STA 110B Fall 1997

Midterm Exam 1
October 7, 1997

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 4 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!

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1.	(35)		
2.	(30)		
3.	(15)		
4.	(20)		
Total	(100)		

1) A test (called CAGE) to judge current or past alcohol abuse consists of four yes/no questions. An individual's CAGE "score" is the number of questions answered in the affirmative. The CAGE test was administered to a sample of 18 individuals judged (by other means) not to be alcoholic **and** a sample of 18 individuals judged to be alcoholic, their scores are tabulated below.

CAGE Scores, Non–Alcoholic Sample

0	0	0	0	0	0	0	0	0
0	0	0	0	1	1	1	1	3

CAGE Scores, Alcoholic Sample

1	1	2	2	2	2	3	3	3
3	3	3	3	3	4	4	4	4

a) (**5 points**) Draw a **stem and leaf** diagram of the **non-alcoholic** sample.

b) (**5 points**) Draw a **stem and leaf** diagram of the **alcoholic** sample.

c) (**5 points**) Calculate a **5 number summary** of the **non–alcoholic** sample (minimum, first quartile, median, third quartile, and maximum).

d) (**5 points**) Calculate a **5 number summary** of the **alcoholic** sample (minimum, first quartile, median, third quartile, and maximum).

1) Continued. These questions continue our analysis of the CAGE data, which is repeated here for your convenience.

CAGE Scores, Non–Alcoholic Sample

0	0	0	0	0	0	0	0	0
0	0	0	0	1	1	1	1	3

CAGE Scores, Alcoholic Sample

1	1	2	2	2	2	3	3	3
3	3	3	3	3	4	4	4	4

e) (**5 points**) Calculate the **mean** of the **non-alcoholic** sample.

f) (**5 points**) Calculate the **mean** of the **alcoholic** sample.

g) (**5 points**) **Briefly** compare the distribution of CAGE scores in alcoholics and non–alcoholics. Does the CAGE score show promise for identifying individuals that might be alcoholics?

2) The following table shows the distribution of patients who visit a general medical clinic classified by alcoholic status and CAGE scores (Buchsbaum, *et. al*, 1991).

	CAGE Score				
	0	**1**	**2**	**3**	**4**
Non-alcoholic	0.54	0.07	0.04	0.01	0.00
Alcoholic	0.04	0.05	0.10	0.08	0.06

Physicians at this clinic are contemplating using CAGE scores to diagnose alcoholism. Using the proposed diagnostic "test" a patient will test positive for alcoholism if they have a CAGE score of 1 or more. Imagine that you are a physician at this clinic and a new patient comes to you; answer the following questions regarding this patient.

a) (**5 points**) What is the probability that the patient is an alcoholic?

b) (**5 points**) What is the probability that the patient will test positive for alcoholism (have a CAGE score of 1 or more)?

c) (**5 points**) What is the probability that the patient is an alcoholic **and** will test positive for alcoholism?

2) Continued

	CAGE Score				
	0	**1**	**2**	**3**	**4**
Non-alcoholic	0.54	0.07	0.04	0.01	0.00
Alcoholic	0.04	0.05	0.10	0.08	0.06

d) (**5 points**) What is the probability that the patient will have a CAGE score of 1 or more **given** that the patient is an alcoholic?

e) (**10 points**) What is the probability that the patient is an alcoholic **given** that they test positive for alcoholism?

3) Heights of a population of men are known to be normally distributed with mean 67.56 inches and standard deviation 2.57 inches.

a) (**5 points**) What fraction of individuals from this population have heights between 5 and 6 feet?

b) (**5 points**) 95% of individuals in this population are shorter than what height?

c) (**5 points**) Find the value of c such that 95% of individuals in this population are between $67.56 - c$ and $67.56 + c$ inches tall?

4) A company manufactures widgets. Each widget has a 10% chance of being flawed, independent of the others. You purchase a package of 10 widgets manufactured by this company.

a) (**5 points**) What is the **expected** number of flawed widgets in the package?

b) (**5 points**) What is the probability that one or more are flawed?

c) (**5 points**) What is the probability that 3 or fewer are flawed?

d) (**5 points**) You are informed by a colleague that one or more in the package are flawed, now what is the probability that 3 or fewer are flawed?