression equation shown below the table, are indicated in the second column next to the respective test scores. The totals for the row frequencies are shown in the last column, thus constituting a one-way frequency distribution of the test scores.

The five rows at the bottom of Table 4.1 present summary statistics. The totals for the column frequencies are shown in the row labeled Total, thus constituting a one-way frequency distribution of the preliminary course grades, with the total number of students enrolled in Biology 214 who participated in the study indicated in the last cell. The four rows following show, for each group of students earning a particular preliminary course grade, the percentage of students earning that grade (with the last cell totaling 100%), their group's mean placement test score (and the total group's mean placement test score in the last cell), the standard deviation of that mean score (and the standard deviation for the total group's test score mean in the last cell), and the expected placement test score for that grade as calculated by substituting the preliminary course grade into the expected score regression equation shown below the table.

The boxes below the table present the two regression equations, and summary information for the total group. The mean preliminary course grade for the students who took Biology 214 is 2.65--approximately a *B-* average--with standard deviation 1.04. The coefficient of correlation between preliminary course grades and test scores is .59.

The data concerning expected grades and expected scores are included in view of UT Austin's policy concerning the award of credit by examination. The policy provides that the criterion for the award of credit is that the same standard of performance must be demonstrated by students who take an

Table 3.3  
 End-of-Course Test Scores on the Biological Sciences Test for BIO 213 in  
 Relation to Performance in Biology 213: Possible Decision Scores and  
 Corresponding Accuracies of Placement for the  
 Biology Validity Study of Fall 2000  
 (N = 332)

Place- ment Category	Cumulative Number of Students		Placement of Students in Each Placement Category				Overall Accuracy of Placement		
	Unsatisfactory 0-1 (N=40)	Satisfactory 2-4 (N = 292)	Unsatisfactory		Satisfactory		Placement Accuracy	Number of Students	% of Students
32 - up	Too High 9	163 Correct	Too High 23%		56% Correct		Too High	9	3%
Below 32	Correct 31	129 Too Low	Correct 78%		44% Too Low		Correct	194	58%
31 - up	Too High 15	190 Correct	Too High 38%		65% Correct		Too High	15	5%
Below 31	Correct 25	102 Too Low	Correct 63%		35% Too Low		Correct	215	65%
30 - up	Too High 17	211 Correct	Too High 43%		72% Correct		Too High	17	5%
Below 30	Correct 23	81 Too Low	Correct 58%		28% Too Low		Correct	234	70%
26 - up	Too High 25	255 Correct	Too High 63%		87% Correct		Too High	25	8%
Below 26	Correct 15	37 Too Low	Correct 38%		13% Too Low		Correct	270	81%
25 - up	Too High 27	265 Correct	Too High 68%		91% Correct		Too High	27	8%
Below 25	Correct 13	27 Too Low	Correct 33%		9% Too Low		Correct	278	84%
24 - up	Too High 34	273 Correct	Too High 85%		93% Correct		Too High	34	10%
Below 24	Correct 6	19 Too Low	Correct 15%		7% Too Low		Correct	279	84%
23 - up	Too High 35	278 Correct	Too High 88%		95% Correct		Too High	35	11%
Below 23	Correct 5	14 Too Low	Correct 13%		5% Too Low		Correct	283	85%
22 - up	Too High 37	286 Correct	Too High 93%		98% Correct		Too High	37	11%
Below 22	Correct 3	6 Too Low	Correct 8%		2% Too Low		Correct	289	87%
20 - up	Too High 37	289 Correct	Too High 93%		99% Correct		Too High	37	11%
Below 20	Correct 3	3 Too Low	Correct 8%		1% Too Low		Correct	292	88%
19 - up	Too High 37	290 Correct	Too High 93%		99% Correct		Too High	37	11%
Below 19	Correct 3	2 Too Low	Correct 8%		1% Too Low		Correct	293	88%
18 - up	Too High 38	290 Correct	Too High 95%		99% Correct		Too High	38	11%
Below 18	Correct 2	2 Too Low	Correct 5%		1% Too Low		Correct	292	88%
17 - up	Too High 39	290 Correct	Too High 98%		99% Correct		Too High	39	12%
Below 17	Correct 1	2 Too Low	Correct 3%		1% Too Low		Correct	291	88%
							Too Low	2	1%

