King Fahd University of Petroleum and Minerals
Department of Mathematics

CODE00 **CODE00**

STAT 211
Major Exam II
Term 212
02-April-2022

Name: ______________________________

ID: ____________________ Sec: ____________________.

Check that this exam has 25 questions.

Important Instructions:

1. All types of calculators may be used, provided that they cannot store text.
2. Use HB 2.5 pencils only.
3. Use a good eraser. DO NOT use the erasers attached to the pencil.
4. Write your name, ID number and Section number on the examination paper and in the upper left corner of the answer sheet.
5. When bubbling your ID number and Section number, be sure that the bubbles match with the numbers that you write.
6. The Test Code Number is already bubbled in your answer sheet. Make sure that it is the same as that printed on your question paper.
7. When bubbling, make sure that the bubbled space is fully covered.
8. When erasing a bubble, make sure that you do not leave any trace of penciling.

1 A lab orders 100 rats a week for each of the 52 weeks in the year for experiments that the lab conducts. Prices for 100 rats follow the following distribution:

Price	\$10.00	\$12.50	\$15.00
Probability	0.35	0.40	0.25

How much should the lab budget for next year's rat orders be, assuming this distribution does not change?

(a) \$637

(b) \$520

(c) \$650

(d) \$780

(e) \$460

2 Which of the following about the binomial distribution is a **TRUE** statement

(a) the probability of event of interest π is stable from trial to trial

(b) the variable X is continuous

(c) the number of trials n must be at least 30

(d) the results of one trial are dependent on the results of the other trials.

(e) cannot be approximated by the normal distribution

3 An Undergraduate Study Committee of 6 members at a major university is to be formed from a pool of faculty of 18 men and 6 women. If the committee members are chosen randomly, what is the probability that precisely half of the members will be women?

(a) 0.1213
(b) 0.8787
(c) 0.1963
(d) 0.6793
(e) 0.8037

4 A national trend predicts that women will account for half of all business travelers in the next 3 years. To attract these women business travelers, hotels are providing more amenities that women particularly like. A recent survey of American hotels found that 70% offer hairdryers in the bathrooms. Consider a random and independent sample of 20 hotels. Approximate the probability that at least 9 of the hotels in the sample do not offer hairdryers in the bathrooms.

(a) 0.1112
(b) 0.2288
(c) 0.8888
(d) 0.9564
(e) 0.9279

5 The value of the cumulative standardized normal distribution at Z is 0.8770. The value of Z is

(a) 1.16
(b) 0.81
(c) 0.18
(d) 1.47
(e) 2.15

6 A company that receives the majority of its orders by telephone conducted a study to determine how long customers were willing to wait on hold before ordering a product. The length of waiting time was found to be a variable best approximated by an exponential distribution with a mean length of waiting time equal to 3 minutes (i.e. the mean number of calls answered in a minute is 1/3). Find the waiting time at which only 10% of the customers will continue to hold

(a) 6.9 minutes
(b) 3.3 minutes
(c) 2.8 minutes
(d) 13.8 minutes
(e) 6.6 minutes

7 The amount of time necessary for assembly line workers to complete a product is a normal variable with a mean of 15 minutes and a standard deviation of 2 minutes. So, 90% of the products require more than $\cdots\cdots$ minutes for assembly.

(a) 12.44
(b) 17.56
(c) 14.80
(d) 13.20
(e) 16.80

8 The Central Limit Theorem is important in statistics because

(a) for a large n, it says the sampling distribution of the sample mean is approximately normal, regardless of the shape of the population.
(b) for a large n, it says the population is approximately normal.
(c) for any population, it says the sampling distribution of the sample mean is approximately normal, regardless of the sample size.
(d) for a large n, it says the population is not normal.
(e) for any sized sample, it says the sampling distribution of the sample mean is approximately normal.

9 For air travelers, one of the biggest complaints is of the waiting time between when the airplane taxis away from the terminal until the flight takes off. This waiting time is known to have a right skewed distribution with a mean of 10 minutes and a standard deviation of 8 minutes. Suppose 100 flights have been randomly sampled. Describe the sampling distribution of the mean waiting time between when the airplane taxis away from the terminal until the flight takes off for these 100 flights.

(a) Distribution is approximately normal with mean = 10 minutes and standard error = 0.8 minutes.
(b) Distribution is approximately normal with mean = 10 minutes and standard error = 8 minutes.
(c) Distribution is right skewed with mean = 10 minutes and standard error = 0.8 minutes.
(d) Distribution is right skewed with mean = 10 minutes and standard error = 8 minutes.
(e) Distribution is left skewed with mean = 10 minutes and standard error = 0.8 minutes.

