PRINCE SULTAN UNIVERSITY
Department of Mathematical Sciences
STAT 101
Final Examination
Summer Semester 2006/2007
Term (063)
14th August, 2007
Dr. Aiman Mukheimer

Maximum Time 130 minuets

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

ID Number: _____

Section: 63206

Serial No.: _____

- **You may use CASIO scientific calculator that does not have programming or graphing capabilities.**
- **You may NOT borrow a calculator from anyone.**
- **You do NOT get special consideration if you forget your calculator.**
- **You may Not use notes or any notebook.**
- **There should be NO talking during the examination.**
- **If your mobile is seen or heard, your exam will be taken immediately without any warning.**
- **You must show all your work beside the problem. Be organized.**
- **You may use the back of the pages for extra space, but be sure to indicate that on the page with the problem.**
- **This examination has 13 problems, some with several parts. Make sure that your paper has all these problems**

Q1. (6 points) An investor holds shares in three independent companies which, according to her business analyst, should show an increase in profit per share with probabilities 0.4, 0.6 and 0.7, respectively. Assume that the analyst's estimates for the probabilities of profit increases are correct.

a. Find the probability that all three companies show profit increases for the coming year.

b. Find the probability that none of the companies shows a profit increase.

Q2. (8 points) Ali takes either a bus or the subway to go to work with probabilities 0.25 and 0.75, respectively. When he takes the bus, he is late 40% of the days. When he takes the subway, he is late 30% of the days.

a. What is the probability that Ali is late, regardless of which way he took?

b. If Ali is late for work on a particular day, what is the probability that he took the bus?

Q3. (10 points) One hundred shoppers at a local shopping mall were categorized by age and gender as shown in the frequency distribution below:

Gender	Under 25 years A_1	25-40 years A_2	Over 40 years A_3
Male (M)	15	13	12
Female (F)	24	18	18

1. One shopper is selected at random form that group of 100 shoppers. What is the probability the randomly selected shopper is under 25 years of age?

2. What is the probability the randomly selected shopper is male?

3. What is the probability the randomly selected shopper is male and under 25 years of age?

4. If the randomly selected shopper is under 25 years of age, what is the probability the shopper is male?

5. What is the probability the randomly selected shopper is female or over 40 years of age?

6. If the randomly selected shopper is female, what is the probability that she is 25 to 40 years old?

7. Is gender of the shopper and age mutually exclusive events? Explain.

Q4. (10 points) A police car visits a given neighborhood a random number of times x per evening. The probability distribution, $p(x)$ is given by:

x	$p(x)$
0	0.1
1	0.6
2	?
3	0.1

a. Find the average value of x , *i.e.* $E(x)$

b. Find the standard deviation of x .

c. Calculate the interval $\mu \pm 2\sigma$ **and** find the probability that the random variable x lies within this interval.

d. What is the probability that the patrol car will visit the neighborhood at least twice in a given evening?

Q5. (6 points) About 80% of Florida residents believe that Florida is a nice or very nice place to live. Suppose that five randomly selected Florida residents are interviewed.

1. Find the probability that all five residents think that Florida is a nice or very nice place to live.

2. What is the probability that at least one resident <u>does not</u> think that Florida is a nice or very nice place to live?

3. What is the probability that exactly one resident <u>does not</u> think that Florida is a nice or very nice place to live?

Q6. (6 points) A particular machine produces an average 10 defective items per week. The remainder of the items is not defective. Assume that the number of defectives follows a **Poisson distribution**. Find the probability that the number of defectives is between 5 and 15 (inclusive), i.e. find $p(5 \le x \le 15)$.

Q7. (8 points) Find z_0 for the following:

1. $P(z > z_0) = 0.1$

2. $P(z < z_0) = 0.01$

3. $P(-z_0 < z < z_0) = 0.95$

Q8. (10 points) An industrial engineer has found that the standard household light bulbs produced by a certain manufacturer have a useful life that is normally distributed with a mean of 250 hours and a variance of 2500.

a. What is the probability that a randomly selected bulb from this production process will have a useful life in excess of 300 hours?

b. What is the probability that a randomly selected bulb from this production process will have a useful life between 190 and 270 hours?

c. What is the probability that a randomly selected bulb from this production process will have a useful life not exceeding 260 hours?

d. Within what limits would you expect the number of hours of the bulbs have a useful life to lie with probability .95?

Q9. (6 points) 1. For a binomial experiment with n=20 and p=0.7, calculate $P(10 \le x \le 16)$ by

a. using the binomial tables.

b. using the normal approximation.

Q10. (6 points) Let x denote a normal random variable with mean 30 and standard deviation 5. What x-value is the 67th percentile of this distribution?

Q11. (6 points) A normal random variable x has an unknown mean μ and standard deviation $\sigma = 2.5$. If the probability that x exceeds 7.5 is 0.8289, find μ.

Q12. (7 points) An agricultural economist is interested in determining the average diameter of peaches produced by a particular tree. A random sample of n=30 peaches is taken and the sample mean $\bar{x}$ is calculated. Suppose that the average diameter of peaches on this tree is known from previous years' production to be μ=60 millimeters with σ =10 mm. What is the probability that the sample mean, $\bar{x}$, exceeds 65 millimeters?

Q13. (11 points) A machine that manufactures a part for a car engine was observed over a period 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 sampling distribution of the proportion of defectives approximately normal?

3. What is the mean?

4. What is the standard deviation?

5. What is the probability that the sample proportion will lie within 0.02 of the true population proportion of defective parts?