Plan and Results for Assessing

Learning Outcomes in

MATH 1070, Elementary Statistics

Report of the Mathematics & Statistics Department

Date:	**June 2009**
Person Reporting:	**Valerie Miller**
General Learning Outcome Assessed:	**Quantitative Literacy**
Departmental Outcomes Assessed:	**All Course Learning Outcomes**
Core Course Assessed:	**MATH 1070, Elementary Statistics**

Assessment Plan for the 2008-2009 academic year

- Description of student behavior(s) to be assessed:

1	**Students will use quantitative reasoning in problem solving including**	
	a	Geometric and symbolic representation
	b	Manipulation
	c	Pattern recognition
2	**Students will be able to construct and interpret graphical displays of univariate data such as**	
	a	stem plot
	b	histogram
	c	box plot
	d	time plot
3	**Students will be able to calculate and interpret summary statistics such as**	
	a	mean
	b	median
	c	standard deviation
	d	five number summary
4	**Students will be able to describe and use density curves such as**	
	a	uniform density curves
	b	normal density curves
5	**Students will be able to use the normal density curve to calculate proportions**	
6	**Students will be able to construct and interpret graphical displays of bivariate data such as**	
	a	scatter plots
	b	regression lines
	c	residual plots
	d	outliers
	e	influential points
7	**Students will be able to discuss the meaning of the correlation coefficient and the least-squares regression line**	
8	**Students will be able to select a simple random sample using a table of random digits**	
9	**Students will be able to recognize biased sampling such as voluntary and convenience sampling**	
10	**Students will be able to describe some experimental designs such as completely randomized and block designs**	
11	**Students will demonstrate knowledge and be able to examine and understand and use basic probability concepts**	
	a	including sample spaces of possible outcomes of random experiments
	b	random variables and their probability distributions
	c	the sampling distribution of the mean
	d	the central limit theorem
12	**Students will demonstrate the ability to understand and use the vocabulary of statistical inference including**	
	a	confidence intervals
	b	confidence levels and margins of error in general
	c	confidence level in general as the probability to give a correct estimate of the confidence intervals for the mean of a normal population of known variance
	d	the difference between the means of two normal populations of know variances
	e	null and alternative hypotheses
	f	rejection region in terms of the population(s) standard deviation(s) and sample size(s)
	g	level of significance and p-values for one and two sided tests for means
13	**Students will demonstrate the ability to make design and make correct inferential statements about**	
	a	sampling distribution of a sample proportion
	b	confidence intervals for a (difference between two) population proportion(s)
	c	sample size for a required margin of error

14	**Students will demonstrate the ability to understand and apply inferential statements including**
	a confidence level as the probability to give a correct estimate of the mean (difference of means) of a (two) normal population(s) when the standard deviation(s) is (are) unknown
	b level of significance and p-values for one and two sided tests for means
15	**Students will be able to arrange general bivariate categorical data in several groups into a two-way table of counts in all the groups**
16	**Students will be able to explain what null hypothesis the chi-square statistic tests in a specific two-way table**
17	**Students will be able to use percents, comparison of expected and observed counts and the components of the chi-square statistic to see what deviations from the null hypothesis are important**
18	**Students will make a quick assessment of the significance of the statistic by comparing the observed value to the degrees of freedom of the chi-square statistic.**
19	**When applying analytic, algebraic, geometric, and algorithmic techniques to solving applied statistical problems students will**
	a use appropriate technology
	b communicate how the problem is modeled by a mathematical/statistical formulation and how to interpret the results of the statistical analysis

Georgia State University's General Learning Outcome – Quantitative Literacy

- Effectively performs arithmetic operations, as well as reasons and draws appropriate conclusions from numerical information. (Outcomes 1, 2, 3, 8 above)
- Effectively translates problem situations into symbolic representations and uses those representations to solve problems. (Outcomes 1, 6, 11, 13, 19 above)

- Brief description of assessment methods, i.e., tests, scoring rubrics, etc. used to evaluate student learning:
    - The cumulative final exam will be aligned with the learning outcomes
    - 1 common problem on all final exams
    - Students will complete at least one project that requires the use of Microsoft Excel
    - Summative assessment – final grade in the course

- Description of data collection and analysis—including projected number of students to be assessed:
    - Each instructor is required to complete an alignment/performance table of student success on each of the learning outcomes. The categories for this table are
        - Totally Correct
        - Partially Correct
        - Totally Incorrect
        - No Response
    - Beginning Fall 2006, all students in MATH 1070 have been required to complete at least one project. Results of students' ability to utilize Excel and communicate appropriately will be tabulated in the manner described above.

    This information will be combined to produce an overall portrait of student success on each standard. "Success in Achieving the Learning Outcomes" will be determined as follows:

    A Boolean approach is implemented using the following:
    - Totally Correct = 100%;
    - Partially Correct = 70%;
    - Totally Incorrect or No Answer = 0%

The “Success Rate” is calculated as

1.0*(Totally Correct %) + .7*(Partially Correct %)

Examples:

1. Using 50% Totally Correct AND 25% Partially Correct would equate to a total of 67.5%, which is "almost a low C"

2. Using 50% Totally Correct AND 30% Partially Correct would equate to a total of 71%, which would be a low C.

The targeted “Success Rate” is 70% on each standard.

