KING FAHD UNIVERSITY OF PETROLEUM & MINERALS
DEPARTMENT OF MATHEMATICS AND STATISTICS
Term 162

STAT 211 BUSINESS STATISTICS I

Friday May 26, 2017

Please circle your instructor name:

W. Al- Sabah M. Saleh

Name: _____ ID #:_____

Important Note:

- Show all your work including formulas, intermediate steps and final answer

Question No	Full Marks	Marks Obtained
1	4	
2	7	
3	7	
4	5	
5	4	
6	5	
7	17	
8	11	
9	10	
Total	70	

Q1: The weekly repair cost for a certain machine has a probability density function given by

$$f(x) = \begin{cases} 6x(1-x) & 0 \le x \le 1 \\ 0 & otherwise \end{cases}$$

With measurements in $100s

a. (*2 pts.*) What is the probability that repair costs will exceed $75 during a week?
b. (*2 pts.*) Find the mean of the repair costs.

Q2: The number of overnight emergency calls to a clinic and their probabilities are summarized the table below:

number of calls	0	1	2	3	4	5
the probability	0.05	0.1	0.15	0.35	0.2	0.15

a. (*2 pts.*) Find the probability that the clinic will receive at most 3 calls.

b. (*3 pts.*) Find the probability that the clinic will receive more than 2 calls given that it received at most 3 calls.

c. (2 *pts.*) Find the expected number of overnight emergency calls.

Q3: Historical records show that customers who enters Extra store will purchase a television with probability 0.3, a mobile with probability 0.15 and will not buy anything with probability 0.55.

a. (*2 pts.*) For the next five customers, what is the probability three customers will purchase three televisions?

b. (*3 pts.*) For the next five customers, what is the probability that at least one customer will purchase a mobile?

c. (*2 pts.*) For the next hundred customers, find the expected number of customers who will not purchase anything?

Q4: (*5 pts.*) In a particular city, the proportion of cars that would fail an air quality emissions test is thought to be 0.13. Find the probability that a random sample of 200 cars will have a sample proportion between 0.11 and 0.15.

Q5: A study of cars arriving at a parking structure at the local airport shows that the mean time between arrivals is 1.6 minutes and is exponentially distributed.

a. (*2 pts.*) Find the probability that more than two minutes will elapse between the arrivals of cars.

b. (*2 pts.*) How many minutes will elapse between the arrivals of 90 percent of the cars?

Q6: The population of soft drink cans filled by a particular machine is known to be normally distributed with a mean equal to 12 ounces and a standard deviation equal to 0.25 ounces. For a sample of size 25 cans,

a. (*3 pts.*) What is the distribution of the sample mean?

b. (*2 pts.*) Find the probability that the sample mean exceeds 12.05 ounces.

Q7: The real estate assessor for the government wants to study various characteristics concerning single – family houses in Al – Dammam. A random sample of size 25 houses revealed that the cooling area of the house has a mean 70 $meter\ square$, $standard\ deviation$ 9 $meter\ square$

a. (*5 pts.*) Construct and interpret a 99% confidence interval estimate for the true average cooling area of the house.

b. (5 *pts.*) If 10 houses had central air-conditioning, Construct and interpret a 93% confidence interval estimate for the proportion of houses that have central air – conditioning.

Suppose that the assessor also wishes to take a survey in Al – Riyadh.

c. (*3 pts.*) What sample size is needed to have a 95% confidence interval estimating the true average cooling area of the house to be within ±2 if the population standard deviation is estimated to be 8 meter square?

d. (*2 pts.*) What sample size is needed to have a 95% confidence interval estimating the population proportions of houses having central air – conditioning to be within ±0.14 if no previous estimate is available?

e. (*2 pts.*) Based on your answers in c and d, what sample is needed if a single survey is being conducted?