Table 3.4  
 Scores on the Biological Sciences Test in Relation to Student Performance in  
 Biology 213: Scores Suggested by Six Guidelines for Use in Selecting  
 Decision Scores for the Biology Validity Study of Spring 2001  
 (N=332)

Guideline	Biological Sciences Test Score
1. Expected Score for students whose performance in the course was just minimally satisfactory (i.e., students with preliminary grades of C -; see the Expected Score row at the bottom of Table 3.1).	30
2. Score for which the Expected Grade is just minimally satisfactory (i.e., C - or 7.01; see the Expected Grade column in Table 3.1).	23
3. Score for which the percents of errors of students in each academic performance category (Unsatisfactory, Satisfactory) are most nearly equal. (See the values for % Too High and % Too Low in the middle columns of Table 3.3.)	31
4. Score for which the overall percents of errors are most nearly equal. (See the values for % Too High and % Too Low in the last column of Table 3.3.)	25
5. Scores that would cut off (or hold back) approximately the same number of students as were in the Unsatisfactory performance group. (See Table 3.2 for the number of students in the Unsatisfactory group, and note the test score that would hold back most nearly that number of low-scoring students.)	24
6. Score that would maximize the overall accuracy of placement. (See the Number Correct in the next-to-last column of Table 3.3.)	19

Table 4.1  
 End-of-Course Test Scores on the Biological Sciences Test for BIO 214 in Relation to  
 Student Performance in Biology 214: Frequency Distributions, Descriptive Statistics,  
 Regression Equations, Expected Grades, and Expected Scores for the  
 Biology Validity Study of Fall 2000  
 (N = 516)

Test Scores	Expected Grades	Preliminary BIO 214 Grades (0-4)					Total N
		0 <i>F</i>	1 <i>D</i>	2 <i>C</i>	3 <i>B</i>	4 <i>A</i>	
49	4.00					1	1
48	4.00					3	3
47	4.00				1	2	3
46	3.94				1	1	2
45	3.86				1	6	7
44	3.77				5	5	10
43	3.69			1	1	4	6
42	3.60				2	4	6
41	3.51				2	8	10
40	3.43				9	9	18
39	3.34			1	8	7	16
38	3.26		1	3	10	9	23
37	3.17		1	1	12	3	17
36	3.09		1	5	10	4	20
35	3.00			6	16	9	31
34	2.92		1	6	4	3	14
33	2.83			5	11	8	24
32	2.74	1		3	11	3	18
31	2.66			7	11	3	21
30	2.57	1	1	9	12	8	31
29	2.49	1	7	10	15	3	36
28	2.40		4	13	9	4	30
27	2.32		3	10	7	3	23
26	2.23		3	8	8	2	21
25	2.15	1		13	3		17
24	2.06	2	5	8	10	4	29
23	1.97	2	7	5	3	1	18
22	1.89	2	4	6	3		15
21	1.80		3	5	2	1	11
20	1.72	2	7	6	1		16
19	1.63	2	3	1	1		7
18	1.55	1	1				2
17	1.46		2	1	1		4
16	1.37		2				2
9 - 15	0.78 - 1.29		3	1			4
Total		15	59	134	190	118	516
Percent		2.9%	11.4%	26.0%	36.8%	22.9%	100.0%
Mean Score		23.3	23.7	28.0	32.5	36.5	30.9
Standard Deviation		4.06	5.66	5.11	5.90	6.40	7.14
Expected Score		20	24	28	32	36	

$\text{Expected Grade} = (\text{Test Score} \times 0.08558) + 0.005719$
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$\text{Expected Score} = (\text{Preliminary Grade} \times 4.0124) + 20.2909$
--

Mean Grade 2.65	Standard Deviation 1.04	Coefficient of Correlation $r = .59$
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examination as by students who complete course work. That standard is taken to be the minimally satisfactory grade of *C*. The data concerning expected grades and expected scores may be used, therefore, to determine that the minimally satisfactory grade of *C* may be expected for students with a test score of 23, or that for students receiving the minimally satisfactory grade of *C* the expected test score is 30.