- Plan for having your department review the results and implement any curricular or instructional changes).
    - During the summer semester, the results of these assessments (exams and projects) as well as actual student work will be reviewed by the coordinating committee of MATH 1070 to determine the appropriateness of the questions, projects, and resultant student success levels. These results will determine whether the need for a more uniform problem/project base will need to be developed and what, if any, support needs to be provided to further student learning

Report of assessment data:

MATH 1070 is not an Area A mathematics class and hence is often a "second" class for the majority of students enrolled. This class is required of all students in the College of Business. It is an elective taken often by History majors, Biology majors, Sociology majors, Nursing majors, as well as many others.

In the fall semester, 1157 students were enrolled, while in the spring there were 1236. Response rates from faculty for collecting this information was 80% in fall (up from 40% last year – missing respondents were all GTAs) and 85% in spring (70% last year). The tables of "Student Success Rates" for Fall 2008 and Spring 2009 are appended at the end of this report. A summary of these tables follows:

MATH 1070 Content Standards		Success Rates Fall 2008	Success Rates Spring 2009
1	Students will use quantitative reasoning in problem solving	91.84	91.74
2	Students will be able to construct and interpret graphical displays of univariate data	87.61	89.82
3	Students will be able to calculate and interpret summary statistics	90.32	90.25
4	Students will be able to describe and use density curves	78.60	91.66
5	Students will be able to use the normal density curve to calculate proportions	77.37	75.00
6	Students will be able to construct and interpret graphical displays of bivariate data	82.00	79.80
7	Students will be able to discuss the meaning of the correlation coefficient and the least-squares regression line	79.03	81.92
8	Students will be able to select a simple random sample using a table of random digits	83.99	90.48
9	Students will be able to recognize biased sampling such as voluntary and convenience sampling	75.561	81.89
10	Students will be able to describe some experimental designs such as completely randomized and block designs	77.65	76.67
11	Students will demonstrate knowledge and be able to examine and understand and use basic probability concepts	78.53	79.04
12	Students will demonstrate the ability to understand and use the vocabulary of statistical inference	76.41	77.26
13	Students will demonstrate the ability to make design and make correct inferential statements	78.53	79.04
14	Students will demonstrate the ability to understand and apply inferential statements	73.98	73.75
15	Students will be able to arrange general bivariate categorical data in several groups into a two-way table of counts in all the groups	75.86	86.71
16	Students will be able to explain what null hypothesis the chi-square statistic tests in a specific two-way table	75.77	77.42
17	Students will be able to use percents, comparison of expected and observed counts and the components of the chi-square statistic to see what deviations from the null hypothesis are important	67.63	92.74
18	Students will make a quick assessment of the significance of the statistic by comparing the observed value to the degrees of freedom of the chi-square statistic.	67.63	97.44
19a	When applying analytic, algebraic, geometric, and algorithmic techniques to solving applied statistical problems students will use appropriate technology	N/A	69.67
19b	When applying analytic, algebraic, geometric, and algorithmic techniques to solving applied statistical problems students will communicate how the problem is modeled by a mathematical/statistical formulation and how to interpret the results of the statistical analysis	N/A	39.44

Note – not all students were assessed on all outcomes (or sub-outcomes) on their final exam.

The common problem was a z hypothesis test in the fall (hypotheses, observed value, p-value, and conclusion) and a t-distribution confidence interval (compute the CI numerical limits, and change for larger sample size). The total value of the problem was 10 points. In the fall, data for 968 students was provided to the course coordinator for grading (one GTA did not submit the requested student work). The average score was 5.64 with a median equal to 6.0 and standard deviation of 3.01. Of the 25 sections reporting, only 6 sections had an average greater than or equal to7.0. In the spring, data for 961 students was provided (one lecturer, one visiting lecturer and one GTA did not supply any student work – this accounted for 6 sections of students). The average score was 7.52 with a median equal to 7.0 and a standard deviation of 2.6. Students typically do worse on hypothesis testing so that the difference in means is not unexpected. However we will endeavor to increase this score next year.

Final Grades Data

	A	B	C	D	F	WF	A-WF	AVG	W	OTH	TOTAL	All DWF %	Completers ABC %	DF %
Fall 2008	421	343	162	58	84	0	1068	2.9	83	6	1157	19.4	86.7	13.3
Spring 2009	503	417	196	62	83	2	1263	2.9	143	9	1415	20.5	88.4	11.5

We compare the distribution of grades which improved somewhat to that of previous years:

	A	B	C	D	F	WF	A-WF	AVG	W	OTH	TOTAL	DWF %	ABC %	DF %
Fall 2007	335	300	171	67	85	8	966	2.7	125	4	1095	26.0	83.4	15.7
Spring 2008	421	343	162	58	84	0	1068	2.9	83	6	1157	19.4	86.7	13.3
Fall 2006	281	289	180	63	74	8	895	2.7	144	35	1074	26.9	83.8	15.3
Spring 2007	320	327	205	87	118	14	1071	2.6	148	17	1236	29.7	79.6	19.1
Fall 2005	291	241	191	76	58	10	867	2.7	127	9	1003	27.0	83.4	15.5
Spring 2006	321	307	185	80	94	5	992	2.7	179	6	1177	30.4	82.0	17.5

Comparing DWF rates of all students enrolled in the class we see that for the first time we had a successful completion rate of approximately 80% for the academic year. The greatest gain in this area was in the fall semester. In an effort to determine how the improvement occurred, a closer inspection of the instruction was done. We first consider the DWF% by instructor type.

