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

STAT 211 BUSINESS STATISTICS I
Semester 172, First Major Exam
Monday April 16, 2018

Serial Number

Please circle your instructor's name:

M. Malik M. Saleh

Name: ____ ID #:____________________________

Important Note:

- Formula sheet will be provided to you in exam. You are not allowed to bring, with you, formula sheet or any other printed/written paper.
- Mobiles are not allowed in exam. If you have your mobile with you, turn it off and put it under your seat so that it is visible to proctor.
- Show all your work including formulas, intermediate steps and final answer. No points for answer without justification.
- Round up to 4 decimal points if needed.
- Make sure you have 7 unique pages of exam paper (including this title page).

Question No	Full Marks	Marks Obtained
1	4	
2	3	
3	7	
4	4	
5	4	
6	8	
Total	30	

Q1: When the health department tested private wells in a county for two impurities commonly found in drinking water, it found that 20% of the wells had neither impurity, 40% had impurity A, and 50% had impurity B. (Obviously, some had both impurities.) If a well is randomly chosen from those in the county, find the probability mass function or the random variable Y, the number of impurities found in the well. (4 pts.)

Q2: A rental car facility has 10 foreign cars and 15 domestic cars waiting to be serviced on a particular Saturday morning. Because there are so few mechanics working on Saturday, only 6 cars can be serviced. If the 6 cars are chosen at random, what is the probability that at least 2 of the selected cars are domestic? (3 pts.)

Q3: The length of time, in minutes, that a customer queues in a Bank is a random variable X with probability density function

$$f(x) = \frac{1}{486}(81 - x^2), \qquad 0 \le x \le 9$$

a. Find the probability that a customer will queue for longer than three minutes. (2 pts.)

b. A customer has been queueing for three minutes, find the probability that this customer will be queueing for at least seven minutes. (3 pts.)

c. Three customers are selected at random, find the probability that exactly two of them has to queue for longer than three minutes. (2 pts.)

Q4: The operator of a pumping station has observed that demand for water during early afternoon hours has an exponential distribution with mean 100 cfs (cubic per second).

a. Find the probability that the demand will exceed 200 cfs during the early afternoon on a randomly selected day. (2 pts.)

b. What is the maximum water-producing capacity that the station should keep on line for this hour so that the demand will exceed this production capacity with a probability of only 0.01? (2 pts.)

Q5: An airline finds that 5% of the persons who make reservations on a certain flight do not show up for the flight. If the airline sells 160 tickets for a flight with only 155 seats, approximate the probability that a seat will be available for every person holding reservation and planning to fly? (4 pts.)

Q6: Wires manufacture for use in a computer system are specified to have resistance of between 0.12 and 0.14 ohms. The actual measured resistances of the wires produced by company A have a normal distribution with mean 0.13 ohm and standard deviation 0.05 ohm.

a. What is the probability that a randomly selected wire from company A's production will meet the specifications? (2 pts.)

b. If four of these wires are used in each computer system and all are selected from company A, what is the probability that all four in a randomly selected system will meet the specifications? (2 pts.)

c. What is the probability that the average of 4 resistances is 0.2 ohms or higher? (4 pts.)

Some Useful Formulas

Probability

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

Random Variables

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