Table 4.2 shows a two-way frequency distribution for test scores (indicated down the first column, ranging from 9 to 49) by course outcomes (indicated across the second and third columns, 0-1 Unsatisfactory and 2-4 Satisfactory). The totals for the row frequencies are shown in the last column, and are the same as those shown in Table 4.1, thus constituting the same one-way frequency distribution of the test scores as shown in Table 4.1.

The four rows at the bottom of Table 4.2 present summary statistics. The totals for the column frequencies are shown in the row labeled Total, thus constituting a one-way frequency distribution of the course outcomes, with the total number of students enrolled in Biology 214 who participated in the study indicated in the last cell. The three rows following show, for each of the two possible course outcomes, the percentage of students with that outcome (with the last cell totaling 100%), their group's mean placement test score (and, as in Table 4.1, the total group's mean placement test score in the last cell), and the standard deviation of that mean score (and, as in Table 4.1, the standard deviation for the total group's test score mean in the last cell). The boxes to the right of the table present the same summary information for the total group as shown in Table 4.1.

Table 4.3 shows the accuracy, for each of several possible decision scores, with which the students who took Biology 214 would have been placed in Biology 214 if their placement in the course had been on the basis of their test scores. For each possible decision score in the first column, the second and third columns, as a pair, show the cumulative numbers of students who would be placed correctly, too high, or too low if that decision score were used as the criterion for the award of credit.

The second column shows the frequency of the two possible placement outcomes for students whose performance in Biology 214, as indicated by their actual preliminary course grades, was Unsatisfactory (grades of 0-1). They would be placed too high if their test scores were at least as high as the possible decision score in the first column, or they would be placed correctly if their test scores were below that decision score. The third column shows the frequency of the two possible placement outcomes for students whose performance in Biology 214, as indicated by their actual preliminary course grades, was Satisfactory (grades of 2-4). They would be placed correctly if their test scores were at least as high as the possible decision score in the first column, or they would be placed too low if their test scores were below that decision score.

The fourth and fifth columns indicate the associated percentages for the numbers of students indicated in the second and third columns. The last two columns of data indicate, for the total group of students, the numbers and percentages of students who would be placed too high, correctly, and too low by the respective possible decision score.

Table 4.4 lists six guidelines for choosing a decision score, and indicates to the right of each guideline the placement test score that would be chosen as the decision score if that guideline were used. Included with the statement of the rationale for each guideline is a reference to a location in one of the Tables 4.1, 4.2, or 4.3 where the decision score may be determined based on that rationale. The range of possible decision scores is from 21 to 28.

Table 4.2  
 End-of-Course Test Scores on the Biological Sciences Test for BIO 214 in Relation to  
 Student Performance in Biology 214: Combined Frequency Distributions and  
 Descriptive Statistics for the Biology Validity Study of Fall 2000  
 (N = 516)

Test Scores	Preliminary BIO 214 Grades		Total N
	Unsatisfactory 0-1	Satisfactory 2-4	
49		1	1
48		3	3
47		3	3
46		2	2
45		7	7
44		10	10
43		6	6
42		6	6
41		10	10
40		18	18
39		16	16
38	1	22	23
37	1	16	17
36	1	19	20
35		31	31
34	1	13	14
33		24	24
32	1	17	18
31		21	21
30	2	29	31
29	8	28	36
28	4	26	30
27	3	20	23
26	3	18	21
25	1	16	17
24	7	22	29
23	9	9	18
22	6	9	15
21	3	8	11
20	9	7	16
19	5	2	7
18	2		2
17	2	2	4
16	2		2
9 - 15	3	1	4
Total	74	442	516
Percent	14.3%	85.7%	100.0%
Mean Score	23.6	32.2	30.9
Standard Deviation	5.38	6.65	7.14

Mean Grade	Standard Deviation
2.65	1.04

Coefficient of Correlation
$r = .59$

Table 4.3  
 End-of-Course Test Scores on the Biological Sciences Test for BIO 214 in  
 Relation to Performance in Biology 214: Possible Decision Scores and  
 Corresponding Accuracies of Placement for the  
 Biology Validity Study of Fall 2000  
 (N = 516)

