KING FAHD UNIVERSITY OF PETROLEUM & MINERALS
DEPARTMENT OF MATHEMATICS & STATISTICS
DHAHRAN, SAUDI ARABIA

STAT 319: Probability & Statistics for Engineers & Scientists

Semester 153

Second Major Exam

Sunday, August 14, 2016

Time: 90 minutes

Please circle your instructor name

Riaz Saleh Al-Momani Malik

Name: ID#: Section #: Serial #:

Question No	Full Marks	Marks Obtained
1	**21**	
2	**8**	
3	**6**	
4	**8**	
5	**5**	
6	**6**	
7	**8**	
8	**8**	
Total	**70**	

1. The ages (in months) at which 50 children were first enrolled in a preschool are listed below:

30	30	30	31	31	32	32	32	33	33
34	34	35	35	35	36	36	36	36	36
37	37	38	38	39	39	39	40	40	40
40	41	41	41	41	42	42	43	43	45
45	46	46	46	47	48	48	50	50	55

Given that $\sum x_i = 1954$, $\sum x_i^2 = 78118$

a. Find the mean and standard deviation for this data. (3 points)

b. Find the percentage of measurements that lie in the interval $(\bar{x} - 2S, \bar{x} + 2\,S)$. Do the data satisfy the empirical rule in this interval? Reason? (4 points)

c. Construct a box plot for this data and comment on the shape. (6 points)

d. Construct a relative frequency table for these data using [30, 35) as your first class. (3 points)

e. Construct a relative frequency histogram for these data. Comment on the shape. (3 points)

f. Find the coefficient of skewness. (2 points)

2. The probability density function of the time failure of an electronic component in a copier in hours is

$$f(x) = 0.001e^{-0.001x}, \ x \geq 0$$

a. Find the probability that a component lasts more than 3000 hours before failure. (3 points)

b. Find the expected failure time. (1 points)

c. Determine the number of hours at which 10% of all components have failed. (4 points)

3. A company produces component parts for an engine. Parts specifications suggest that 85% of items met specifications. The parts are shipped to customers in lots of 90. Find the probability that more than 15 items will be defective in a lot. (6 points)

4. Many manufacturing problems involve the matching of machine parts, such as shafts that fit into a valve hole. A particular design requires a shaft with a diameter of 22.000 mm, but shafts with diameters between 21.990 mm and 22.010 mm are acceptable. Suppose that the manufacturing process yields shafts with diameters normally distributed, with a mean of 22.002 mm and a standard deviation of 0.005 mm. For this process, what is

a. The probability that a shaft is not acceptable? (4 points)

b. The diameter that will be exceeded by only 2% of the shafts? (4 points)

5. If a certain machine makes electrical resistors having a mean resistance of 40 ohms and a standard deviation of 2 ohms, what is the probability that a random sample of size 36 of these resistors will have a combined resistance of more than 1458 ohms? (5 points)

6. In July, 2001 research note, the U.S Department of Transportation reported the results of the National Occupant Protection Use Survey. One focus of the survey was to determine the level of cell phone use by drivers while they are in the act of driving a passenger motor vehicle. Data collected by observers at randomly selected intersections across the country revealed that in a sample of 1,165 drivers, 535 were using their cell phone.
   a. What is the margin of error in order to calculate a 99% confidence interval for the true proportion of the drivers using cell phone? (3 points)

   b. How large must the sample be if we wish to be 90% confident that the error in estimating p is less than 0.02 regardless of the true value of p? (3 points)

7. Suppose that we wanted to estimate the true average diameter of shafts produced by a production process with 90.5% confidence. The margin of error we are willing to accept is 0.5. Suppose we also know that sample standard deviation is about 10 mm.

a. What sample size is required for this? (3 points)

b. Construct a 99% confidence interval for the true average diameter of shafts, if a random sample (of size obtained in part a) gives a mean equal to 50 mm. Also interpret your interval. (5 points)

8. A polymer is manufactured in a batch chemical process. Viscosity measurements are normally made on each batch, and long experience with the process has indicated that the variability in the process is fairly stable with standard deviation of 20.

Fifteen batch viscosity measurements are given as follows:
724, 718, 776, 760, 745, 759, 795, 756, 742, 740, 761, 749, 739, 747, 742.

A process change that involves switching the type of catalyst used in the process is made. Following the process change, eight batch viscosity measurements are taken:
735, 775, 729, 750, 783, 760, 738, 780.

Assume that process variability is unaffected by the catalyst change.
Find a 90% confidence interval on the difference between means of batch viscosities and interpret. (8 points)