Q8: The table below presents the summary statistics for the starting annual salaries (in thousands of dollars) for individuals entering the public accounting and financial planning professions

Public accounting	Financial planning
Size of sample: 12	Size of sample: 14
Mean of sample: 60.35	Mean of sample: 58.20
Standard deviation of sample: 3.25	Standard deviation of sample: 2.48

a. (*9 pts.*) Form and interpret a 95% confidence interval estimate for the difference in the two means.

b. (*2 pts.*) What additional assumptions is needed to perform the confidence interval above?

Q9: (*1 pt. each*) Choose the correct answer in each of the following

1. Those methods involving the collecting, presentation, and characterization of a set on order to properly describe the various features of that set of data are called

   a. Statistical inference.
   b. Sample.
   c. Population.
   d. Descriptive statistics.
   e. Parameters.

2. Which of the following is a continuous quantitative variable?

   a. The color of student's eyes.
   b. The number of employees of an insurance company.
   c. The amount of milk in a 2 – liter carton.
   d. The number of milk containers sold at the local grocery store yesterday.
   e. The classification of student major.

3. The possible responses of the question " How many people are there in your household" results in

   a. A nominal scale variable.
   b. An ordinal scale variable.
   c. An interval scale variable.
   d. A ratio scale variable.
   e. A nominal or an interval variable.

4. The dean of students mailed a survey to a total of 400 students. The sample included 100 students randomly selected from each of the freshman, sophomore, junior, and senior classes on campus last term. What Sampling method was used?

   a. Simple random sample.
   b. Systematic sample.
   c. Stratified sample.
   d. Cluster sample.
   e. Judgment sample.

5. You have collected information on the market share of 5 different search engines used by U.S Internet users in a particular quarter. Which of the following is the best for presenting the information?

   a. A pie chart.
   b. A histogram.
   c. A stem – and – leaf display.
   d. A contingency table.
   e. A polygon.

6. In a right – skewed distribution

   a. The median equals the mean.
   b. The median is less than the mean.
   c. The median the more than the mean.
   d. The mean is less than the mode.
   e. The median equals the mode.

7. According to the empirical rule, if the data form a bell shaped, _____ percent of the observations will be contained within two standard deviation around the mean.

   a. 95%.
   b. 86%.
   c. 100%.
   d. 68%.
   e. 75%.

8. The ordered array below represents the number of vitamin supplements sold by a health food store in a sample of size 16 days.

19	19	20	20	22	23	25	26
27	30	33	34	35	36	38	41

   25% of the number of vitamin supplements sold in this sample lies below

   a. 20.5
   b. 26.5
   c. 34.75
   d. 4.25
   e. 12.75

9. You were told that the 1^{st} , 2^{nd} ,3^{rd} , quartiles of students' weight at kfupm are 95 lbs, 125 lbs, and 138 lbs. what percentage of the students weight more than 138 lbs?

   a. 50%
   b. 75%
   c. 80%
   d. 20%
   e. 25%

10. Suppose A and B are events where $P(A) = 0.4,\ P(B) = 0.5$ and $P(A \cap B) = 0.1$, then $P(A|B) =$

    a. 0.2
    b. 0.25
    c. 0.4
    d. 0.5
    e. 0

Formula Sheet

Descriptive Statistics

- $\bar{x} = \frac{\sum x}{n}$ or $\bar{x} = \frac{\sum xf}{\sum f}$
- $s = \sqrt{\frac{\sum x^2 - n\bar{x}^2}{n-1}}$ or $s = \sqrt{\frac{\sum x^2 f - n\bar{x}^2}{n-1}}$
- $R_\alpha = \frac{\alpha(n+1)}{100}$ & $P_\alpha = X_{(i)} + d\left(X_{(i+1)} - X_{(i)}\right)$