10 According to a survey, only 15% of customers who visited the web site of a major retail store made a purchase. Random samples of size 50 are selected. What proportion of the samples will have less than 30% of customers who will make a purchase after visiting the web site?

(a) 0.9985
(b) 0.1596
(c) 0.8389
(d) 0.0015
(e) 0.8404

11 A campus program evenly enrolls undergraduate and graduate students. If a random sample of 4 students is selected from the program to be interviewed about the introduction of a new fast food outlet on the ground floor of the campus building, what is the probability that all 4 students selected are undergraduate students?

(a) 0.0625
(b) 0.0256
(c) 0.5
(d) 0.16
(e) 1.00

12 The quality control manager of a candy plant is inspecting a batch of chocolate chip bags. When the production process is in control, the average number of blue chocolate chips per bag is 6.0. The manager is interested in analyzing the probability that any particular bag being inspected has fewer than 5.0 blue chocolate chips. What type of probability distribution will most likely be used to analyze the number of blue chocolate chips per bag in this problem?

(a) Poisson
(b) Binomial
(c) Hypergeometric
(d) Negative binomial
(e) Uniform

13 A company has 2 machines that produce widgets. An older machine produces 23% defective widgets, while the new machine produces only 8% defective widgets. In addition, the new machine produces 3 times as many widgets as the older machine does. Given a randomly chosen widget was tested and found to be defective, what is the probability it was produced by the new machine?

(a) 0.511
(b) 0.080
(c) 0.150
(d) 0.489
(e) 0.456

14 If we know that the length of time it takes a college student to find a parking spot in the library parking lot follows a normal distribution with a mean of 3.5 minutes and a standard deviation of 1 minute, find the probability that a randomly selected college student will take between 2 and 4.5 minutes to find a parking spot in the library parking lot.

(a) 0.7745
(b) 0.0919
(c) 0.2255
(d) 0.4938
(e) 0.9245

15 A wheel spinning game is played with a special wheel with 24 equal segments that determine the dollar values of a single spin. Which of the following distributions can best be used to compute the probability of winning a specific dollar value in a single spin?

(a) Uniform
(b) Binomial
(c) Normal
(d) Exponential
(e) Geometric

16 A judicial court in a certain country may return any one of three verdicts 'guilty', 'not guilty' and 'not proven'. Of the cases tried by this court, 65% of the verdicts were 'guilty', 25% of the verdicts were 'not guilty' and 10% were 'not proven'. Suppose that when the court's verdict is 'guilty' there is a probability 0.05 that the accused is actually innocent. The corresponding probabilities for the verdicts 'not guilty' and 'not proven' are 0.90 and 0.30, respectively. What is the probability that an innocent person will be found guilty?

(a) 0.113
(b) 0.271
(c) 0.561
(d) 0.001
(e) 0.800

17 The amount of time required for an oil and filter change on an automobile is normally distributed with a mean of 45 minutes and a standard deviation of 10 minutes. A random sample of 16 cars is selected. 90% of the sample means will be greater than what value?

(a) 41.8 minutes
(b) 45.1 minutes
(c) 68.3 minutes
(d) 23.2 minutes
(e) 56.4 minutes

18 The service manager for a new automobile dealership reviewed dealership records of the past 20 sales of new cars to determine the number of warranty repairs he will be called on to perform in the next 90 days. Corporate reports indicate that the probability any one of their new cars needs a warranty repair in the first 90 days is 0.05. The manager assumes that calls for warranty repair are independent of one another and is interested in predicting the number of warranty repairs he will be called on to perform in the next 90 days for this batch of 20 new cars sold.

(a) Binomial
(b) Poisson
(c) Hypergeometric
(d) Geometric.
(e) Exponential

19 Upon studying low bids for shipping contracts, a microcomputer manufacturing company finds that intrastate contracts have low bids that are uniformly distributed between 20 and 25, in units of thousands of dollars. Find the probability that the low bid on the next intrastate shipping contract is below $22,000.

(a) 0.4
(b) 0.2
(c) 0.1
(d) 0.8
(e) 0.6

20 The number of power outages at a nuclear power plant has a Poisson distribution with a mean of 6 outages per year. The probability that there will be at least 3 power outages in a year is

(a) 0.9380
(b) 0.0025
(c) 0.0149
(d) 0.0446
(e) 0.0620

21 At a computer manufacturing company, the actual size of a particular type of computer chips is normally distributed with a mean of 1 centimeter and a standard deviation of 0.1 centimeter. A random sample of 12 computer chips is taken. What is the probability that the sample mean will be between 0.99 and 1.01 centimeters?