	Fall 06		**Spring 07**		**Fall 07**		**Spring 08**		**Fall 08**		**Spring 09**	
DWF %	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
GTA	4	18.4	6	14.6	9	22.1	5	25.6	11	20.1	9	16.9
LECT			1	69.8	1	52.6	3	34.3			4	21.4
PTI	1	12.8	1	69.8								
TT	9	23.8	6	23.0	8	20.6	6	22.2	7	16.2	5	23.7
VI/VL	5	37.1	5	31.0	1	44.2	3	33.9	2	24.6	3	21.4

The most dramatic change was in the Visiting Instructor/Visiting Lecturer category. Given the volatile nature of this position (individuals are hired only on a yearly basis and for a maximum of three years) we cannot hope for this to be a sustainable difference. For example, there were three different VI/VLs that taught in the fall and spring (2 in the fall for 4 sections and all three in the spring for 8 sections) only one will be returning in Fall 09.

If we consider the success rate of the students who complete the class (as measured by the ABC%) we have the following data:

ABC%	**Fall 06**		**Spring 07**		**Fall 07**		**Spring 08**		**Fall 08**		**Spring 09**	
GTA	4	91.0	6	94.2	9	86.9	5	84.0	11	86.3	9	90.9
LECT			1	41.8	1	59.4	3	82.6	0		4	87.0
PTI	1	100.0	1	40.6								
TT	9	86.4	6	86.0	8	87.0	6	88.4	7	89.1	5	84.1
VI/VL	5	75.8	5	77.2	1	71.9	3	81.5	2	82.4	3	89.7

As can be seen the success rate is much more equitable across instructor type the last few semesters. Note that the Lecturer in Spring and Fall 07 was replaced in Spring 08 by a VI and not rehired for this past academic year.

Preliminary Analysis and Action Plan

Overall success rate improved on most standards from fall to spring meeting the targeted 70% on all but 1 standard in the spring.

Georgia State University's General Learning Outcome – Quantitative Literacy

- Effectively performs arithmetic operations, as well as reasons and draws appropriate conclusions from numerical information. (Outcomes 1, 2, 3, 8)

MATH 1070 Content Standards		Success Rates Fall 2008	Success Rates Spring 2009
1	Students will use quantitative reasoning in problem solving	91.84	91.74
2	Students will be able to construct and interpret graphical displays of univariate data	87.61	89.82
3	Students will be able to calculate and interpret summary statistics	90.32	90.25
8	Students will be able to select a simple random sample using a table of random digits	83.99	90.48

- Effectively translates problem situations into symbolic representations and uses those representations to solve problems. (Outcomes 1, 6, 11, 13, 19 above)

MATH 1070 Content Standards		Success Rates Fall 2008	Success Rates Spring 2009
1	Students will use quantitative reasoning in problem solving	91.84	91.74
6	Students will be able to construct and interpret graphical displays of bivariate data	82.00	79.80
11	Students will demonstrate knowledge and be able to examine and understand and use basic probability concepts	78.53	79.04
13	Students will demonstrate the ability to make design and make correct inferential statements	78.53	79.04
19a	When applying analytic, algebraic, geometric, and algorithmic techniques to solving applied statistical problems students will use appropriate technology	N/A	69.67

19b	When applying analytic, algebraic, geometric, and algorithmic techniques to solving applied statistical problems students will communicate how the problem is modeled by a mathematical/statistical formulation and how to interpret the results of the statistical analysis	N/A	39.44

Students are meeting the first part of the QL General Learning Outcome at high levels (success rate well over 80% both semesters) while the second part is being met at high levels in 4 of 6 parts. Last year, the communication component (19b) did not quite make our target. Efforts were focused on improving student performance on this and other aspects of the project oriented outcomes to raise all of these performances to 80% or above. Specific data on these were not collected in the fall. In the spring, some instructors provided their students the opportunity to attend Excel seminars while others simply provided handouts (these handouts were available to all instructors). We seem to have effected appropriate improvements in (19b), but to detriment of (19a). An analysis and comparison of student performance based on these two activities and the impact they had will be performed this summer. Additional seminars can be scheduled if they are found to be beneficial to student performance. Ways to improve student communication of their findings will be determined and implemented in the fall semester. Formalizing the format in which results are submitted will also be discussed (e.g., requiring write-ups to be done on a word processor).

The Final Grade distribution improved greatly from previous years with a DWF rate of approximately 20% in both the fall and the spring.

Review of the course's content standards will be done to determine why certain outcomes are not being assessed (in particular the chi-squared outcome). If the content is not part of the course, then the standard needs to be removed, or the syllabus needs to be reviewed to determine how that content can be covered in the class.

Lastly, our current course coordinator, Dr. J. Walker, is retiring at the end of the summer so the coordinator and assessment activities may change. The new coordinator has not as yet been named.