Probability

- $P(A \cup B) = P(A) + P(B) - P(A \cap B)$
- $P(A|B) = \frac{P(A \cap B)}{P(B)}, P(B) > 0$
- $P\left(A_j \middle| B\right) = \frac{P(A_j \cap B)}{P(B)} = \frac{P(A_j)P\left(B \middle| A_j\right)}{\sum_{i=1}^{k} P(A_i)P(B|A_i)}, \quad j = 1, 2, \dots, k$

Random Variables

- $\mu = E(X) = \sum xP(X = x)$ or $\mu = E(X) = \int xf(x)dx$
- $\sigma^2 = E(x - \mu)^2 = E(x)^2 - \left(E(X)\right)^2$
- $P(X = x) = C_x^n \pi^x (1 - \pi)^{n-x}, \ x = 0, 1, 2, \dots, n, \ \mu = n\pi$ & $\sigma = \sqrt{n\pi(1 - \pi)}$
- $P(X = x) = \frac{C_x^K C_{n-x}^{N-K}}{C_n^N}, \ x = 0, 1, 2, \dots, min\{K, n\}, \ \mu = n\frac{K}{N}$ & $\sigma = \sqrt{n\frac{K}{N}\left(1 - \frac{K}{N}\right)}\sqrt{\frac{N-n}{N-1}}$
- $P(X = x) = \frac{(\lambda t)^x e^{-\lambda t}}{x!}, x = 0, 1, 2, \dots; \quad \mu = \lambda t$ & $\sigma = \sqrt{\lambda t}$
- $f(x) = \frac{1}{b-a}, \quad a \le x \le b; \quad \mu = \frac{b+a}{2}$ & $\sigma = \sqrt{\frac{(b-a)^2}{12}}$
- $f(x) = \lambda e^{-\lambda x}, \quad x > 0; \quad \mu = \frac{1}{\lambda}$ & $\sigma = \frac{1}{\lambda}$
- $f(x) = \frac{1}{\sqrt{2\pi\sigma}} e^{-\frac{(x-\mu)^2}{2\sigma^2}}$

Estimation

- $\bar{x} \pm z_{\frac{\alpha}{2}} \frac{\sigma}{\sqrt{n}}, \quad or \quad \bar{x} \pm z_{\frac{\alpha}{2}} \frac{s}{\sqrt{n}}, \ or \quad \bar{x} \pm t_{\frac{\alpha}{2}, n-1} \frac{s}{\sqrt{n}}, \ or \quad \bar{p} \pm z_{\frac{\alpha}{2}} \sqrt{\frac{\bar{p}(1-\bar{p})}{n}}$
- $n \ge \left(\frac{z_{\frac{\alpha}{2}}\sigma}{e}\right)^2, \quad or \ n \ge \left(\frac{z_{\frac{\alpha}{2}}s}{e}\right)^2, \ or \ n \ge \left(\frac{z_{\frac{\alpha}{2}}}{e}\right)^2 \pi(1 - \pi)$
- $(\bar{x}_1 - \bar{x}_2) \pm z_{\frac{\alpha}{2}} \sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}$
- $(\bar{x}_1 - \bar{x}_2) \pm z_{\frac{\alpha}{2}} \sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$
- $(\bar{x}_1 - \bar{x}_2) \pm t_{\frac{\alpha}{2}} s_p \sqrt{\frac{1}{n_1} + \frac{1}{n_2}} \quad where \ s_p = \sqrt{\frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}}$
- $(\bar{x}_1 - \bar{x}_2) \pm t_{\frac{\alpha}{2}} \sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}} \quad where \quad f.d = \frac{\left(\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}\right)^2}{\frac{\left(\frac{s_1^2}{n_1}\right)^2}{n_1 - 1} + \frac{\left(\frac{s_2^2}{n_2}\right)^2}{n_2 - 1}}$
- $(\bar{p}_1 - \bar{p}_2) \pm z_{\frac{\alpha}{2}} \sqrt{\frac{\bar{p}_1(1-\bar{p}_1)}{n_1} + \frac{\bar{p}_2(1-\bar{p}_2)}{n_2}}$