Place- ment Category	Cumulative Number of Students		Placement of Students in Each Placement Category				Overall Accuracy of Placement		
	Unsatisfactory 0-1 (N = 74)	Satisfactory 2-4 (N = 442)	Unsatisfactory		Satisfactory		Placement Accuracy	Number of Students	% of Students
30 - up	Too High 7	274 Correct	Too High 9%		62% Correct		Too High	7	1%
Below 30	Correct 67	168 Too Low	Correct 91%		38% Too Low		Correct	341	66%
29 - up	Too High 15	302 Correct	Too High 20%		68% Correct		Too High	15	3%
Below 29	Correct 59	140 Too Low	Correct 80%		32% Too Low		Correct	361	70%
28 - up	Too High 19	328 Correct	Too High 26%		74% Correct		Too High	19	4%
Below 28	Correct 55	114 Too Low	Correct 74%		26% Too Low		Correct	383	74%
27 - up	Too High 22	348 Correct	Too High 30%		79% Correct		Too High	22	4%
Below 27	Correct 52	94 Too Low	Correct 70%		21% Too Low		Correct	400	78%
26 - up	Too High 25	366 Correct	Too High 34%		83% Correct		Too High	25	5%
Below 26	Correct 49	76 Too Low	Correct 66%		17% Too Low		Correct	415	80%
25 - up	Too High 26	382 Correct	Too High 35%		86% Correct		Too High	26	5%
Below 25	Correct 48	60 Too Low	Correct 65%		14% Too Low		Correct	430	83%
24 - up	Too High 33	404 Correct	Too High 45%		91% Correct		Too High	33	6%
Below 24	Correct 41	38 Too Low	Correct 55%		9% Too Low		Correct	445	86%
23 - up	Too High 42	413 Correct	Too High 57%		93% Correct		Too High	42	8%
Below 23	Correct 32	29 Too Low	Correct 43%		7% Too Low		Correct	445	86%
22 - up	Too High 48	422 Correct	Too High 65%		95% Correct		Too High	48	9%
Below 22	Correct 26	20 Too Low	Correct 35%		5% Too Low		Correct	448	87%
21 - up	Too High 51	430 Correct	Too High 69%		97% Correct		Too High	51	10%
Below 21	Correct 23	12 Too Low	Correct 31%		3% Too Low		Correct	453	88%
20 - up	Too High 60	437 Correct	Too High 81%		99% Correct		Too High	60	12%
Below 20	Correct 14	5 Too Low	Correct 19%		1% Too Low		Correct	451	87%
19 - up	Too High 65	439 Correct	Too High 88%		99% Correct		Too High	65	13%
Below 19	Correct 9	3 Too Low	Correct 12%		1% Too Low		Correct	448	87%

Table 4.4  
 Scores on the Biological Sciences Test in Relation to Student Performance in  
 Biology 214: Scores Suggested by Six Guidelines for Use in Selecting  
 Decision Scores for the Biology Validity Study of Fall 2000  
 (N=516)

Guideline	Biological Sciences Test Score
1. Expected Score for students whose performance in the course was just minimally satisfactory (i.e., students with preliminary grades of C -; see the Expected Score row at the bottom of Table 4.1).	28
2. Score for which the Expected Grade is just minimally satisfactory (i.e., C - or 7.01; see the Expected Grade column in Table 4.1).	24
3. Score for which the percents of errors of students in each academic performance category (Unsatisfactory, Satisfactory) are most nearly equal. (See the values for % Too High and % Too Low in the middle columns of Table 4.3.)	28
4. Score for which the overall percents of errors are most nearly equal. (See the values for % Too High and % Too Low in the last column of Table 4.3.)	24
5. Scores that would cut off (or hold back) approximately the same number of students as were in the Unsatisfactory performance group. (See Table 4.2 for the number of students in the Unsatisfactory group, and note the test score that would hold back most nearly that number of low-scoring students.)	23
6. Score that would maximize the overall accuracy of placement. (See the Number Correct in the next-to-last column of Table 4.3.)	21

## Recommendations and Decisions

BIO 211

Table 1.4 shows possible decision scores based on six traditional guidelines for choosing decision scores.

