KING FAHD UNIVERSITY OF PETROLEUM & MINERALS
DEPARTMENT OF MATHEMATICS AND STATISTICS
Term 141

STAT 211 BUSINESS STATISTICS I

Tuesday December 30, 2014

Name: ____ ID #:_____________________________

Important Note:

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

Question No	Full Marks	Marks Obtained
1	13	
2	10	
3	12	
4	10	
5	40	
Total	85	

Q1: Health care issues receiving much in both academic and political arenas. A sociologist recently conducted a survey of citizens over 60 years of age whose net worth is too high to qualify for Medicaid and have no private health insurance. The age of 25

60	61	62	63	64	65	66
68	68	69	70	73	73	74
75	76	76	81	81	82	86
87	89	90	92			

a. Calculate the following:

i. The mean age of the uninsured senior citizens to the nearest hundredth of years. (1 pt)

ii. The median age of the uninsured senior citizens. (2 pts)

iii. the standard deviation of the age of the uninsured senior citizens (2 pts)

b. What type of shape does the distribution of the sample appear to have? Why? (2 pts)

c. Using the z - score, is there any outliers? Explain (2 pts)

d. Calculate the first quartile, the third quartile of the ages of the uninsured senior citizens. (2 pts)

e. Construct a box plot, comment on the shape. (2 pts)

Q2: in the past several years credit card companies have made an aggressive effort to solicit new accounts from travelers. Suppose that a sample 0f 200 travelers indicated that 120 travelers has bank credit card, 75 travelers has travel and entertainment credit Card, and 60 travelers has both

a. If a traveler is selected at random, what is the probability that

    i. The traveler has either a bank credit card or a traveler and entertainment card? (2 pts)

    ii. The traveler has a bank credit card but not a traveler and entertainment card? (2 pts)

    iii. the probability that he does not have a traveler and entertainment card, given that he has a has a bank credit card (2 pts)

b. Let the event A: the traveler has a bank credit card, the event B: the traveler has a traveler and entertainment card

    i. Are the events collectively exhaustive? Why? (2 pts)

    ii. Are the events independent? Why? (2 pts)

Q3: Determine the following:

a. If customers arrive in a store at the rate of 4 per hour, what is the probability that we will have to wait between 15 and 30 minutes for the next customer to arrive. (3 pts)

b. The number of calls arriving at the Swampside Police Station follows a Poisson distribution with rate 4.6 per hour, find the probability that exactly 7 calls will come between 9:00 p.m. and 10:30 p.m. (3 pts)

c. From a batch of 100 items of which 20 are defective, exactly two items are chosen, one at a time, without replacement. Calculate the probabilities that the second item chosen is defective. (2 pts)

d. Machines A and B produce 10% and 90% respectively of the production of a component intended for the motor industry. From experience, it is known that the probability that machine A produces a defective component is 0.01 while the probability that machine B produces a defective component is 0.05. If a component is selected at random from a day's production and is found to be defective, find the probability that it was made by machine A (4 pts)

Q4: The travel time experienced by a driver going from Al-Riyad to Al-Dammam can be viewed as normally distributed random variable with mean of 3.5 hours and standard deviation of 0.45 hours.

a. Calculate the probability that a randomly selected driver experiences a travel time in excess of 4 hours. (2 pts)

b. Consider an experiment involving the measurement of the travel time of 50 different randomly and independently selected drivers going from Al-Riyad to Al-Dammam.

   i. What would you expect the standard error of the average travel time (taken over the 50 driver's) to be? Why? (2 pts)

   ii. Calculate the probability that the average travel time (taken over the 50 driver's) is in excess of 4 hours. (3 pts)

   iii. What is the expected number of the drivers in this sample who will have experienced a travel time in excess of 4 hours? What is its the standard deviation? (3 pts)

Q5: The manager of a restaurant serving seafood wants to study characteristics his customers. In particular, he decides to focus on two variables:

- The amount of money spent by the customer
- Whether the customer would consider purchase lobsters

The results from a sample of size 70 customers are as follows:

- Amount spent: Sample mean: SR 1759, sample standard deviation: SR 380
- 42 customers stated that they would consider purchasing lobsters

a. Set up and interpret a 99% confidence interval estimate of the population mean amount spent in the restaurant. (6 pts)

b. Do you need any assumptions? If yes, what? If no, why? (2 pts)

c. Set up and interpret a 91 % confidence interval estimate of the population proportion of customers who would consider purchasing lobsters. (6 pts)

If a manager from another restaurant wants to conduct a similar survey in his restaurant, he does not have access to the information obtained by the manager of the first restaurant

d. If he wants to have 95% confidence of estimating the true population mean amount spent in his restaurant to within SR91 and the standard deviation is assumed to be SR250, what sample size is needed?
(3 pts)

e. How many customers need to be selected to have 90% confidence of estimating the population proportion of customers who purchase dessert to within ± 0.04? (3 pts)

f. Based on your answers to **(d)** and **(e)**, how large a sample should the owner take. (2 pts)

The owner decides to sample the number he found in **part (d)** above, and the results are

