Q#1(12%): Circle the correct answer

1. One of the following is true
    a) If $P(A) = 0.4$ and $P(B) = 0.6$, then A and B must be mutually exclusive.
    b) If $P(A$ or $B) = 1$, then A and B must be mutually exclusive.
    c) If either A or B must occur they are called mutually exclusive.
    d) If A and B cannot occur at the same time they are called mutually exclusive

2. What type of data would answer the following question: How much gas do you use per week?
    a) Quantitative Discrete
    —b) Quantitative Continuous
    c) Qualitative

3. You are interested in the average amount of money a Ramallah family of 5 spends on groceries each month. You will survey 50 families of size 5. Which type of sampling technique does the following method represent?
Call 50 of your parents' friends who have a family of size 5 and ask them.
    a) Stratified
    b) Cluster
    c) Convenience
    d) Systematic

4. The Z score of an observation measures how many standard deviations is the value from the mean
    —a) True
    b) False

5. According to the Chebyshev's rule, at least 84% of all observations in any data set are contained within a distance of how many standard deviations around the mean?
    a) 2
    b) 2.5
    c) 1.5
    d) 3

6. The value of one score in a distribution is changed from $X = 20$ to $X = 30$. Which measure(s) of central tendency is/are certain to be changed?
    a) the mean and the median
    —b) the mean
    c) the median
    d) the mode

7. A market researcher computed a confidence interval for a population proportion using a 99% confidence level. Her boss decided that she wanted a 95% confidence level instead. The new interval with 95% confidence level will be wider than the original one with a 99% confidence level.
    a) True
    —b) False

8. Which of the following p-values will lead us to reject the null hypothesis if the level of significance equals 0.05?
    a) 0.065
    b) 0.150
    c) 0.100
    —d) 0.001

9. The coefficient of variation measures variability in a data set relative to the size of the median
    a) True
    —b) False

10. Which of the following statistics are resistant to outliers?
   I. The median
   II. The standard deviation
   III. The interquartile range
   a) I and II only
   b) I and III only
   c) II and III only
   - d) I, II, and III
   e) None of the above.

- 11. A correlation of r = - 0.35 indicates that the scatter diagram of the data would show
   a) Points tightly packed around a line that slopes up to the right.
   → b) Points tightly packed around a line that slopes down to the right.
   c) Points widely scattered around a line that slopes up to the right.
   · d) Points widely scattered around a line that slopes down to the left.

12. If a hypothesis test leads to the rejection of the null hypothesis
   a) a Type I error may have been committed
   b) a Type II error must have been committed
   c) a Type II error may have been committed
   → d) a Type I error must have been committed

Q#2 (40%): Circle the correct answer. *Justify* your answer

(1 – 2)The time, measured in minutes, that a student gets help from a certain math TA at mathematics department follows an exponential distribution with mean of 5 minutes.

1. Find the probability that a student spends less than 10 minutes getting help from this teacher.
   → a) 0.8647
   b) 0.5353
   c) 0.8521
   d) 0.1353

2. 25% of the students get help from this TA for at most how long?
   a) 6.93 min.
   → b) 1.43 min.
   c) 0.06 min.

3. The mean of a sample values: 3, 5, 12, 3 and 2 is
   a) 25
   b) 4.18
   c) 4
   d) 17.5
   → e) 5

4. The median of a sample values: 1, 5, 12, 3 and 4 is
   a) 25
   b) 4.18
   → c) 4
   d) 17.5
   e) 5

5. The variance of a sample values: 1, 5, 12, 3 and 4 is
   a) 25
   b) 4.18
   c) 4
   → d) 17.5
   e) 5

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6. Calculate the Interquartile Range (IQR) for the following numbers: 1, 4, 7, 11, and 12.
   a) 3
   b) 7
   c) 4
   d) 5

1, 4, 7, 11, 12.

