I. (112 points) Problems prepared in advance.

1. (14 points) Problem 1: Is there sufficient evidence to conclude that in-state students score higher on the math SAT test than out-of-state students? If our level of significance is specified as $\alpha = 0.05$, answer the following questions and fill in the information requested.

_____
Smallest p-value for the normality assumption

_____ _____
Value of the correct computational formula. Write out the correct computational formula.

_____ H_1 for testing the **SAT scores.**

Reject H_0 if _____ Critical Region for testing the **SAT scores.**

_____ Is there sufficient evidence to conclude that in-state students score higher than out-of-state students?

_____ What is the value of the sample mean for the out-of-state students?

2. (4 points) Problem 2: Identify the major possible bias and describe an experimental design that could avoid this bias.

Identify the bias **(PRINT)**:_____

_____

Describe a better experimental design **(PRINT)**:_____

_____

_____

3. (14 points) Problem 3: Is there sufficient evidence to conclude that nontraditional students perform better in statistics than traditional students? If our level of significance is specified as $\alpha = 0.05$ fill in the requested information.

_____ Smallest of the p-values for testing **Normality.**

_____ H_1 for the **equal variances assumption.**

_____ Value of computational formula for testing the **equal variances assumption.**

Reject H_0 if _____ Critical Region for testing the **equal variances assumption.**

_____ H_1 for testing the **means or location.**

_____ Value of computational formula for testing the **means or location.**

Reject H_0 if _____ Critical Region for testing the **means or location.**

4. (12 points) Problem 4: Does pay based on commission make the sales force more productive than pay based on hourly wages? Use $\alpha = 0.01$ to answer the following.

_____
Smallest p-value for the normality assumption

_____ _____
Value of the correct computational formula. Write out the correct computational formula.

_____ H_1 for testing the **pay effect.**

Reject H_0 if _____ Critical Region for testing the **pay effect.**

Conclusion stated in terms of the Pay Levels: **(PRINT)** _____

_____

_____

5. (18 points) Problem 5: Is there sufficient evidence to support the dean's belief? Using $\alpha = 0.10$, answer the following questions and fill in the information requested.

_____H_0

$E(n_1) =$_____ $E(n_2) =$_____ $E(n_3) =$_____ $E(n_4) =$_____

_____Value of computational formula.

Reject H_0 if _____Critical Region.

_____The p-value of the statistic is closest to which of the following numbers: 0.10, 0.05, 0.025, 0.01, 0.005.

_____<_____<_____Confidence Interval for seniors (place values and the symbols in the inequalities.)

6. (6 points) Problem 6: Is there sufficient evidence to conclude that the planned commutation modes are proportionally different across the four job categories? If our level of significance is specified as $\alpha = 0.01$, answer the following questions and fill in the information requested.

_____H_0

_____Value of computational formula.

Reject H_0 if _____Critical Region.

II. (38 points) Problems given on test (not given beforehand).

10. (6 points) Suppose that we are testing $H_0: \mu = 75$ and it is appropriate to use the **z-test**. If the numerical value of our statistical formula is $z = -1.78$, find the **p-value** that corresponds to the following possible alternative hypotheses.

_____$H_1: \mu < 75$

_____$H_1: \mu > 75$

_____$H_1: \mu \neq 75$

11. (4 points) For the Anderson-Darling Normality test, state the null and alternative hypotheses.

_____ _____

null hypothesis alternative hypothesis

13. (2 points) What assumption must be satisfied when using the χ^2 distribution to test for proportions or independence?

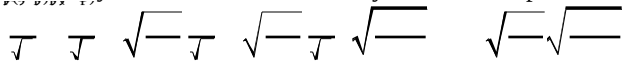
Assumption: _____

MAT 127 **Sample Final – Fall 2002 - Take Home Problems** **John Climent**

Approximately 3/4 of your Final will consist of questions concerning the problems given on the following sheets. The remainder of your test may involve several general questions that require some minimal computations and looking up values in statistical tables.

Instructions:

1. Be prepared to answer questions concerning the following problems and their accompanying data sets.
2. You may use Minitab or a calculator to answer these questions.
3. The data sets are available in Minitab form from your instructor in class. If you fail to get them from him, you will have to enter the data onto Minitab by hand from the printed copies on the other side of these sheets.
4. For each problem, make sure you prepare in advance the appropriate summary statistics.
5. For each problem you will be asked to choose the most appropriate statistical test or procedure to use from those discussed in class.
6. For each problem, you may be asked to describe a suitable population based on the data given and the narrative of the problem. In addition, you should be prepared to address if the study is observational or a designed experiment.
7. For each problem, you should be prepared to explain whether or not the sample is a random sample. If it is not a random sample, you should be prepared to explain why it is or is not representative of the population. If it is not representative, prepare examples of possible biases.
8. For hypothesis testing problems you should be prepared to supply the usual seven pieces of information: H_0, H_1, level of significance, correct statistical formula, value of the statistical formula, the decision rule in terms of both the **critical region and p-values**, and your conclusion written in a narrative in the context of the problem. In addition, for two-tailed tests you should prepare confidence intervals where appropriate.
9.
10. If the level of significance is not specified on any of the problems listed on these sheets, it will be given to you on the actual test. This means you may have to look up the critical region on the test. It also means that your conclusion as to whether or not to reject the null hypothesis may depend on the significance level specified on the test.
11. For confidence interval problems you should be prepared to state the formulas, values of the formulas, the critical value of the appropriate statistic and state the confidence interval in both inequality and interval formats. In addition, you should be prepared to find the size of the sample needed for greater precision.
12. In all of your statistical formulas, you will be expected to give the **complete formula for the standard deviation, e.g.,**



