

King Fahd University of Petroleum and Minerals
Department of Mathematics
Stat 319
Major Exam I
243
03 July 2025
Net Time Allowed: 90 Minutes

USE THIS AS A TEMPLATE

Write your questions, once you are satisfied upload this file.

1. Samples of emissions from three suppliers are classified for conformance to air-quality specifications. The results from 100 samples are summarized as follows:

Supplier	Conforms	
	Yes	No
H	22	8
L	25	5
M	30	10

Let A denote the event that a sample is from supplier H , and let B denote the event that a sample conforms to specifications. If a sample is selected at random, then $P(\overline{A} \mid \overline{B}) =$

- (a) 0.6522
 - (b) 0.4286
 - (c) 0.1139
 - (d) 0.2025
 - (e) 0.7619
2. If A, B , and C are mutually exclusive events with $P(A) = 0.2$, $P(B) = 0.3$, and $P(C) = 0.4$, then $P(\overline{A} \cap \overline{B} \cap \overline{C}) =$
- (a) 0.1
 - (b) 0
 - (c) 0.8
 - (d) 0.9
 - (e) 0.2

3. A lot of 50 spacing washers contains 30 washers that are **thicker** than the target dimension. Washers are selected from the lot at random without replacement; what is the minimum number of washers that need to be selected so that the probability that all the washers are **thinner** than the target is less than 0.10?
- (a) 3
 - (b) 2
 - (c) 1
 - (d) 4
 - (e) 5
4. An email filter is being developed to help distinguish between spam and real (non-spam) emails. In this system, 10% of all emails are spam. The word 'free' appears in 80% of spam emails and in only 3% of real emails. What is the probability that a randomly selected email does not contain the word 'free'?
- (a) 0.893
 - (b) 0.107
 - (c) 0.089
 - (d) 0.978
 - (e) 0.252

5. The thickness of wood paneling (in inches) that a customer orders is a random variable with the following cumulative distribution function:

$$F(x) = \begin{cases} 0 & \text{for } x < 1 \\ 0.2 & \text{for } 1 \leq x < 2 \\ 0.5 & \text{for } 2 \leq x < 3 \\ 0.9 & \text{for } 3 \leq x < 4 \\ 1 & \text{for } x \geq 4 \end{cases}$$

What is the probability that a randomly selected order is for paneling at least 3 inches thick?

- (a) 0.5
 - (b) 0.2
 - (c) 0.3
 - (d) 0.1
 - (e) 0.7
6. In a sample of 30 heart failure patients, each independently having a 13% chance of being affected by external factors, what is the probability that at least 3 patients are affected by external factors?
- (a) 0.767
 - (b) 0.208
 - (c) 0.130
 - (d) 0.870
 - (e) 0.792

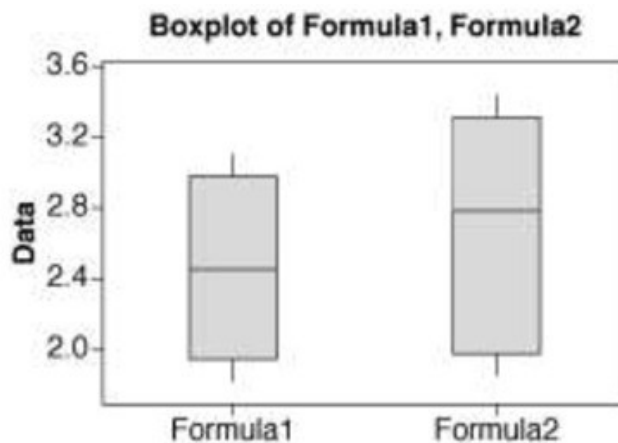
7. A batch contains 40 bacterial cells, 12 of which are unable to replicate. If three cells are randomly selected without replacement, what is the probability that at least one of them is unable to replicate?
- (a) 0.6684
 - (b) 0.7951
 - (c) 0.2049
 - (d) 0.3316
 - (e) 0.6830
8. The number of telephone calls that arrive at a phone exchange is often modeled as a Poisson random variable. Assume that on the average there are 8 calls per hour, what is the probability that there are exactly 5 calls in 30 minutes?
- (a) 0.1563
 - (b) 0.0916
 - (c) 0.0424
 - (d) 0.0992
 - (e) 0.1843

9. There is a chance that a bit transmitted through a digital transmission channel is received in error. Let X equal the number of bits in error in the next four bits transmitted. Assume that the probability mass function of X is given by

$$P(X = x) = \begin{cases} ax & x = 1, 2, 3 \text{ or } 4 \\ 0 & \text{otherwise} \end{cases}$$

The expected value of the number of properly functioning components

- (a) 1
 - (b) 2
 - (c) 4
 - (d) 5
 - (e) 3
10. The “cold start ignition time” of an automobile engine is being investigated by a gasoline manufacturer. Two formulation of the gasoline was tested in the same vehicle. Use the following graph to comment on both formulas:



Which of the following statements is **true**?

- (a) Formula 1 has a lower mean cold start ignition time and is more consistent
- (b) Both formulas have identical performance characteristics
- (c) Formula 2 has a lower median ignition time than Formula 1, indicating better performance
- (d) Formula 1 has more variation in ignition time than Formula 2
- (e) Formula 2 shows more consistent performance than Formula 1

11. Which of the following statements is **NOT true**?

- (a) The median can be greater than the mean when the sample is symmetric about the mean value
- (b) The median will equal the mode when the sample is symmetric with a single mode
- (c) The symmetry implies the mode is at the median of the sample
- (d) The median will be equal to the mean when the sample is symmetric about the mean value
- (e) The mean is sensitive to extreme values while the median is not sensitive to the extreme values

12. Which of the following statements is **true**?

- (a) The sample standard deviation can be equal to zero
- (b) The sample mean will always correspond to one of the observations in the sample
- (c) Exactly half of the observations in a sample will fall below the mean
- (d) The sample mean will always be the most frequently occurring data value in the sample
- (e) Suppose that you add 10 to all of the observations in a sample, the sample standard deviation will change

13. The following data are direct solar intensity measurements ($watts/m^2$) on different days at a location in southern Spain:

562	869	708	775	775	704	809	856	655	806	878	909
918	558	768	870	918	940	946	661	820	898	935	952
957	693	835	905	939	955	960	498	653	730	753	

Given that $\sum_{i=1}^{35} x_i = 28368$ & $\sum_{i=1}^{35} x_i^2 = 23552500$. The estimated value of the population standard deviation.

- (a) 128.3184
- (b) 126.4719
- (c) 15995.16
- (d) 16465.61
- (e) 810.5143

14. The data are available on compressive strengths in pounds are square inch (psi) of 80 specimens of a new aluminum-lithium alloy undergoing evaluation as a possible material for aircraft structural elements. A summary descriptive statistic of the data is given below

Min.	1st Qu.	Median	Mean	3rd Qu.	Max.
76	144.5	161.5	162.7	181	245

Which of the following is **true**?

- (a) The interquartile range equal to 36.5
- (b) There are no outliers in the data
- (c) There are extreme outliers in the data
- (d) The data negatively skewed (left skewed)
- (e) The data symmetric around the mean