If the School wished to choose the decision score by using the linear regression equation, two scores were candidates (see Table 1.1): a score of 31, the expected score for students from the study whose performance in BIO 211 was just minimally satisfactory (that is, the expected score for students who received a grade of *C* in BIO 211), or a score of 29, the score for which the expected grade in BIO 211 was just minimally satisfactory (a grade of *C*, 1.99). If the School wished to choose the decision score by equalizing errors in placement, two scores were candidates (see Table 1.3): a score of 30, the score for which the percents of placement errors for students in each academic performance category were most nearly equal (17% of the students who performed Unsatisfactorily placed too high versus 21% of the students who performed Satisfactorily placed too low), or a score of 25, the score for which the overall percents of errors were most nearly equal (8% of all students in the study placed too high versus 6% of all the students in the study placed too low). If the School wished to choose the decision score by maintaining the size of the Unsatisfactory performance group from the study, the candidate would be a score of 24 (see Table 1.2), which would deny credit by examination to nearly the same number of students (120) as were in the Unsatisfactory performance group (a total of 133 students). If the School wished to choose the decision score by considering the overall accuracy of placement, the candidate would be a score of 21 (see Table 1.3), which would maximize the overall accuracy of placement (87% of the students in the study placed accurately).

After evaluating these six possible decision scores and other factors important to the faculty, the School of Biological Sciences chose a score of 34 as the decision score for a grade of *C* in BIO 211. The score ranges chosen for awarding letter grades of *B* and *A* were based on the standard error of measurement for the test, which is 3.2 points. Therefore, the decision scores for awarding grades of *B* and *A* were chosen to be in successive increments above the score of 34 of approximately one and one-half standard errors of measurement each.

The new policy for credit by examination in BIO 211 went into effect in September of 2001.

BIO 212

Table 2.4 shows possible decision scores based on six traditional guidelines for choosing decision scores.

If the School wished to choose the decision score by using the linear regression equation, two scores were candidates (see Table 2.1): a score of 35, the expected score for students from the study whose performance in BIO 212 was just minimally satisfactory (that is, the expected score for students who received a grade of *C* in BIO 212), or a score of 33, the score for which the expected grade in BIO 212 was just minimally satisfactory (a grade of *C*, 2.03). If the School wished to choose the decision score by equalizing errors in placement, two scores were candidates (see Table 2.3): a score of 34, the score for which the percents of placement errors for students in each academic performance category were most nearly equal (21% of the students who performed Unsatisfactorily placed too high versus 21% of the students who performed Satisfactorily placed too low), or a score of 29, the score for which the overall percents of errors were most nearly equal (8% of all students in the study placed too high versus 6% of all the students in the study placed too low). If the School wished to choose the decision score by maintaining the size of the Unsatisfactory performance group from the study, the candidate would be a score of 28 (see Table 2.2), which would deny credit by examination to nearly the same number of students (65) as were in the Unsatisfactory performance group (a total of 73 students). If the School wished to choose the decision score by considering the overall accuracy of placement, the candidate would be a score of 30 (see Table 2.3), which would maximize the overall accuracy of placement (86% of the students in the study placed accurately).

After evaluating these six possible decision scores and other factors important to the faculty, the School of Biological Sciences chose a score of 37 as the decision score for a grade of *C* in BIO 211. The score ranges chosen for awarding letter grades of *B* and *A* were based on the standard error of measurement

for the test, which is 3.2 points. Therefore, the decision scores for awarding grades of *B* and *A* were chosen to be in successive increments above the score of 37 of approximately one and one-half standard errors of measurement each.

The new policy for credit by examination in BIO 212 went into effect in September of 2001.

### BIO 213

Table 3.4 shows possible decision scores based on six traditional guidelines for choosing decision scores.

