

Stat 2510 Midterm Exam - Practice Questions

Sampling and Bias

1. Which statement about stratified random sampling is true?
 - (a) It increases bias compared to simple random sampling.
 - (b) It ensures representation from all key subgroups.
 - (c) It only works for small populations.
 - (d) It requires that all strata are the same size.
2. What is sampling bias?
 - (a) It's error from using a sample instead of the whole population.
 - (b) It's error unrelated to sampling (e.g., mistakes in measurement, recording, or nonresponse).
 - (c) It's introduced when certain individuals are more likely to be chosen.
 - (d) It's introduced when using random sampling.
3. Which situation introduces bias?
 - (a) Using simple random sampling to select participants.
 - (b) Conducting a phone survey that excludes those without cell phones.
 - (c) Stratifying the population and selecting random individuals from each group.
 - (d) Assigning each individual in the population a random number.

Descriptive Statistics

4. The following data show the number of emails received per day: 5, 7, 7, 10, 12, 15, 20. What is the median?
 - (a) 7
 - (b) 10
 - (c) 9.5
 - (d) 12
5. For the data: 3, 4, 5, 8, 8, 10, 11, 15, what is the IQR?
 - (a) 4
 - (b) 5.5
 - (c) 6
 - (d) 7
6. The variance of a dataset is 16. What is the standard deviation?
 - (a) 2
 - (b) 4
 - (c) 8

(d) 256

Probability

7. Two events A and B are mutually exclusive. Then:

- (a) $P(A \cap B) = 0$
- (b) $P(A \cup B) = 0$
- (c) $P(A) = P(B)$
- (d) $P(A \cap B) = P(A) + P(B)$

8. If events A and B are independent, what is $P(A \cap B)$?

- (a) $P(A) + P(B)$
- (b) $P(A) - P(B)$
- (c) $P(A) * P(B)$
- (d) $P(A)/P(B)$

9. If $P(A) = 0.5$, $P(B) = 0.4$, and $P(A \cup B) = 0.7$, are A and B independent?

- (a) Yes, because $0.5 + 0.4 - 0.7 = 0.2 = 0.5 \times 0.4$
- (b) Yes, because $0.5 + 0.4 = 0.9$
- (c) Yes, because $0.5 + 0.4 \neq 0.9$
- (d) No, because $0.5 \times 0.4 = 0.2$

10. Which of the following best describes the complement rule?

- (a) $P(A') = 1 - P(A)$
- (b) $P(A') = P(A \cap B)$
- (c) $P(A') = P(A)/P(B)$
- (d) $P(A') = 0$

Discrete Distributions

11. A binomial distribution requires:

- (a) Fixed number of trials and constant probability of success.
- (b) Trials that depend on each other.
- (c) An infinite number of possible outcomes.
- (d) Each trial having a changing probability.

12. Suppose $X \sim \text{Binomial}(n = 8, p = 0.3)$. What is $P(X = 0)$?

- (a) 0.7
- (b) 0.058
- (c) 0.0003
- (d) 0.9

13. A fair coin is flipped until a head appears. Let X = number of flips needed to get the first head. What is the probability that $X=3$?

- (a) 0.25
- (b) 0.125
- (c) 0.375
- (d) 0.5

14. Calls arrive at a help desk at an average rate of 4 per hour. Let X be the number of calls received in one hour. What is $P(X = 2)$?

- (a) $\frac{4^2 e^{-4}}{2!}$
- (b) $\frac{2^4 e^{-2}}{4!}$
- (c) $1 - e^{-4}$
- (d) $\frac{4^2}{2!}$

Continuous Distributions

15. A random variable $X \sim U(2, 10)$. What is the expected value of X ?

- (a) 4
- (b) 6
- (c) 8
- (d) 12

16. Based on #15, what is $P(X < 9)$?

- (a) 0.25
- (b) 0.5
- (c) 0.875
- (d) 1.00

17. Based on #15, Find the 80th percentile of X ?

- (a) 8.4
- (b) 8
- (c) 9.2
- (d) 6.5

18. For an exponential random variable with expected value 10, what is λ ?

- (a) 0.1
- (b) 10
- (c) 1
- (d) 0.01

19. A component's lifetime (in hours) follows $\text{Exp}(\lambda = 0.2)$. What is the mean life time?

- (a) 2
- (b) 5
- (c) 10
- (d) 20

20. If $X \sim N(120, 25)$, what is the z-score for $X = 130$?

- (a) 0.4
- (b) 0.2
- (c) 1
- (d) 2

21. A variable $X \sim N(50, 10)$. What is $P(X > 60)$?

- (a) $P(Z > 1)$
- (b) $P(Z > 0.5)$

- (c) $P(Z > 2)$
- (d) $P(Z > -1)$

22. $X \sim N(100, 16)$. Find $P(X < 108)$.

- (a) 0.841
- (b) 0.933
- (c) 0.691
- (d) 0.977

23. Heights of students follow $N(66, 4)$. What percentage are between 62 and 70 inches?

- (a) 68%
- (b) 95%
- (c) 34%
- (d) 84%

Central Limit Theorem

24. Which statements is TRUE according to the Central Limit Theorem?

- (a) The population must be normally distributed for the sample mean to be approximately normal.
- (b) For large n , the distribution of the sample mean is approximately normal, regardless of the population distribution.
- (c) The sample mean is exactly normal for any sample size n .
- (d) The CLT applies only when $\sigma^2 = 1$

25. The lifetime of a light bulb has mean 800 hours and standard deviation 100 hours. The distribution of lifetimes is not normal. A random sample of $n = 64$ bulbs is selected. What is approximately $P(\bar{X} > 820)$?

- (a) $P(Z > 0.2)$
- (b) $P(Z > 1.6)$
- (c) $P(Z > 2.0)$
- (d) $P(Z > 0.8)$