7. In a sample of 400 voters, 360 indicated they favor XY brand of energy drink. The 99% confidence interval of voters not favoring XY brand of energy drink is
   a) 0.871 to 0.929
   b) 0.061 to 0.139
   c) 0.765 to 0.835
   d) 0.071 to 0.129
   e) None of the above

$E \cap F$

$P(E \cup F) \leq P(E) + P(B) - P(A)$

8. If E and F are events with P (E AND F) = 0.1, P (E | F) = 0.25, and P (F | E) = 0.2, find P(E OR F).
   a) 0.4
   b) 0.32
   c) 0.2
   d) 0.8

$P(E/F) = \dfrac{P(E \cap F)}{P(F)}$

$P(F/E) \leq \dfrac{P(F \cap E)}{P(E)}$

9. In a single-sample t - test, what is the respective critical value for:
   α = 0.05, n=10, one - tailed test?
   a) 1.41
   b) 1.833
   c) 2.262

$t \geq t_d$

(10 – 12) The monthly telephone expenditure of a student of BZU is uniformly distributed from 20 NIS to 70 NIS. One student of BZU is randomly selected. (Let X = the monthly telephone expenditure of a student of BZU).

10. Find the probability that the expenditure of the selected student is less than 50 NIS
    a) 0.2
    b) 0.8
    c) 0.4
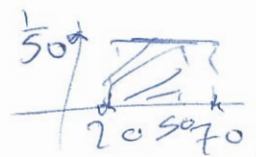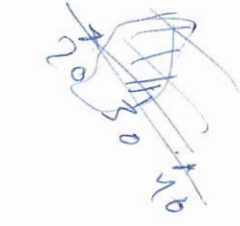   d) 0.6

$P(X < 50)$ $\left(\dfrac{40}{100}\right)n$

$\begin{cases}\dfrac{1}{b-a} & a \leq x \leq 1 \\ 0 & \text{elswh}\end{cases}$

11. The 40th percentile of the expenditure of a student of BZU is:
    a) 60 NIS
    b) 56 NIS
    c) 38 NIS
    d) 40 NIS

$P_{40} =$

$P(A) P(B)$

12. Find the probability that the income of the selected citizen is less than 30 NIS, GIVEN that it is less than 40 NIS.
    a) 0.2
    b) 0.66
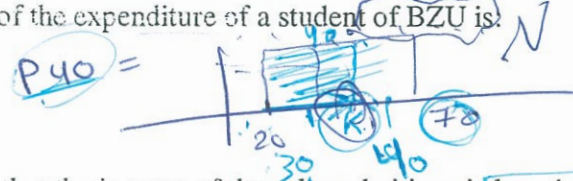   c) 0.34
    d) 0.5
    e) None of the above

$P(X < 30 | X < 40)$

$\dfrac{P(A \cap B)}{P(B)}$

$P(X < 40) = P(X < 30)$

$\dfrac{1}{50}(40 - 20) = \dfrac{1}{50}(40 - a)$

13. A certain type of new business succeeds 60% of the time. Suppose that 4 such businesses open (where they do not compete with each other, so it is reasonable to believe that their relative successes would be independent) , the probability that all 4 businesses fail is
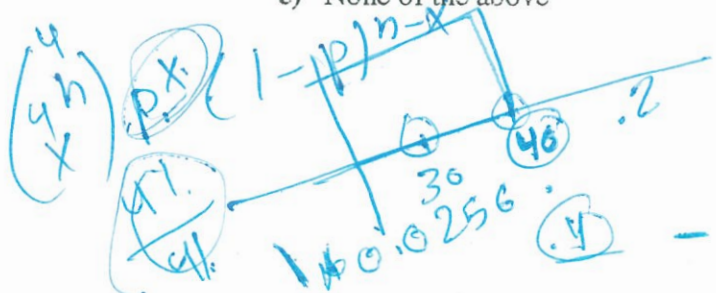   a) 0.0256
    b) 0.9744
    c) 0.1296
    d) 0.8704
    e) None of the above

$\dfrac{40}{10\%}$　40%　$\dfrac{40}{.40} = \dfrac{1}{50}$　$(K - 20)$　$\dfrac{.4 - .2}{\leq .2}$

$K - 20 = \dfrac{.50}{50} + 20$

$+ \dfrac{20}{50}$

$\binom{4}{X}P^X(1-P)^{n-X}$

$0.8 \leq \dfrac{K}{50} \times 5$

$40\% \quad .2$

$30 \quad 46 \quad .0256 \quad (.4) - (2)$

(14 – 16) Assume that the hourly number of customers served by the TNB Bank is 16 customers. Let X be the number of customers served hourly.

