Prince Sultan University
STAT 101
Final Examination
Summer Semester 2007/2008, Term 073
Monday, 20th August 2008
Dr. Aiman Mukheimer

Time Allowed: 120 minutes

Name: _____ _____ _____
(First) (Middle) (Last)

ID Number: _____

Serial No.: _____

Important Instructions*:*

1. You may use CASIO scientific calculator that does not have programming or graphing capabilities.
2. You may **NOT borrow** a calculator from anyone.
3. There should be **NO talking** during the examination.
4. Your exam will be taken **immediately** without any warning if your mobile is seen or heard
5. You must show all your work beside the problem. Be organized.
6. You may use the back of the pages for extra space, but be sure to indicate that on the page with the problem.
7. This examination has **10** problems, some with several parts. Make sure that your paper has all these problems

Problems	Max points	Student's Points
1,2	22	
3,4	18	
5,6	18	
7,8	20	
9,10	22	
Total	100	

Q1. (12 points) A law school administrator was interested in whether a student's score on the entrance exam can be used to predict a student's grade point average (GPA) after one year of law school. The administrator took a random sample of 15 students and computed the following summary information, where x = entrance exam score and y = GPA after one year: $n = 15, \sum x_i = 1293, \sum y_i = 48.58, \sum x_i y_i = 4226.2, s_x = 6.9714,$ and $s_y = 0.4236$.

1. Find the correlation between the entrance exam score and the grade point average after one year of law school.

2. Find the best fitting line relating grade point average after on year of law school and score on the entrance exam.

3. If a student scored 91 on the entrance exam, what would you predict the student's grade point average to be after one year of law school?

Q2. (10 points) Let the random variable *x* represent the number of cars owned by a family. Assume that *x* can take on five values: 0, 1, 2, 3, 4. A partial probability distribution is shown below:

x	0	1	2	3	4
p(x)	0.2	0.1	0.3	?	0.1

1. Calculate the population mean, variance, and standard deviation

2. What is the probability that a family owns more than two cars?

3. What is the probability that that a family owns at most 3 cars?

Q3. (8 points) Medical case histories indicate that different illnesses may produce identical symptom. Suppose a particular set of symptoms, which we will denote as event *H*, occurs only when any one of these illnesses: *A, B,* or *C* occurs. (For the sake of simplicity, we will assume that illnesses *A, B,* and *C* are mutually exclusive.) Studies show these probabilities of getting the three illnesses: $P(A) = 0.015$, $P(B) = 0.005$, and $P(C) = 0.025$. The probabilities of developing the symptoms *H*, given a specific illness, are $P(H / A) = 0.85$, $P(H / B) = 0.90$, and $P(H / C) = 0.70$.

1. Find P(H)

2. Assuming that an ill person shows the symptoms *H*, what is the probability that the person has illness *A*?

Q4. (10 points) From past experience, it is known 90% of one-year-old children can distinguish their mother's voice from the voice of a similar sounding female. A random sample of 20 one-year-olds are given this voice recognition test.

1. Find the probability at least 3 children do not recognize their mother's voice.

2. Find the probability all 20 children recognize their mother's voice.

3. Let the random variable x denote the number of children who do not recognize their mother's voice. Find the mean of x.

4. Let the random variable x denote the number of children who do not recognize their mother's voice. Find the variance of x.

5. Find the probability that at most 4 children do not recognize their mother’s voice?

Q5. (9 points) The number *x* of people entering the intensive care unit at a particular hospital on any one day has a Poisson probability distribution with mean equal to four persons per day.

1. What is the probability that the number of people entering the intensive care unit on a particular day is two?

2. What is the probability that the number of people entering the intensive care unit on a particular day is Less than or equal to two?

3. What is the probability that the number of people entering the intensive care unit on a particular day is more than two?

Q6. (9 points) A student government representative claims that 55% of the student body of a local university favor a move to Division I in college football. A random sample of 2000 students is selected.

1. What is the expected number of students that will, favor the move to Division I?

2. What is the approximate probability that less than 1150 students of the 2000 selected will favor the move to Division I?

Q7. (10 points) The annual rainfall in a particular area of the country is normally distributed with mean 40 inches and standard deviation 8 inches.

1. In what proportion of years will the annual rainfall be between 42 and 50 inches?

2. A drought occurs after a year where the annual rainfall was below the 20^{th} percentile. Find the 20^{th} percentile for the annual rainfall in this area of the country.

Q8. (10 points) Suppose a random sample of 25 students is selected from a community college where the scores in the final exam (out of 125 points) are normally distributed, with mean equal to 112 and standard deviation equal to 12.

1. Give the mean and the standard deviation of the sampling distribution of the sample mean $\bar{x}$.

2. Find the probability that $\bar{x}$ exceeds 116.

3. Find the probability that the sample mean deviates from the population mean μ = 112 by no more than 4.

Q9. (10 points) Let z denote a standard normal random variable.

a. Find $P(-0.44 < z < 2.68)$.

b. Determine the value of z_0 which satisfies $P(z \geq z_0) = 0.7995$.

c. Find z_0 such that $P(-z_0 < z < z_0) = 0.901$.

d. Find z_0 such that $P(z < z_0) = 0.0375$.

Q10. (12 points) A machine which manufactures a part for a car engine was observed over a period of time before a random sample of 300 parts was selected from those produced by this machine. Out of the 300 parts, 15 were defective.

1. Find the proportion of defective parts in the sample.

2. Is the distribution of $\hat{p}$ approximately normal? Justify your answer.

3. What are the mean and standard deviation of $\hat{p}$, the sample proportion of defective parts?

4. What is the probability that the sample proportion is greater than 0.02 of defective parts?