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

STAT 201 INTRODUCTORY STATISTICS
Semester 181, Second Major Exam
Sunday Nov. 11, 2018

Serial Number

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 6 unique pages of exam paper (including this title page).

Question No	Full Marks	Marks Obtained
1	7	
2	6	
3	9	
4	8	
5	8	
6	7	
7	9	
Total	54	

Q1: A shipment of 20 calculators contains 4 defective sets. A sample of three calculators is selected in succession without replacement from this shipment.

a. What is the probability that sample will contain at least one defective calculator given the number of defective calculators is not three? *(4 pts.)*

b. What is the probability that the calculator selected at the second draw is not defective but the third draw is defective? *(3 pts.)*

Q2: An oil drilling company ventures into various locations, and their success or failure is independent from one location to another. Suppose the probability of a success at any specific location is 0.25.

a. What is the probability that a driller drills 10 locations and finds one success? *(3 pts.)*

b. The driller feels that he will go bankrupt if he drills 10 times without success occurs. What are the driller's chances for bankruptcy? *(3 pts.)*

Q3: A hole is drilled in a sheet-metal component, and then a shaft is inserted through the hole. The shaft clearance is equal to the difference between the radius of the hole and the radius of the shaft. Let the random variable X denote the clearance, in millimeters. The probability density function is

$$f(x) = \begin{cases} \alpha(1-x)^9 & 0 < x < 1 \\ 0 & otherwise \end{cases}$$

a. Components with clearances larger than 0.9 must be scrapped. What proportion of the components are scrapped? *(6 pts.)*
b. Evaluate $P(X < m) = 0.5$, and explain the meaning of m . *(3 pts.)*

Q4: A local newspaper sells an average of 2100 papers per day, with a standard deviation of 500 papers. Consider a sample of 64 days of operation.

a. What is the shape of the sampling distribution of the sample mean number of papers sold per day? Why? *(3 pts.)*

b. Find the expected value and the standard error of the sample mean. *(2 pts.)*

c. What is the probability that the sample mean will be more than 2250 papers? *(3 pts.)*

Q5: The resistance (in milliohms) of 1 meter of copper cable at a certain temperature is normally distributed with mean 23.8 and standard deviation of 1.28.

a. What is the probability that a 1 meter segment of copper has a resistance greater than 24 milliohms? *(3 pts.)*
b. Suppose that a random sample of 100 one-meter copper cables are selected, what is the probability that the total resistance of 100 one-meter copper cables will be less than 2410 milliohms? *(5 pts.)*

Q6: Suppose a consumer advocacy group would like to conduct a survey to find the proportion of consumers who are happy with their purchase of the newest generation of an MP3 player.

a. How large a sample n should they take to be at least 90% confident that the error in estimating the true population proportion to be within ±2%? (*3 pts.*)
b. The advocacy group took a random sample of 1000 consumers who recently purchased this MP3 player and found that 400 were happy with their purchase. Find a 95% confidence interval for the true population proportion. (*4 pts.*)

Q7: A company records the number of compressors sold each week, and the results are summarized in the following stem and leaf plot

Stem	Leaves
0	4 5 8 9
1	5 7 7 9 9
2	3 4 5 6 6 6 9
3	3 4 4 6 9
4	2 3 8 9

a. If you need to estimate the population mean, using an interval estimate, do you need any assumption? Justify your answer. (*2 pts.*)

b. Given that the sample mean is 26 and the sample variance is 164.42, use the sample results to develop and interpret a 93% confidence interval estimate for the population mean. (5 *pts.*)

c. The manager of the company claims that the average number of compressors sold each week is 32 compressors. According to your answer in part c above, do you support his claim? (*2 pts.*)

Formula Sheet

Probability

- $P(A \cup B) = P(A) + P(B) - P(A \cap B)$
- $P(A|B) = \frac{P(A \cap B)}{P(B)}, P(B) > 0$

Random Variables

- $\mu = E(X) = \sum xP(X = x) \quad or \quad \mu = E(X) = \int xf(x)dx$
- $\sigma^2 = E(x-\mu)^2 = E(x)^2 - \left(E(X)\right)^2$
- $P(X = x) = C_x^n p^x (1-p)^{n-x}, \; x = 0, 1, 2, \dots, n, \quad \mu = np \; \& \; \sigma = \sqrt{np(1-p)}$
- $P(X = x) = \frac{C_x^K C_{n-x}^{N-K}}{C_n^N}, \; x = \; max\{0, n + K - N\} \; to \; min\{K, n\},$

  $\mu = n\frac{K}{N} \; \& \; \sigma = \sqrt{n\frac{K}{N}\left(1 - \frac{K}{N}\right)}\sqrt{\frac{N-n}{N-1}}$
- $P(X = x) = \frac{(\lambda t)^x \, e^{-\lambda t}}{x!}, \quad \mu = \lambda t, \quad \sigma = \sqrt{\lambda t}$
- $f(x) = \frac{1}{b-a}, \; a \le x \le b; \quad \mu = \frac{b+a}{2} \; \& \; \sigma = \sqrt{\frac{(b-a)^2}{12}}$
- $f(x) = \frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{1}{2}\left(\frac{x-\mu}{\sigma}\right)^2}, -\infty < x < \infty \quad \& \quad Z = \frac{X-\mu}{\sigma} \quad or \quad Z = \frac{\bar{X}-\mu_{\bar{x}}}{\sigma_{\bar{x}}} = \frac{(\bar{X}-\mu)}{\frac{\sigma}{\sqrt{n}}}$
- $\mu = \frac{\sum x}{N} \quad or \quad \mu = \frac{\sum xf}{N} \quad or \quad \bar{x} = \frac{\sum x}{n} \quad or \quad \bar{x} = \frac{\sum xf}{\sum f}$
- $\sigma^2 = \frac{\sum x^2 - N\mu^2}{N} \quad or \quad \sigma^2 = \frac{\sum x^2 f - N\mu^2}{N} \quad or \quad S^2 = \frac{\sum x^2 - n\bar{x}^2}{n-1} \quad or \quad S^2 = \frac{\sum x^2 f - n\bar{x}^2}{\sum f - 1}$
- $\bar{X} \pm Z_{\frac{\alpha}{2}} \frac{\sigma}{\sqrt{n}} \quad or \quad \bar{X} \pm Z_{\frac{\alpha}{2}} \frac{S}{\sqrt{n}} \quad or \quad \bar{X} \pm t_{\frac{\alpha}{2}, n-1} \frac{S}{\sqrt{n}} \quad or \quad \hat{p} \pm z_{\frac{\alpha}{2},} \sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$
- $n \ge \left(\frac{Z_{\frac{\alpha}{2}}\sigma}{E}\right)^2 \quad or \; n \ge \left(\frac{Z_{\frac{\alpha}{2}} \, s}{E}\right)^2 \quad or \quad n \le \frac{1}{4}\left(\frac{Z_{\frac{\alpha}{2}}}{E}\right)^2 \quad or \quad n \ge \left(\frac{Z_{\frac{\alpha}{2}}}{E}\right)^2 \hat{p}(1-\hat{p})$