MIDTERM (ver 2)

STA 110
Monday, October 23, 1995.

TA: _____   Section: _____

Name _____

Notes:

1. This is an open book and open notes exam.

2. You must show your work and explain your answer in order to receive credit.

3. The exam has 6 problems.

4. The exam carries 100 points.

5. The points assigned to each problem are indicated at the beginning of that problem. Use them to plan your time. You have 75 minutes to finish.

Problem	Sleep I	Guess	Aggression	Sleep II	Anxiety	Rats & Mazes	Total
Score	/15	/20	/15	/15	/20	/15	

Sleep deprivation. [15pt] A psychologist is interested in the effect of sleep deprivation on motor performance. Thirty subjects are randomly assigned to a 12-hour sleep deprivation group or a 36-hour sleep deprivation group. After being "sleep-deprived," the subjects' (ordered) reaction times on a task assessing fine-motor skills are as follows:

12-hour sleep deprivation group	3.42	3.55	3.59	3.65	3.77
	3.87	3.94	3.96	3.97	4.00
	4.11	4.18	4.22	4.28	4.31
36-hour sleep deprivation group	7.59	7.74	7.83	7.90	8.00
	8.01	8.03	8.03	8.15	8.16
	8.19	8.20	8.46	8.50	8.50

Find the 5-number summary for the 36-hour sleep deprivation group.

Guess. **[20pt]** A student answers a multiple choice examination question that has 5 possible answers. Suppose that the probability that the student knows the answer to the question is 0.80 and the probability that the student guesses is 0.20. If student guesses, probability of correct answer is 0.20.

(i) What is the probability that the fixed question is answered correctly?

(ii) If it is answered correctly what is the probability that the student really knew the correct answer.

Aggression. **[15pt]** In the five fourth-grade classes at a particular elementary school, 15% of the students are considered aggressive based on peer and teacher reports of their behavior. Suppose 3 fourth-graders are selected at random.

(i) Describe (write down the probability distribution) the random variable X-number of aggressive children in the sample.

(ii) What is $P(X \geq 1)$.

(iii) What is EX and $Var(X)$.

Sleep deprivation again. [**15pt**] If you want to give an interval estimator of the population mean for reaction times on the motor task after 36-hour sleep deprivation, what sample size do you need to achieve 99% confidence with an interval of total length 0.1. Assume the reaction times are normally distributed with a standard deviation $\sigma = 0.3$.

Anxiety. **[20pt]** A psychologist has developed a questionnaire for assessing levels of anxiety. The scores on the questionnaire range from 0 to 100. People who obtain scores of 75 and more are classified as *anxious*. The questionnaire has been given to a large sample of people who have been diagnosed with an anxiety disorder, and scores were distributed normally with a mean of 80 and a standard deviation of 5. When given to a large sample of people who do not suffer from an anxiety disorder, scores on the questionnaire were also distributed normally with a mean of 60 and a standard deviation of 10.

What is the probability that the psychologist missclassifies a non-anxious person as anxious?

Rats and Mazes. [15pt] Eighty rats selected at random were taught to run a new maze. All of them finally succeeded in learning the maze, and the number of trials to perfect the performance was normally distributed with a mean of 15.4. Long experience with population of rats trained to run a similar maze shows that the number of trials to success is normally distributed with a mean of 15 and a standard deviation of $\sigma = 3$. Is the new maze harder for rats to learn than the older one? Assume $\alpha = 0.05$.