Data Collected

Fall 2008		Test 1		Test 2		Test 3		Final Exam	
MATH 1070 Content Standards		# Assess	Success	# Assess	Success	# Assess	Success	# Assess	Success
1	Students will use quantitative reasoning in problem solving including	383	84.73	168	91.07	170	79.41	261	91.84
2	Students will be able to construct and interpret graphical displays of univariate data such as	1747	85.33	346	87.92	348	85.69	1044	87.90
3	Students will be able to calculate and interpret summary statistics such as	2277	88.78	564	84.84	566	86.66	1785	90.32
4	Students will be able to describe and use density curves such as	934	80.48	388	71.65	302	75.07	579	78.60
5	Students will be able to use the normal density curve to calculate proportions	879	71.16	210	83.24	124	81.05	540	77.37
6	Students will be able to construct and interpret graphical displays of bivariate data such as	1426	83.64	1135	85.79	434	81.68	961	82.00
7	Students will be able to discuss the meaning of the correlation coefficient and the least-squares regression line	674	78.61	429	85.76	262	79.31	576	79.03
8	Students will be able to select a simple random sample using a table of random digits	0	0.00	582	89.66	84	80.95	298	83.99
9	Students will be able to recognize biased sampling such as voluntary and convenience sampling	0	0.00	618	79.84	262	75.57	437	75.56
10	Students will be able to describe some experimental designs such as completely randomized and block designs	0	0.00	1306	86.91	400	78.50	595	77.65
11	Students will demonstrate knowledge and be able to examine and understand and use basic probability concepts	0	0.00	2468	82.15	1497	78.07	1819	78.53
12	Students will demonstrate the ability to understand and use the vocabulary of statistical inference including	0	0.00	1132	78.88	5371	75.75	4769	76.41
13	Students will demonstrate the ability to make design and make correct inferential statements about	0	0.00	170	77.94	913	75.36	1384	77.52
14	Students will demonstrate the ability to understand and apply inferential statements including	0	0.00	36	100.00	939	70.27	1464	73.98
15	Students will be able to arrange general bivariate categorical data in several groups into a two-way table of counts in all the groups	0	0.00	36	95.00	38	60.53	181	75.86
16	Students will be able to explain what null hypothesis the chi-square statistic tests in a specific two-way table	0	0.00	36	93.33	39	61.54	222	75.77
17	Students will be able to use percents, comparison of expected and observed counts and the components of the chi-square statistic to see what deviations from the null hypothesis are important	0	0.00	36	90.83	40	87.50	135	67.63
18	Students will make a quick assessment of the significance of the statistic by comparing the observed value to the degrees of freedom of the chi-square statistic.	0	0.00	36	95.00	39	82.05	135	67.63
19	When applying analytic, algebraic, geometric, and algorithmic techniques to solving applied statistical problems students will	0	0.00	36	16.67	43	51.16	72	22.22

#Assess = the number of different assessment questions times the number of students.

Fall 2008 Final Exam MATH 1070 Content Standards			Totally Correct	Partially Correct	Totally Incorrect	No Response	Success Rate
1		Students will use quantitative reasoning in problem solving including	91.57	0.38	6.90	1.15	91.84
	a	Geometric and symbolic representation	88.46	0.00	11.54	0.00	88.46
	b	Manipulation					
	c	Pattern recognition	94.66	0.76	2.29	2.29	95.19
2		Students will be able to construct and interpret graphical displays of univariate data such as	75.05	17.95	6.31	0.69	87.61
	a	stem plot	84.57	10.86	4.29	0.29	92.17
	b	histogram	72.46	17.38	8.80	1.35	84.63
	c	box plot	70.86	24.57	4.57	0.00	88.06
	d	time plot	0.00	0.00	0.00	0.00	0.00
3		Students will be able to calculate and interpret summary statistics such as	79.10	16.02	4.43	0.45	90.32
	a	mean	86.55	8.19	4.68	0.58	92.28
	b	median	89.69	7.43	2.64	0.24	94.89
	c	standard deviation	70.40	20.75	7.93	0.93	84.92
	d	five number summary	68.54	29.11	2.35	0.00	88.92
4		Students will be able to describe and use density curves such as	72.19	9.15	18.31	0.35	78.60
	a	uniform density curves	71.43	10.44	18.13	0.00	78.74
	b	normal density curves	72.54	8.56	18.39	0.50	78.54
5		Students will be able to use the normal density curve to calculate proportions	57.41	28.52	12.59	1.48	77.37
6		Students will be able to construct and interpret graphical displays of bivariate data such as	70.34	16.65	10.93	2.08	82.00
	a	scatter plots	81.31	7.54	9.51	1.64	86.59
	b	regression lines	68.30	14.43	13.40	3.87	78.40
	c	residual plots					
	d	outliers	47.76	50.75	1.49	0.00	83.28
	e	influential points	80.23	0.00	19.77	0.00	80.23
7		Students will be able to discuss the meaning of the correlation coefficient and the least-squares regression line	67.36	16.67	14.76	1.22	79.03
8		Students will be able to select a simple random sample using a table of random digits	70.13	19.80	10.07	0.00	83.99
9		Students will be able to recognize biased sampling such as voluntary and convenience sampling	66.59	12.81	20.59	0.00	75.56
10		Students will be able to describe some experimental designs such as completely randomized and block designs	74.12	5.04	20.84	0.00	77.65
11		Students will demonstrate knowledge and be able to examine and understand and use basic probability concepts	68.72	14.02	16.00	1.26	78.53
	a	including sample spaces of possible outcomes of random experiments	62.10	22.86	15.05	0.00	78.10
	b	random variables and their probability distributions	78.33	8.05	12.97	0.66	83.96
	c	the sampling distribution of the mean	62.93	19.25	14.66	3.16	76.41
	d	the central limit theorem	66.58	10.08	21.22	2.12	73.63
12		Students will demonstrate the ability to understand and use the vocabulary of statistical inference including	54.20	31.73	12.52	1.55	76.41
	a	confidence intervals	58.32	29.37	11.45	0.85	78.89
	b	confidence levels and margins of error in general	54.13	33.71	11.18	0.97	77.73
	c	confidence level in general as the probability to give a correct estimate of the confidence intervals for the mean of a normal population of known variance	61.21	19.25	17.82	1.72	74.68
	d	the difference between the means of two normal populations of know variances	52.67	32.82	11.83	2.67	75.65