If the School wished to choose the decision score by using the linear regression equation, two scores were candidates (see Table 3.1): a score of 30, the expected score for students from the study whose performance in BIO 213 was just minimally satisfactory (that is, the expected score for students who received a grade of *C* in BIO 213), or a score of 23, the score for which the expected grade in BIO 213 was just minimally satisfactory (a grade of *C*, 2.03). If the School wished to choose the decision score by equalizing errors in placement, two scores were candidates (see Table 3.3): a score of 31, the score for which the percents of placement errors for students in each academic performance category were most nearly equal (38% of the students who performed Unsatisfactorily placed too high versus 35% of the students who performed Satisfactorily placed too low), or a score of 25, the score for which the overall percents of errors were most nearly equal (8% of all students in the study placed too high versus 8% of all the students in the study placed too low). If the School wished to choose the decision score by maintaining the size of the Unsatisfactory performance group from the study, the candidate would be a score of 24 (see Table 3.2), which would deny credit by examination to the same number of students (40) as were in the Unsatisfactory performance group (a total of 40 students). If the School wished to choose the decision score by considering the overall accuracy of placement, the candidate would be a score of 19 (see Table 3.3), which would maximize the overall accuracy of placement (88% of the students in the study placed accurately).

After evaluating these six possible decision scores and other factors important to the faculty, the School of Biological Sciences chose a score of 31 as the decision score for a grade of *C* in BIO 211. The score ranges chosen for awarding letter grades of *B* and *A* were based on the standard error of measurement for the test, which is 3.2 points. Therefore, the decision scores for awarding grades of *B* and *A* were chosen to be in successive increments above the score of 37 of approximately one and one-half standard errors of measurement each. The new policy for credit by examination in BIO 213 went into effect in September of 2001.

### BIO 214

Table 3.4 shows possible decision scores based on six traditional guidelines for choosing decision scores.

If the School wished to choose the decision score by using the linear regression equation, two scores were candidates (see Table 4.1): a score of 28, the expected score for students from the study whose performance in BIO 214 was just minimally satisfactory (that is, the expected score for students who received a grade of *C* in BIO 214), or a score of 24, the score for which the expected grade in BIO 214 was just minimally satisfactory (a grade of *C*, 2.06). If the School wished to choose the decision score by equalizing errors in placement, two scores were candidates (see Table 4.3): a score of 28, the score for which the percents of placement errors for students in each academic performance category were most nearly equal (26% of the students who performed Unsatisfactorily placed too high versus 26% of the students who performed Satisfactorily placed too low), or a score of 24, the score for which the overall percents of errors were most nearly equal (6% of all students in the study placed too high versus 7% of all the students in the study placed too low). If the School wished to choose the decision score by maintaining the size of the Unsatisfactory performance group from the study, the candidate would be a score of 23 (see Table 4.2), which would deny credit by examination to nearly the same number of students 79 as were in the Unsatisfactory performance group (a total of 74 students). If the School wished to choose the decision score by considering the overall accuracy of placement, the candidate would be a score of 21 (see Table 4.3), which would maximize the overall accuracy of placement (88% of the students in the study placed accurately).

After evaluating these six possible decision scores and other factors important to the faculty, the School of Biological Sciences chose a score of 30 as the decision score for a grade of *C* in BIO 211. The score ranges chosen for awarding letter grades of *B* and *A* were based on the standard error of measurement for the test, which is 3.2 points. Therefore, the decision scores for awarding grades of *B* and *A* were chosen to be in successive increments above the score of 37 of approximately one and one-half standard errors of measurement each.

The new policy for credit by examination in BIO 214 went into effect in September of 2001.

#### Summary of Policies Adopted for Course Placement and Credit by Examination in Biology

Summarized in Table 5.0 are the policies adopted by the School of Biological Sciences for the awarding of credit by examination based on scores on the Biological Sciences tests, effective September 1, 2001.

Table 5.0  
Credit by Examination Minimum Test Scores for Grades of *A*, *B*, and *C* in  
Biology 211, 212, 213, and 214 Using the Biological Sciences Tests,  
Effective September 1, 2001

Biological Sciences Test section for ...	Grade of <i>C</i>	Grade of <i>B</i>	Grade of <i>A</i>	Number of Test Items
BIO 211	34	39	44	54
BIO 212	37	42	47	52
BIO 213	31	35	39	47
BIO 214	30	35	40	54