(a) 0.2736
(b) 0.6368
(c) 0.3632
(d) 0.7264
(e) 0.6468

22 A company that sells annuities must base the annual payout on the probability distribution of the length of life of the participants in the plan. Suppose the probability distribution of the lifetimes of the participants is approximately a normal distribution with a mean of 68 years and a standard deviation of 3.5 years. Find the age at which payments have ceased for approximately 86% of the plan participants.

(a) 71.78 years
(b) 61.78 years
(c) 43.08 years
(d) 87.70 years
(e) 11.38 years

23 Suppose the true proportion of voters who support Proposition A is $\pi = 0.4$. To find the probability that a sample of size 200 yields a sample proportion between 0.40 and 0.45, the standard deviation of the sampling distribution of the sample proportion is

(a) 0.0346
(b) 0.2210
(c) 0.6541
(d) 0.0002
(e) 0.4510

24 Suppose Z has a standard normal distribution with a mean of 0 and standard deviation of 1. The probability that Z is less than 1.15 is

(a) 0.8749
(b) 0.4782
(c) 0.5521
(d) 0.0082
(e) 0.6513

25 A manufacturer produces electrical components of which 3% are faulty. The components are sold in boxes of 20 and the boxes are sold to wholesalers in batches of 10. A box is rejected if there is more than one faulty component in it and a batch is rejected if more than one box in the batch is rejected. What is the probability that a batch is rejected?

A 0.342
B 0.204
C 0.120
D 0.153
E 0.001

Formula Page

Descriptive Statistics

- $\bar{x} = \frac{\sum x}{n}$
- $s = \sqrt{\frac{\sum x^2 - n\bar{x}^2}{n-1}}$

Probability

- $P(A \cup B) = P(A) + P(B) - P(A \cap B)$
- $P(A) + P(\bar{A}) = 1$
- $P(A|B) = \frac{P(A \cap B)}{P(B)}, P(B) > 0, P(A_j|B) = \frac{P(A_j \cap B)}{P(B)} = \frac{P(A_j)P(B|A_j)}{\sum_{i=1}^{k} P(A_i)P(B|A_i)}, \quad j = 1, 2, \ldots, k$
- $\mu = E(X) = \sum xP(X = x)$
- $\sigma^2 = E(X - \mu)^2 = E(X)^2 - \left(E(X)\right)^2$
- $P(X = x) = C_x^n \pi^x (1 - \pi)^{n-x}, \; x = 0, 1, 2, \ldots, n, \quad \mu = n\pi \;\; \& \;\; \sigma = \sqrt{n\pi(1 - \pi)}$
- $P(X = x) = \frac{C_x^K C_{n-x}^{N-K}}{C_n^N}, \; x = \{0, \cdots, min(K, n)\}, \; \mu = n\frac{K}{N} \;\; \& \;\; \sigma = \sqrt{n\frac{K}{N}\left(1 - \frac{K}{N}\right)}\sqrt{\frac{N-n}{N-1}}$
- $P(X = x) = \frac{(\lambda t)^x e^{-\lambda t}}{x!}, x = 0, 1, \; 2, \ldots; \quad \mu = \lambda t \;\; \& \;\; \sigma = \sqrt{\lambda t}$
- $F(b) = P(X \leq b), \; P(a \leq x \leq b) = F(b) - F(a)$
- $f(x) = \frac{1}{b-a}; \; F(x) = \frac{x-a}{b-a}; \; a \leq x \leq b; \quad \mu = \frac{b+a}{2} \;\; \& \;\; \sigma = \sqrt{\frac{(b-a)^2}{12}}$
- $f(x) = \lambda e^{-\lambda x}, x > 0; \quad F(x) = 1 - e^{-\lambda x}; \quad \mu = \frac{1}{\lambda} \;\; \& \;\; \sigma = \frac{1}{\lambda}$
- $f(x) = \frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{1}{2}\left(\frac{x-\mu}{\sigma}\right)^2}, -\infty < x < \infty$
- $Z = \frac{X-\mu}{\sigma} \quad or \quad Z = \frac{\bar{X}-\mu_{\bar{x}}}{\sigma_{\bar{x}}} = \frac{(\bar{X}-\mu)}{\frac{\sigma}{\sqrt{n}}}$