Fall 2008 Final Exam MATH 1070 Content Standards		Totally Correct	Partially Correct	Totally Incorrect	No Response	Success Rate
e	null and alternative hypotheses	53.44	31.55	13.00	2.01	75.53
f	rejection region in terms of the population(s) standard deviation(s) and sample size(s)	50.47	38.32	9.50	1.71	77.29
g	level of significance and p-values for one and two sided tests for means	51.26	32.82	14.27	1.65	74.24
13	Students will demonstrate the ability to make design and make correct inferential statements about	59.47	25.79	12.72	2.02	77.52
a	sampling distribution of a sample proportion	66.73	20.16	11.09	2.02	80.85
b	confidence intervals for a (difference between two) population proportion(s)	52.91	36.77	8.30	2.02	78.65
c	sample size for a required margin of error	57.92	21.04	19.00	2.04	72.65
14	Students will demonstrate the ability to understand and apply inferential statements including	49.11	35.52	13.73	1.64	73.98
a	confidence level as the probability to give a correct estimate of the mean (difference of means) of a (two) normal population(s) when the standard deviation(s) is (are) unknown	52.77	34.04	12.06	1.13	76.60
b	level of significance and p-values for one and two sided tests for means	45.72	36.89	15.28	2.11	71.54
15	Students will be able to arrange general bivariate categorical data in several groups into a two-way table of counts in all the groups	60.77	21.55	17.13	0.55	75.86
16	Students will be able to explain what null hypothesis the chi-square statistic tests in a specific two-way table	48.65	38.74	12.16	0.45	75.77
17	Students will be able to use percents, comparison of expected and observed counts and the components of the chi-square statistic to see what deviations from the null hypothesis are important	47.41	28.89	22.96	0.74	67.63
18	Students will make a quick assessment of the significance of the statistic by comparing the observed value to the degrees of freedom of the chi-square statistic.	47.41	28.89	22.96	0.74	67.63
19	When applying analytic, algebraic, geometric, and algorithmic techniques to solving applied statistical problems students will	22.22	0.00	63.89	13.89	22.22
a	use appropriate technology	22.22	0.00	63.89	13.89	22.22
b	communicate how the problem is modeled by a mathematical/statistical formulation and how to interpret the results of the statistical analysis	22.22	0.00	63.89	13.89	22.22

Spring 2009 MATH 1070 Content Standards		Totally Correct	Partially Correct	Totally Incorrect	No Response	Success Rate
1	Students will use quantitative reasoning in problem solving including	91.74	0.00	8.26	0.00	91.74
a	Geometric and symbolic representation	92.74	0.00	7.26	0.00	92.74
b	Manipulation					
c	Pattern recognition	90.68	0.00	9.32	0.00	90.68
2	Students will be able to construct and interpret graphical displays of univariate data such as	79.76	13.81	5.41	1.03	89.42
a	stem plot	81.64	6.28	11.59	0.48	86.04
b	histogram	79.30	15.90	3.05	1.74	90.44
c	box plot	83.89	10.56	5.00	0.56	91.28
d	time plot					
3	Students will be able to calculate and interpret summary statistics such as	83.59	9.37	6.30	0.74	90.15
a	mean	89.69	4.58	5.34	0.38	92.90
b	median	91.38	4.43	3.20	0.99	94.48
c	standard deviation	80.09	11.76	7.01	1.13	88.33
d	five number summary	76.12	14.73	8.53	0.62	86.43
4	Students will be able to describe and use density curves such as	84.36	10.42	3.91	1.30	91.66
a	uniform density curves	81.19	7.92	8.91	1.98	86.73
b	normal density curves	85.92	11.65	1.46	0.97	94.08
5	Students will be able to use the normal density curve to calculate proportions	55.88	25.29	16.27	2.55	73.59
6	Students will be able to construct and interpret graphical displays of bivariate data such as	68.87	15.61	14.41	1.12	79.80
a	scatter plots	74.29	10.48	14.60	0.63	81.62
b	regression lines	70.33	16.06	11.87	1.75	81.57
c	residual plots					
d	outliers	48.94	31.91	19.15	0.00	71.28
e	influential points	60.87	0.00	39.13	0.00	60.87
7	Students will be able to discuss the meaning of the correlation coefficient and the least-squares regression line	73.40	16.70	8.87	1.03	85.09
8	Students will be able to select a simple random sample using a table of random digits	84.60	8.40	7.00	0.00	90.48
9	Students will be able to recognize biased sampling such as voluntary and convenience sampling	80.60	0.00	19.40	0.00	80.60
10	Students will be able to describe some experimental designs such as completely randomized and block designs	71.02	5.01	23.31	0.65	74.53
11	Students will demonstrate knowledge and be able to examine and understand and use basic probability concepts	68.50	13.57	16.17	1.76	78.00
a	including sample spaces of possible outcomes of random experiments	74.28	15.43	10.29	0.00	85.08
b	random variables and their probability distributions	70.61	15.54	12.50	1.35	81.49
c	the sampling distribution of the mean	66.29	4.12	24.72	4.87	69.18
d	the central limit theorem	51.89	14.59	31.35	2.16	62.11
12	Students will demonstrate the ability to understand and use the vocabulary of statistical inference including	61.28	24.56	12.70	1.45	78.47
a	confidence intervals	57.96	28.16	13.20	0.68	77.67
b	confidence levels and margins of error in general	63.35	25.54	10.53	0.58	81.23
c	confidence level in general as the probability to give a correct estimate of the confidence intervals for the mean of a normal population of known variance	66.53	27.82	5.24	0.40	86.01
d	the difference between the means of two normal populations of know variances	66.39	14.29	19.33	0.00	76.39
e	null and alternative hypotheses	72.41	14.94	10.92	1.72	82.87

