King Fahd University of Petroleum and Minerals
Department of Mathematics

CODE00 **CODE00**

STAT 319
Major Exam I
Term 222
01-March-2023
Net Time Allowed: 120

Name: _____

ID: _____ Sec: _____.

Check that this exam has 18 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 Strands of copper wire from a manufacturer are analyzed for strength and conductivity. The results from 100 strands are as follows:

	Strength	
	High	Low
High conductivity	74	8
Low conductivity	15	3

If a strand is randomly selected, what is the probability that its conductivity is low or its strength is low?

(a) 0.26
(b) 0.74
(c) 0.27
(d) 0.89
(e) 0.11

2 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) 0.341
(b) 0.120
(c) 0.880
(d) 0.657
(e) 0.242

3 The number of cracks in a section of interstate highway that are significant enough to require repair is assumed to follow a Poisson distribution with a mean of two cracks per mile. What is the probability that at least one crack requires repair in $\frac{1}{2}$ mile of highway?

(a) 0.6321
(b) 0.3679
(c) 0.6572
(d) 0.3428
(e) 0.7397

4 The life of automobile voltage regulators has an exponential distribution with a mean life of five years. You purchase a six-year-old automobile, with a working voltage regulator and plan to own it for five years. What is the probability that the voltage regulator fails during your ownership?

(a) 0.6321
(b) 0.3679
(c) 0.1108
(d) 0.8892
(e) 0.5717

5 The operational lifetime X, in years, of a battery powered watch has probability density function

$$f(x) = \begin{cases} cx(6-x) & 3 \leq x \leq 6 \\ 0 & \text{otherwise.} \end{cases}$$

Find the probability that the watch has an operational lifetime in excess of 4 years.

(a) 0.519
(b) 0.286
(c) 0.534
(d) 0.056
(e) 0.318

6 Let R have probability mass function (pmf) $p(r) = \frac{1}{8}$ for $r = 1, 2, \cdots, 8$. Find the variance of R, $var(R)$.

(a) 5.25
(b) 2.67
(c) 4.50
(d) 10.50
(e) 3.70

7 Let A and B be two events such that $P(A/B) = 2P(A/\bar{B})$ and $P(B) = 0.32$ then $P(B/A)$ is

(a) 0.48
(b) 0.68
(c) 0.52
(d) 0.50
(e) 0.00

8 Heart failure is due to either natural occurrences (87%) or foreign objects (13%). Outside factors are related to induced substances or foreign objects. Natural Occurrences are caused by arterial blockage, disease, and infection. Assume that causes of heart failure for the individuals are independent. What is the probability that the fourth patient with heart failure who enters the emergency room is the first one due to nature occurrences?

(a) 0.0019
(b) 0.8700
(c) 0.1300
(d) 0.2568
(e) 0.6126

9 The lifetime (in hours) of a semiconductor laser has a lognormal distribution with $\theta = 4$ and $\omega = 2$. What is the probability that the lifetime exceeds its mean?

(a) 0.15866
(b) 0.84134
(c) 0.50000
(d) 0.69146
(e) 0.30854

10 An e-mail filter is planned to separate valid e-mails from spam. The word free occurs in 60% of the spam messages and only 4% of the valid messages. Also, 20% of the messages are spam. Determine the probability that a message is valid given that it does not contain free:

(a) 0.9057
(b) 0.0339
(c) 0.9999
(d) 0.9600
(e) 0.3600

11 An e-mail message will arrive at a time uniformly distributed between 9:00 a.m. and 11:00 a.m. You check e-mail at 9:15 a.m. and every 30 minutes afterward. What is the probability that the message arrives more than 15 minutes before you view it?

(a) 0.50
(b) 0.33
(c) 0.99
(d) 0.75
(e) 0.25

12 The time that it takes a randomly selected sports car from the same brand to accelerate from 0 to 60 miles per hour (mph) is normally distributed with mean 6.2 seconds and standard deviation 0.15 seconds. Suppose 6 cars are selected at random, and let $X_1, \cdots, X_6$ denote their times to reach 60 mph. What is the probability that the total time $T = \sum_{i=1}^{6} X_i$ is between 36.5 and 37.5 seconds.

(a) 0.7658
(b) 0.6658
(c) 0.9648
(d) 0.1658
(e) 0.0281

13 A research study uses 900 men under the age of 55. Suppose that 30% carry a marker on the male chromosome that indicates an increased risk for high blood pressure. If 10 men are selected randomly and tested for the marker, what is the probability that more than 1 has the marker?

(a) 0.8522
(b) 0.1478
(c) 0.4567
(d) 0.5433
(e) 0.0276

14 Hits to a high-volume Web site are assumed to follow a Poisson distribution with a mean of 10,000 per day. Approximate the probability of more than 20,000 hits in a day.

(a) 0.00
(b) 1.00
(c) 10.00
(d) 0.50
(e) ∞

15 A batch of parts contains 100 from a local supplier of tubing and 200 from a supplier of tubing in the next state. If four parts are selected randomly and without replacement, what is the probability that two or more parts in the sample are from the local supplier?

(a) 0.408
(b) 0.592
(c) 0.110
(d) 0.890
(e) 0.396

16 Errors in an experimental transmission channel are found when the transmission is checked by a certifier that detects missing pulses. The number of errors found in an eight-bit byte is a random variable with the following distribution:

$$F(x) = \begin{cases} 0 & x < 1 \\ 0.7 & 1 \leq x < 4 \\ 0.9 & 4 \leq x < 7 \\ 1 & 7 \leq x \end{cases}$$

$P(X \leq 2)$ is equal to

(a) 0.70
(b) 0.30
(c) 0.90
(d) 0.10
(e) 0.85

17 Suppose that the lifetime of a component (in hours) modeled with a Weibull distribution with parameters $\beta = 0.5$ and $\delta = 4000$ hours. The median lifetime is equal to

(a) 1921.81 hours
(b) 3330.22 hours
(c) 480.453 hours
(d) 832.555 hours
(e) 3843.62 hours

18 An inspector working for a manufacturing company has a 98% chance of correctly identifying defective items and a 0.5% chance of incorrectly classifying a good item as defective. The company has evidence that 1% of the items its line produces are nonconforming. If an item selected at random is classified as non defective, what is the probability that it is indeed good?

(a) 0.9996
(b) 0.0141
(c) 0.9821
(d) 0.9052
(e) 0.0041