QUESTIONS:

1. **Fill in the blank: The _____ value of the normal distribution is a measure of the central tendency & often exists at the peak & centerline of the distribution.**
   - Mean
   - Range
   - Cumulative Probability
   - Probability Density

2. **You manufacture a component whose critical feature follows the normal distribution with a mean value of 5.0, and a standard deviation of 0.25. What is the Z-score associated with the outcome of 4.75?**
   - 1.0
   - 0.33
   - -1.0
   - -0.5

3. **Fill in the blank: _____ is a measure of the location of the mode in relationship to the mean when data is normally distributed.**
   - Kurtosis
   - The Mean Value
   - The Median Value
   - Skewness

4. **You manufacture a component whose critical feature follows the normal distribution with a mean value of 20, and a standard deviation of 2. What is the Z-score associated with the outcome of 23?**
   - 0.5
   - 1.0
   - 1.5
   - 2.0

5. **Fill in the blank: _____ provides a measure of the peakness or flatness of the normal distribution.**
   - Kurtosis
   - The Mean Value
   - The Median Value
   - Skewness

6. **You manufacture a component whose critical feature follows the normal distribution with a mean value of 10, and a variance of 4. What is the Z-score associated with the outcome of 12?**
    - 0.5
    - 1.0
    - 1.5
    - 2.0

7. **Fill in the blank: _____ is the concept that, between trials in an experiment, the results of the 1st experiment do not affect the results of the 2nd experiment.**
    - Constant probability of occurrence
    - Independence
    - Fixed Trials
    - Identical Trials

8. **You manufacture a component whose width feature follows the normal distribution with a mean value of 100, and a variance of 9. What is the Z-score associated with the outcome of 91?**
    - -1.0
    - -2.0
    - -3.0
    - -4.0

9. **Fill in the Blank: The _____ is a statistic that represents in some way, the central value of a data set.**
    - Standard Deviation
    - Variation
    - Central Tendency
    - 95% Confidence Interval

10. **You're preparing for an upcoming production run where the likelihood (probability) of defect A is known to be 7%, and the likelihood of defect B is 4%; and an overlapping 2% had both defect A & defect B. Both of these defects can be reworked. What is the total percentage of product that should be planned to be reworked?**
    - 7%
    - 9%
    - 11%
    - 13%

11. **Fill in the blank: _____ is defined as the likelihood (or chance) that an event will occur.**
    - Quantitative Analysis
    - Probability
    - Qualitative Analysis
    - Conditional Probability

12. **What is the probability of having a z-score greater than zero?**
    - 0%
    - 25%
    - 50%
    - 75%

13. **Fill in the blank: A(n) _____ is defined as a single outcome or collection of outcomes that might occur during an experiment.**
    - Outcome
    - Sample Space
    - Event
    - Union

14. **If you simultaneously flipped a coin and rolled a single six-sided die, what is the probability that the coin lands on heads and the die lands on a 4?**
    - 4%
    - 8%
    - 16%
    - 32%

15. **If the probability of event A is P(A) = 70% and the probability of event B is P(B) = 40% and the intersection of A &B is P(A ∩ B) = 30%. If I told you that Event B had occurred, what is the probability that Event A has also occurred?**
    - 30%
    - 45%
    - 50%
    - 75%

SOLUTIONS:

1. **Fill in the blank: The _____ value of the normal distribution is a measure of the central tendency & often exists at the peak & centerline of the distribution.**
   - **Mean**
   - Range
   - Cumulative Probability
   - Probability Density

2. **You manufacture a component whose critical feature follows the normal distribution with a mean value of 5.0, and a standard deviation of 0.25. What is the Z-score associated with the outcome of 4.75?**
   - 1.0
   - 0.33
   - **-1.0**
   - -0.5

$$Z = \frac{X - \mu}{\sigma} = \frac{4.75 - 5}{0.25} = -1.0$$

3. **Fill in the blank: _____ is a measure of the location of the mode in relationship to the mean when data is normally distributed.**
   - Kurtosis
   - The Mean Value
   - The Median Value
   - **Skewness**

4. **You manufacture a component whose critical feature follows the normal distribution with a mean value of 20, and a standard deviation of 2. What is the Z-score associated with the outcome of 23?**
   - 0.5
   - 1.0
   - **1.5**
   - 2.0

$$Z = \frac{X - \mu}{\sigma} = \frac{23 - 20}{2} = 1.5$$

5. **Fill in the blank: _____ provides a measure of the peakness or flatness of the normal distribution.**
   - **Kurtosis**
   - The Mean Value
   - The Median Value
   - Skewness

6. **You manufacture a component whose critical feature follows the normal distribution with a mean value of 10, and a variance of 4. What is the Z-score associated with the outcome of 12?**
   - 0.5
   - **1.0**
   - 1.5
   - 2.0

$$Z = \frac{X - \mu}{\sigma} = \frac{12 - 10}{2} = 1.0$$

We're given the variance ($\sigma^2 = 4$). To find the standard deviation (σ) we simply take the square root ($\sigma = 2$).