- Amount spent: the mean = SR1620 and the standard deviation SR 280
- 11 customers stated that they would consider purchasing lobsters

g. Construct and interpret a 99% confidence interval for the difference in the mean spent in both restaurants. Based on this confidence interval, what **conclusion** can you draw about the mean amount spent in the first restaurant compared to the mean amount spent in the second restaurant? Do you need any assumptions? If yes, what? If no, why? (10 pts)

h. Construct and interpret a 92% confidence interval for the difference in the proportion of the customers who purchased lobsters in both restaurant. (8 pts)

STAT211 Final Exam Formula Sheet

Descriptive Statistics

- Sample Mean $\bar{X} = \frac{\sum X_k}{n}$ or $\frac{\sum x_i^* f_i}{\sum f_i}$
- Sample Variance $s^2 = \frac{\sum (X_i - \bar{X})^2}{n-1} = \frac{\sum x^2 - \frac{1}{n}\left(\sum x\right)^2}{n-1}$ or $\frac{\sum x_i^{*2} f_i - \left(\sum x_i^* f_i\right)^2 / n}{n-1}$
- Percentiles: $R_\alpha = \frac{\alpha}{100}(n+1) = i.d \quad P_\alpha = X_{(i)} + d\left(X_{(i+1)} - X_{(i)}\right)$

Probability

- $P(A \cup B) = P(A) + P(B) - P(A \cap B)$
- $P(A \cap B') = P(A) - P(A \cap B)$
- $P(A \mid B) = \frac{P(A \cap B)}{P(B)}, \ P(B) > 0$
- $P(B_j \mid A) = \frac{P(B_j \cap A)}{P(A)} = \frac{P(A \mid B_j)P(B_j)}{\sum_{i=1}^{k} P(A \mid B_i)P(B_i)}$ for $j = 1,2,\ldots,k$

Random Variables

- $E(X) = \sum xp(x)$ *or* $E(X) = \int xf(x)dx$
- $\sigma^2 = \sum x^2 p(x) - \mu^2$ *or* $\sigma^2 = \int x^2 f(x)dx - \mu^2$
- Statistical Distributions

  a. $P(x) = C_x^n \, p^x (1-p)^{n-x}, \ x = 0, 1, \ldots, n, \quad \mu = E(x) = np, \ \sigma = \sqrt{np(1-p)}$

  b. $P(x) = \frac{(\lambda t)^x e^{-\lambda t}}{x!}, \ x = 0, 1, \ldots, \quad \mu = E(x) = \lambda t, \ \sigma = \sqrt{\lambda t}$

  c. $P(x) = \frac{C_{n-x}^{N-X} C_x^X}{C_n^N} = \frac{\binom{N-A}{n-x}\binom{A}{x}}{\binom{N}{n}}$

  d. $f(x) = \lambda e^{-\lambda x}, \quad x > 0, \ \mu = E(x) = \frac{1}{\lambda}, \ \sigma = \frac{1}{\lambda}$

- **Confidence Interval Estimation**

a. $\bar{x} \pm z_{\alpha/2} \dfrac{\sigma}{\sqrt{n}}, \qquad n = \left(\dfrac{z_{\alpha/2}\ \sigma}{e} \right)^2$

b. $\bar{x} \pm z_{\alpha/2} \dfrac{s}{\sqrt{n}}, \quad n = \left(\dfrac{z_{\alpha/2}\, s}{e} \right)^2$

c. $\bar{x} \pm t_{\alpha/2, f} \dfrac{s}{\sqrt{n}},$ the number of degrees of freedom $f = n - 1$

d. $\left(\bar{x}_1 - \bar{x}_2 \right) \pm z_{\alpha/2} \sqrt{\dfrac{\sigma_1^{\ 2}}{n_1} + \dfrac{\sigma_2^{\ 2}}{n_2}}$

e. $\left(\bar{x}_1 - \bar{x}_2 \right) \pm z_{\alpha/2} \sqrt{\dfrac{s_1^{\ 2}}{n_1} + \dfrac{s_2^{\ 2}}{n_2}}$

f. $\left(\bar{x}_1 - \bar{x}_2 \right) \pm t_{\frac{\alpha}{2}, f} \ s_p \sqrt{\dfrac{1}{n_1} + \dfrac{1}{n_2}}, \ s_p^2 = \dfrac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}$

g. $\left(\bar{x}_1 - \bar{x}_2 \right) \pm t_{\frac{\alpha}{2}, v} \sqrt{\dfrac{s_1^2}{n_1} + \dfrac{s_2^2}{n_2}}, \ v = \dfrac{\left(\dfrac{s_1^{\ 2}}{n_1} + \dfrac{s_2^{\ 2}}{n_2} \right)^2}{\dfrac{\left(\dfrac{s_1^{\ 2}}{n_1} \right)^2}{n_1 - 1} + \dfrac{\left(\dfrac{s_2^{\ 2}}{n_2} \right)^2}{n_2 - 1}}$

h. $\bar{d} \pm t_{\frac{\alpha}{2}, n-1} \dfrac{s_d}{\sqrt{n}}$

i. $p \pm z_{\alpha/2} \sqrt{\dfrac{p(1-p)}{n}}, \ n = \dfrac{z_{\alpha/2}^2\, p(1-p)}{e^2}, \ n_{\max} = \dfrac{z_{\alpha/2}^2}{4e^2}$

j. $\left(p_1 - p_2 \right) \pm z_{\alpha/2} \sqrt{\dfrac{p_1(1-p_1)}{n_1} + \dfrac{p_2(1-p_2)}{n_2}}$