13. Be prepared to illustrate your results with appropriate graphs, including where appropriate, box plots (single and simultaneous), stem-and-leaf diagrams (individual and back-to-back) and histograms. Be prepared to describe the overall shape of these graphs, identify any outliers and describe any important features.
14. If you use a **totally inappropriate statistical test,** then you will l**ose all credit** for that particular problem. Otherwise partial credit is available. For example, if you use a two-sample t-test, when the paired-observations t-test is called for, then you will lose all credit for that problem. If your error is less severe, such as using the z-test, when the pooled-variance t-test is the correct test, then partial credit may be granted for correct answers provided they match the statistical test you used.
15. You will be **permitted to use** the following materials on the exam
    a. The entire Minitab or calculator outputs you prepared in advance.
    b. Two page of handwritten notes.
    c. Your instructor's handout on one and two sample tests.
    d. Copies of the tables in the back of the book. **Make sure you make copies of them and bring them with you.**
    e. Calculators.
12. You **cannot use** the following materials on the exam:
    a. You may not use your textbook.
    b. You may not use your notebooks.
    c. You may not use copies (handwritten or Xeroxed) of previous tests from the current semester or previous semesters.
    d. Shared materials or calculators with other students.

MAT 127 **Sample Final – Fall 2002 - Take Home Problems** **John Climent**

Problem 1:
A dean at Bald Eagle State University, a state run public university, wanted to compare the SAT math scores for in-state and out-of-state students. The dean compiled data from a large elementary education class with 82 students recording the math SAT scores for each student in the class. The data is shown below and it can be found on the Minitab file: **'O2Fall-MAT127-Final-SAT Scores'**. If the level of significance is specified as 0.05, is there sufficient evidence to conclude that in-state students score higher on the math SAT test than out-of-state students?

Math SAT Scores for Out-of-State Students							**Math SAT Scores for In-State Students**						
580	468	597	636	551	577	584	419	621	560	382	348	534	466
548	564	547	527	553	476	483	609	506	455	570	436	543	556
562	577	494	578	545	574	476	485	500	467	666	565	492	550
650	583	610	526	619	638	560	386	376	350	526	628	538	528
688	526	718	554	587	590	594	598	590	549	578	557	628	549
719	592	589	497	505	643		553	430	604	502	617	552	

Problem 2:
There is at least one major possible bias in the design of the experiment in the previous problem. Be prepared to explain in writing what it is, and describe an experimental design that could avoid this bias. Keep in mind that your description of the target population should reflect the dean's intentions.

Problem 3:
Do nontraditional students perform better in statistics than traditional ones? A group of nontraditional and traditional students took the same stat class and their semester averages were recorded. At a level of significance of 0.05, is there sufficient evidence to conclude that nontraditional students perform better than traditional students. This data can be found on the Minitab Worksheet titled **'02Fall-MAT127-Final-Stat Grades'**. Note: the data has been sorted for your convenience.

Students Performance in Statistics													
Nontraditional	71	76	78	80	81	82	85	86	88	92	94	97	99
Traditional	58	61	63	66	67	71	74	78	83	87	92	95	102

Problem 4:
Does pay based on commission make the sales force more productive than pay based on hourly wages? To see if this is true a manager compared each worker's productivity under both compensation plans. The data is shown in the table below, and it can be found on the Minitab Worksheet titled: **'02Fall-MAT127-Test1-Pay'**. At _ = 0.01, is there sufficient evidence to conclude that commission based pay improves productivity?

Productivity of Workers																	
Worker	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
Hourly	80.5	74.9	76.4	78.0	73.9	79.1	77.6	67.6	82.7	74.1	66.2	83.9	76.5	74.1	73.0	78.1	70.9
Comm.	81.4	79.5	79.7	79.6	73.3	77.2	76.4	71.1	84.6	74.5	69.2	84.0	73.1	79.7	76.2	78.6	76.3

Problems 5: A college dean believes that freshmen and sophomores are three times more likely than juniors or seniors to take a certain English instructor's class. This instructor is a very hard grader and the dean feels that juniors and seniors tend to avoid classes taught by this instructor. This semester there are 228 students enrolled in this instructor's classes and the number of freshmen, sophomores, juniors and seniors is 96, 74, 40 & 18 respectively. At a level of significance **_ = 0.10**, is there sufficient evidence to support the dean's belief. In addition, find the approximate p-value for your statistic and find a 90% confidence interval for the seniors.

Problem 6: A company is relocating to a new location. They poll their employees as to the how they plan to commute to the new location. The results of the poll are shown in the table to the right. At **_ = 0.01**, is there sufficient evidence to conclude that the planned modes of commutation are proportionally different across the four job categories?

	Car	Bus	Train
Maintenance	40	72	44
Support	90	140	60
Management	18	13	7
Executive	12	4	6