Spring 2009 MATH 1070 Content Standards			Totally Correct	Partially Correct	Totally Incorrect	No Response	Success Rate
	f	rejection region in terms of the population(s) standard deviation(s) and sample size(s)	52.50	27.50	18.93	1.07	71.75
	g	level of significance and p-values for one and two sided tests for means	57.28	25.14	13.87	3.71	74.88
13	Students will demonstrate the ability to make design and make correct inferential statements about		60.24	26.68	11.89	1.19	78.92
	a	sampling distribution of a sample proportion	82.30	5.26	12.44	0.00	85.98
	b	confidence intervals for a (difference between two) population proportion(s)	42.11	48.36	7.57	1.97	75.95
	c	sample size for a required margin of error	63.93	18.03	16.80	1.23	76.56
14	Students will demonstrate the ability to understand and apply inferential statements including		50.42	32.78	14.66	2.15	73.36
	a	confidence level as the probability to give a correct estimate of the mean (difference of means) of a (two) normal population(s) when the standard deviation(s) is (are) unknown	65.12	23.18	9.49	2.21	81.35
	b	level of significance and p-values for one and two sided tests for means	33.16	44.04	20.73	2.07	63.99
15	Students will be able to arrange general bivariate categorical data in several groups into a two-way table of counts in all the groups		84.15	3.66	12.20	0.00	86.71
16	Students will be able to explain what null hypothesis the chi-square statistic tests in a specific two-way table		77.42	0.00	22.58	0.00	77.42
17	Students will be able to use percents, comparison of expected and observed counts and the components of thechi-square statistic to see what deviations from the null hypothesis are important		92.74	0.00	7.26	0.00	92.74
18	Students will make a quick assessment of the significance of the statistic by comparing the observed value to the degrees of freedom of the chi-square statistic.		97.44	0.00	2.56	0.00	97.44
19	When applying analytic, algebraic, geometric, and algorithmic techniques to solving applied statistical problems students will		62.67	10.00	23.33	4.00	69.67
	a	use appropriate technology	27.78	16.67	47.22	8.33	39.44
	b	communicate how the problem is modeled by a mathematical/statistical formulation and how to interpret the results of the statistical analysis	73.68	7.89	15.79	2.63	79.21

Spring 2009		Test 1		Test 2		Test 3		Final Exam	
MATH 1070 Content Standards		# Assess	Success	# Assess	Success	# Assess	Success	# Assess	Success
1	Students will use quantitative reasoning in problem solving including	759	81.42	0	0.00	0	0.00	242	91.74
2	Students will be able to construct and interpret graphical displays of univariate data such as	2048	87.02	0	0.00	0	0.00	1114	89.82
3	Students will be able to calculate and interpret summary statistics such as	3037	89.63	74	95.68	0	0.00	2059	90.25
4	Students will be able to describe and use density curves such as	768	75.86	175	80.91	0	0.00	307	91.66
5	Students will be able to use the normal density curve to calculate proportions	1103	68.16	393	80.20	36	79.17	552	75.00
6	Students will be able to construct and interpret graphical displays of bivariate data such as	1645	81.83	1353	85.40	0	0.00	1076	79.80
7	Students will be able to discuss the meaning of the correlation coefficient and the least-squares regression line	557	73.12	317	81.64	0	0.00	527	81.92
8	Students will be able to select a simple random sample using a table of random digits	0	0.00	781	86.58	0	0.00	500	90.48
9	Students will be able to recognize biased sampling such as voluntary and convenience sampling	94	65.96	712	81.28	0	0.00	243	81.89
10	Students will be able to describe some experimental designs such as completely randomized and block designs	94	76.60	976	77.49	0	0.00	501	76.67
11	Students will demonstrate knowledge and be able to examine and understand and use basic probability concepts	0	0.00	3488	80.46	598	80.15	1777	79.04
12	Students will demonstrate the ability to understand and use the vocabulary of statistical inference including	0	0.00	982	70.31	4026	76.44	3776	77.26
13	Students will demonstrate the ability to make design and make correct inferential statements about	0	0.00	237	80.84	1266	82.24	799	79.42
14	Students will demonstrate the ability to understand and apply inferential statements including	0	0.00	0	0.00	1298	71.90	881	73.75
15	Students will be able to arrange general bivariate categorical data in several groups into a two-way table of counts in all the groups	0	0.00	0	0.00	0	0.00	82	86.71
16	Students will be able to explain what null hypothesis the chi-square statistic tests in a specific two-way table	0	0.00	0	0.00	75	64.00	124	77.42
17	Students will be able to use percents, comparison of expected and observed counts and the components of the chi-square statistic to see what deviations from the null hypothesis are important	0	0.00	0	0.00	150	90.20	124	92.74
18	Students will make a quick assessment of the significance of the statistic by comparing the observed value to the degrees of freedom of the chi-square statistic.	0	0.00	0	0.00	150	78.00	78	97.44
19	When applying analytic, algebraic, geometric, and algorithmic techniques to solving applied statistical problems students will	0	0.00	0	0.00	225	68.40	150	69.67

