STA 110B Spring 1998

Midterm Exam 1
February 19, 1998

Name:	**Section:**

I understand and agree to abide by the Duke honor code,

Signed:

Instructions

This is a closed-book exam, however, one 8.5 by 11 inch "crib sheet" is permitted. You may use a calculator if you find it useful. Show your work in the space provided, but be concise. Correct but unsubstantiated answers will receive no credit.

Point assignments for each of the 3 problems are given in parentheses in the table below. You have 1 hour and 15 minutes total; plan accordingly. You must hand the exam in at 12:10pm, no extra time will be given. Good luck!

		Page 1	**Page 2**	**Page 3**
1.	(55)			
2.	(25)			
3.	(20)			
Total	(100)			

1) ACORN (Association of Community Organizations for Reform Now) presented the following data to a Joint Congressional Hearing on discrimination in lending in October of 1991. The data are loan acceptance rates at 15 major banks in the U.S. for high income white and high income minority applicants. The difference between the two rates (minority minus white) is also included.

Loan Acceptance Rates

Bank	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Minority	41.1	41.3	21.4	24.2	5.8	36.6	38.3	39.1	29.5	33.3	21.7	28.6	17.3	38.0	32.9
White	26.8	25.1	2.2	14.1	4.2	15.3	15.0	15.8	7.3	10.3	7.4	10.1	5.5	7.6	9.2
Difference	14.3	16.2	19.2	10.1	1.6	21.3	23.3	23.3	22.2	23.0	14.3	18.5	11.8	30.4	23.7

a) (**8 points**) Draw a bar graph for *white applicants* using bars with midpoints 5, 15, 25, 35, and 45. Label the graph's vertical axis with both frequencies and relative frequencies.

b) (**8 points**) Draw a bar graph for *minority applicants* using bars with midpoints 5, 15, 25, 35, and 45. Label the graph's vertical axis with both frequencies and relative frequencies.

1) Continued. These questions continue our analysis of the ACORN data, which is repeated here.

Loan Acceptance Rates

Bank	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Minority	41.1	41.3	21.4	24.2	5.8	36.6	38.3	39.1	29.5	33.3	21.7	28.6	17.3	38.0	32.9
White	26.8	25.1	2.2	14.1	4.2	15.3	15.0	15.8	7.3	10.3	7.4	10.1	5.5	7.6	9.2
Difference	14.3	16.2	19.2	10.1	1.6	21.3	23.3	23.3	22.2	23.0	14.3	18.5	11.8	30.4	23.7

c) (**10 points**) Calculate the 5 number summary of *differences* in acceptance rates.

d) (**3 points**) What is the range of *differences* in acceptance rates.

e) (**3 points**) What is the inter–quartile range of *differences* in acceptance rates.

f) (**8 points**) Graph the box-plot of *differences* in acceptance rates.

1) Continued. These questions continue our analysis of the ACORN data, which is repeated here.

Loan Acceptance Rates

Bank	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
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Difference	14.3	16.2	19.2	10.1	1.6	21.3	23.3	23.3	22.2	23.0	14.3	18.5	11.8	30.4	23.7

g) (**5 points**) Calculate the sample mean *difference* in acceptance rates.

h) (**5 points**) Calculate the sample standard deviation of *differences* in acceptance rates.

i) (**5 points**) In words, **briefly** (in 2 or 3 sentences) summarize/describe the data. Does there appear to be evidence of a racial differential in loan acceptance rates?

2) The Elias test, the standard test for presence of the HIV virus, gives a positive result for HIV infected individuals with probability 99.8% (this is the test's sensitivity) and gives a negative result for virus–free individuals with probability 99.8% (this is the test's specificity).

a) (**15 points**) Suppose that 2 in every 1000 individuals in a population is HIV positive. If an individual from this population tests positive (using the Elias test) for HIV, what is the probability that this individual is infected with the virus?

2) Elias Test, Continued. Suppose that every individual that tests positive using the Elias test is administered a second Elias test. Further suppose that results of the two tests are independent.

b) (**10 points**) Given that an individual from the aforementioned population tests positive on both tests, what is the probability that this individual is infected with the virus?

3) A manufacturer requires washers between 0.11872 and 0.12128 inches thick; any thickness outside this range is unusable. A machine shop produces washers whose thickness is normally distributed with a mean of 0.12000 inches and a standard deviation of 0.00100 inches.

a) (**10 points**) What fraction of the machine shop's washers are unusable by the manufacturer?

b) (**10 points**) Ten washers are drawn at random from those supplied by the machine shop. What is the probability that 3 or more are unusable?