BUSINESS STATISTICS: FINAL MOCK EXAM

Time: 3 Hours — Total Questions: 20

Exam Instructions

- Show all work in the spaces provided to receive partial credit.
- You may use a standard Z-table and T-table where necessary.
- Round all final probabilities to four decimal places.

1. A manufacturer of lightbulbs claims that the average life of a bulb is 1,200 hours with a population standard deviation of 100 hours. You take a sample of 25 bulbs. What is the probability that the sample mean will be less than 1,150 hours?

2. An HR department classifies employees by their job level (Junior, Mid-Level, Senior) and their preferred work style (Remote, Hybrid, In-Office). Which scale of measurement applies to "Job Level"?

3. You are tasked with estimating the proportion of customers who will renew their subscriptions. You want a 95% confidence level with a margin of error of no more than 0.05. Since you have no prior data, calculate the required sample size (n).

4. A set of data contains the following observations: $\{5, 8, 12, 12, 15, 20, 50\}$. Identify any potential outliers using the $1.5 \times IQR$ rule.

5. The time between orders at an online pharmacy follows an exponential distribution with a mean of 5 minutes. What is the probability that the next order arrives in more than 10 minutes?

6. Consider two events, A and B. $P(A) = 0.45$, $P(B) = 0.35$, and $P(A|B) = 0.45$. Are these events independent? Explain why or why not.

7. A small company has 15 employees. You want to choose a committee of 3 to plan the holiday party. How many different committees can be formed?

8. In a sample of 16 coffee shops, the mean price of a latte was \$4.50 with a sample standard deviation of \$0.40. Construct a 90% confidence interval for the population mean price.

9. A distribution is "Skewed Left." Draw a rough sketch of this distribution and label where the Mean and Median would likely sit in relation to each other.

10. A factory produces 5% defective parts. If a quality control manager selects 10 parts at random, what is the probability that exactly 2 are defective?

MOCK EXAM: STEP-BY-STEP SOLUTIONS

S1. (Sampling Distribution):

- $\mu = 1200, \sigma = 100, n = 25$.
- $SE = 100/\sqrt{25} = 20$.
- $z = (1150 - 1200)/20 = -2.5$.
- From Z-table, $P(Z < -2.5) = \mathbf{0.0062}$.

S2. (Data Scales): Ordinal. (There is a clear rank/hierarchy, but the "distance" between Junior and Mid-level is not numerically defined).

S3. (Sample Size):

- Use $p^* = 0.50$ (no prior info), $z = 1.96$ (95% CI), $E = 0.05$.
- $n = (1.96^2 \times 0.5 \times 0.5)/0.05^2 = \mathbf{385}$ (rounded up).

S4. (Outliers):

- $Q_1 = 8, Q_3 = 20$. $IQR = 12$.
- Upper Limit $= 20 + (1.5 \times 12) = 38$.
- Lower Limit $= 8 - (1.5 \times 12) = -10$.
- **50** is an outlier (it is above 38).

S5. (Exponential):

- $P(X > 10) = e^{-(10/5)} = e^{-2} \approx \mathbf{0.1353}$.

S6. (Independence): Yes. $P(A|B) = P(A) = 0.45$. Since the occurrence of B did not change the probability of A, they are independent.

S7. (Counting): $\binom{15}{3} = (15 \times 14 \times 13)/(3 \times 2 \times 1) = \mathbf{455}$ ways.

S8. (T-Interval):

- $df = 15$. t-value for 90% (0.05 tail) $= 1.753$.
- $SE = 0.40/\sqrt{16} = 0.10$.
- Error $= 1.753 \times 0.10 = 0.1753$.
- CI $= 4.50 \pm 0.1753 \rightarrow [\$\mathbf{4.32}, \$\mathbf{4.68}]$.

S10. (Binomial):

- $n = 10, x = 2, p = 0.05, (1 - p) = 0.95$.
- $f(2) = \binom{10}{2}(0.05^2)(0.95^8) = 45 \times 0.0025 \times 0.6634 = \mathbf{0.0746}$.