Common Question Data

Fall 2008

Scores -- Frequencies

10	9	8	7	6	5	4	3	2	1	0		N	Average	Std. Dev.	Median
1	2	12	3	9	5	1	3	1	4	1		42	5.79	2.57	6.00
1	2	6	10	8	7	2	3	1	4	1		45	5.60	2.41	6.00
2	8	4	7	6	2	5	1	1	2	4		42	5.86	2.99	6.50
6	5	3	4	3	1	0	4	5	3	3		37	5.54	3.53	6.00
4	1	7	3	8	4	2	2	3	1	5		40	5.38	3.09	6.00
9	2	9	6	8	3	2	2	1	0	1		43	7.00	2.40	7.00
4	1	10	5	4	4	2	1	3	4	4		42	5.45	3.19	6.00
9	4	3	3	2	3	1	3	1	4	3		36	6.03	3.60	7.00
3	3	6	2	3	2	2	7	4	1	5		38	4.87	3.26	4.50
1	0	2	2	1	1	3	4	1	6	10		31	2.68	2.94	1.00
7	0	14	5	2	6	3	1	2	0	2		42	6.62	2.65	7.50
0	0	1	3	5	2	7	4	2	3	9		36	3.22	2.54	3.50
2	0	8	5	3	4	5	3	2	4	5		41	4.73	3.03	5.00
2	2	10	3	2	2	3	3	2	4	13		46	4.13	3.57	4.00
0	1	3	11	6	3	3	3	0	1	3		34	5.38	2.42	6.00
12	4	5	3	6	3	2	0	2	1	0		38	7.39	2.57	8.00
10	4	12	1	3	4	0	2	2	0	2		40	7.18	2.85	8.00
0	5	6	7	5	9	5	3	2	1	1		44	5.70	2.27	6.00
0	1	1	5	3	4	3	1	3	0	2		23	4.83	2.44	5.00
3	0	6	3	1	3	3	0	0	0	1		20	6.60	2.50	7.00
0	0	0	0	0	0	0	0	0	0	0		0			
1	2	2	4	10	3	5	3	3	0	4		37	4.92	2.61	6.00
10	0	9	0	4	10	5	2	1	1	0		42	6.55	2.58	6.00
8	6	7	9	2	0	1	2	1	2	1		39	7.15	2.77	8.00
1	7	5	9	11	8	0	1	0	1	3		46	6.22	2.38	6.00
1	3	6	8	9	3	3	1	2	6	2		44	5.34	2.79	6.00
97	63	157	121	124	96	68	59	45	53	85		968	5.64	3.01	6.00