14. What is the name of the probability distribution of the number of customers served hourly
    a) Binomial
    • b) Exponential
    c) Uniform
    —d) Poisson

15. What is the probability that on any given 15 minutes period this bank will serve more than 2 customers?
    a) 0.0916
    b) 0.7619
    c) 0.9084
    d) 0.2381
    e) None of the above

- 16. What is the expected number of customers served by this bank in two work days (eight hours daily)
    • a) 256
    b) 80
    c) 128
    d) None of the above

17. A sample of size 50 is taken from an infinite population whose mean and standard deviation are 68 and 12, respectively. The probability that the sample mean is larger than 66 equals
    a) 11.96%
    b) 60%
    c) 88.04%
    d) 40%
    e) None of the above

18. Suppose $P(A) = 0.50$, $P(B) = 0.75$, and A and B are independent. The probability of the complement of the event (A and B) is:
    a) 0.125
    → b) 0.625
    c) 0.75
    d) 0.25

$$P(A \cap B) = (0.50)(0.75) = 0.375$$
$$1 - 0.375 = 0.625$$

(19 – 20) At a computer manufacturing company, the actual size 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.

19. What is the probability that the sample mean will be between 0.98 and 1.02 centimeters?
    a) 0.4902
    b) 0.2736
    c) 0.5098
    d) 0.9024
    —• e) None of the above

. 20. Above what value do 5% of the sample means fall?
    a) 1.2
    b) 1.057
    c) 0.94
    d) 1.047
    e) None of the above

$$\bar{x} \pm Z_{\frac{\alpha}{2}} \cdot \frac{\sigma}{\sqrt{n}}$$

Q#3(20%): *Short answers*

1. In order to estimate the average time spent on the computer terminals per student at a BZU, data were collected for a sample of 81 business students over a one week period. Assume the population standard deviation is 1.8 hours. If the sample mean is 9 hours, then the 95% confidence interval is

$$1 - \alpha = 0.95 \Rightarrow \frac{\alpha}{2} = .025 \Rightarrow Z_{0.025} = 196$$

$$9 \pm 1.96 \left(\frac{1.8}{\sqrt{81}}\right) \Rightarrow (8.608, 9.392).$$

2. According to a survey of 320 BZU students who drive, 40 students have been involved in some type of car accident (minor to major).Construct a 99% Confidence Interval for the true proportion of BZU students that drive who have been involved in some type of car accident (minor to major).

3. A survey organization would like to estimate a population percentage in a large population to an accuracy of 15 percentage points with 95% confidence. They have no current knowledge of the size of the population percentage. How large should a random sample be selected to achieve their goal for the margin of sampling error?

4. A survey of 16 doctors selected at random revealed that the average annual consumption of aspirin tablets per doctor was 100 with a standard deviation of 32. Establish 95% confidence limits for the average annual consumption of aspirin tablets of all doctors. (Assume that the population is normal).

5. A student believes that no more than 70% of the students who finish a stat 236 course will pass the course. A random sample of 150 students was taken. Thirty six of the students in the sample passed. Using the *p*-value approach, test the hypotheses at the 1% level of significance.

Q#4(20%): Show all your work

Trying to encourage people to stop driving to campus, the university claims that on average it takes people 30 minutes to find a parking space on campus. I don't think it takes so long to find a spot. In fact I have a sample of the last **five** times I drove to campus, and I calculated $\bar{x} = 24\text{minutes}$. Assuming that the time it takes to find a parking spot is normal, and that $\sigma = 8 \text{ minutes}$. Perform a hypothesis test with 1% significant level to see if the claim is correct.

1) State the null and alternative hypotheses for this test.

    Ho

    Ha

2) What is (are) the critical value (s)? What is the rejection rule?

3) Calculate the appropriate test statistic

4) Find the p-value

5) What is your conclusion:

6) What is your decision if the significant level is changed to 10%?

7) Construct and **interpret** the 98% confidence interval for the population mean.