Common Question Data

Spring 2009

Scores -- Frequencies

10	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**		**N**	**Average**	**Std. Dev.**	**Median**
17	1	4	11	1	0	0	0	0	0	0		34	8.65	1.45	9.5
10	2	2	2	1	2	0	0	0	0	1		20	8.20	2.61	9.5
21	4	2	9	2	2	0	0	1	0	0		41	8.51	1.93	10
22	4	3	5	1	0	2	0	2	0	0		39	8.54	2.26	10
24	1	5	7	2	1	0	0	0	0	0		40	8.88	1.52	10
0	0	0	0	0	0	0	0	0	0	0		0			
0	0	0	0	0	0	0	0	0	0	0		0			
0	0	0	0	0	0	0	0	0	0	0		0			
26	2	2	4	0	4	2	1	1	1	0		43	8.28	2.60	10
28	1	7	5	1	2	1	0	1	2	0		48	8.42	2.45	10
5	0	0	9	1	3	0	1	4	0	3		26	5.58	3.28	7
8	0	1	11	3	5	4	1	1	1	2		37	6.22	2.81	7
13	0	0	21	4	0	2	0	1	0	0		41	7.59	1.94	7
11	3	1	21	0	3	0	1	0	0	1		41	7.56	2.10	7
8	0	2	21	1	1	0	0	0	0	0		33	7.70	1.40	7
12	0	0	16	2	4	0	0	1	0	0		35	7.60	2.02	7
0	0	0	0	0	0	0	0	0	0	0		0			
0	0	0	0	0	0	0	0	0	0	0		0			
13	2	6	11	0	4	0	2	1	1	1		41	7.37	2.66	8
8	0	0	14	0	10	0	2	1	0	0		35	6.74	2.21	7
6	0	2	21	1	4	2	0	0	0	2		38	6.76	2.25	7
0	0	0	0	0	0	0	0	0	0	0		0			
13	2	2	17	1	6	1	1	0	0	0		43	7.58	1.97	7
13	3	2	12	2	2	0	2	1	1	5		43	6.70	3.36	7
31	2	4	0	1	1	1	0	1	0	0		41	9.20	1.82	10
22	0	1	13	2	0	3	0	1	0	0		42	8.21	2.16	10
4	0	1	14	0	3	2	1	7	1	8		41	4.56	3.32	5
6	0	1	17	4	6	1	0	1	1	4		41	6.05	2.79	7
13	2	2	11	0	3	0	1	2	0	3		37	7.11	3.13	7
15	2	4	17	1	3	0	0	0	0	0		42	8.10	1.64	7.5
18	0	1	10	1	3	1	2	1	0	2		39	7.46	2.95	7
												961	**7.52**	**2.608415**	**7**

Sample Projects

Math 1070 Excel Project I: Data Analysis

1. Find a data set of interest to you on a quantitative variable. The source can be the textbook (including examples, exercises, and the accompanying CD) or the internet.

2. Input or import the data into Excel. Within Excel, choose Tools → Data Analysis → Histogram to make a histogram. Make sure that the Gap Width is 0 and all labels are appropriate (and non-generic). Mark the classes using half open intervals.

3. Use Excel to compute the five-number summary, mean, and standard deviation.

4. Provide some background information that gives the context of the data.

5. Interpret the histogram to describe the distribution. [Is the distribution symmetric or skewed to one side? Is there a peak? Are there outliers? Estimate the center and spread].

* * * *

MATH 1070 — EXCEL PROJECT 2

Do Problem 5.9, as modified below, [which will answer the textbook's parts (a), (b), and (c)]. Try to organize all of your work and answers on one or more Excel "worksheets," which you will then print out to turn in.

NOTE: The data set is available on the textbook CD in the file "drive:\PCDataSets\PC-Excel\ex05-09.xls", and will also be posted on WebCT.

a) Use Excel to construct the scatterplot for predicting farm population (in millions) based on year. Label the axes of your scatterplot appropriately.

b) Use Excel to add a linear trendline (prediction line) to your scatterplot, as described in the distributed instructions and in class. Include the display of the prediction equation and the r-squared value on the spreadsheet chart.

c) Write one or more complete sentences to answer the questions in part (b) of the textbook problem [on page 133] regarding the yearly decline in farm population and the percentage of variation in farm population that is accounted for by the changes in the year.

d) For use in the next part, use the Excel functions "slope" and "intercept" to find the slope and y-intercept of the least-squares prediction equation, as described in the distributed instructions. (Do not copy the values from the scatterplot equation display, or you will not obtain the required accuracy.) The value for the slope should be displayed to at least six (6) decimal places, and the value for the y-intercept should be displayed to at least three (3) decimal places. If necessary, use the "Format", "Cells", "Number" menu to enable display of the required accuracy.

e) Construct a table (properly labeled) showing the x-values (year) and y-hat values (predicted farm populations, in millions) for the years 1940, 1960, 1980, and 2000. These values should be displayed to at least three (3) decimal places. Try to do this using "absolute cell references" and "relative cell references" and the "fill down" operation, because you will need to use similar techniques on a future project. Since the $\hat{y}$ values are obtained from the equation "$\hat{y} = a + b\,x$", or "$\hat{y}$ = intercept + slope * x", you can create the table as follows:

Use the values for "slope" and "intercept" that you found in part (d). [Let us suppose that the slope is in cell D21 and the intercept is in cell D22.] Create a column that contains the x-values (years) for which you want $\hat{y}$s. [Let us suppose that they are in cells C26:C29.] Then use a formula such as the following to obtain the first $\hat{y}$ value [which would go in cell D26] « =$D$22+$D$21*C26 ». Then highlight cells D:26:D29 and use the “fill down” operation to calculate the remaining $\hat{y}$ values. [The cell references with $-signs are absolute and do not change on copy or fill operations, while the cell references without $-signs are relative and change relative to the original cell when the formula is copied or filled to a different cell.]

f) Write one or more complete sentences to answer the questions in part (c) of the textbook problem [on page 133] regarding the reasonableness of the prediction of farm population in 2000.

* * * *

<u>Rubrics</u>

The rubrics for the projects varied by instructor, but many used the following:

- 70 - 80 % on the "mechanics" and correct values from the Excel computations and 20 - 30% on the "writing" portion involving interpretations and conclusions.
- Although the rubric was subjective, it was "loosely" based on "Totally Correct" - 100%; "Mostly Correct" -80 %; "Partly Correct" - 60%; "Totally Incorrect" or "No Answer" - 0%.