7. **Fill in the blank: _____ is the concept that, between trials in an experiment, the results of the 1st experiment do not affect the results of the 2nd experiment.**
   - Constant probability of occurrence
   - **Independence**
   - Fixed Trials
   - Identical Trials

8. **You manufacture a component whose width feature follows the normal distribution with a mean value of 100, and a variance of 9. What is the Z-score associated with the outcome of 91?**
   - -1.0
   - -2.0
   - **-3.0**
   - -4.0

$$Z = \frac{X - \mu}{\sigma} = \frac{91 - 100}{3} = -3.0$$

We're given the variance ($\sigma^2 = 9$). To find the standard deviation (σ) we simply take the square root ($\sigma = 3$).

9. **Fill in the Blank: The _____ is a statistic that represents in some way, the central value of a data set.**
   - Standard Deviation
   - Variation
   - Central Tendency
   - 95% Confidence Interval

10. **You're preparing for an upcoming production run where the likelihood (probability) of defect A is known to be 7%, and the likelihood of defect B is 4%; and an overlapping 2% had both defect A & defect B. Both of these defects can be reworked. What is the total percentage of product that should be planned to be reworked?**
    - 7%
    - **9%**
    - 11%
    - 13%

    In this situation the following information is true:

    P(A) = 7%

    P(B) = 4%

    $$P(A \cap B) = P(A \,\&\, B) = 2\%$$

    Therefore, the probability of either event occurring, thus requiring rework follows the Addition Rule:

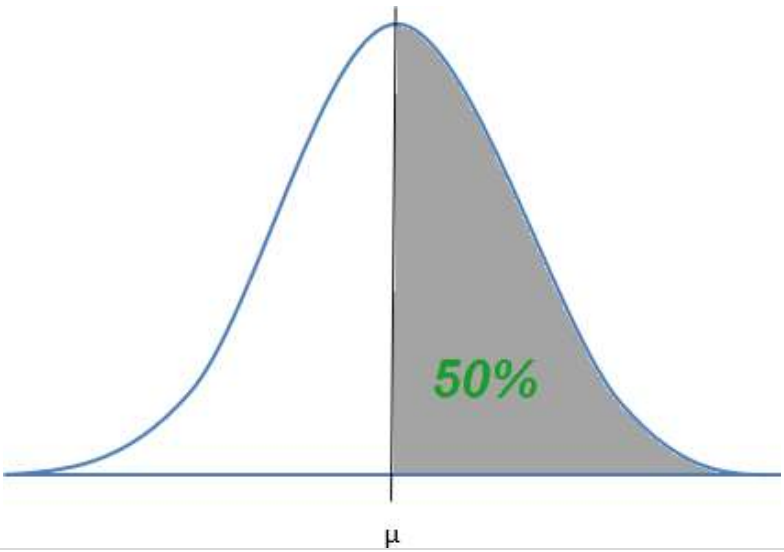
    $$\mathbf{P(A \cup B) = P(A) + P(B) - P(A \cap B) = 7\% + 4\% - 2\% = 9\%.}$$

11. **Fill in the blank: _____ is defined as the likelihood (or chance) that an event will occur.**
    - Quantitative Analysis
    - **Probability**
    - Qualitative Analysis
    - Conditional Probability

12. **What is the probability of having a z-score greater than zero?**
    - 0%
    - 25%
    - **50%**
    - 75%

    The normal distribution is symmetric around the mean.

    This means that 50% of the distribution is greater than the mean, and 50% is less than the mean.



13. **Fill in the blank: A(n) _____ is defined as a single outcome or collection of outcomes that might occur during an experiment.**
    - Outcome
    - Sample Space
    - **Event**
    - Union

14. **If you simultaneously flipped a coin and rolled a single six-sided die, what is the probability that the coin lands on heads and the die lands on a 4?**
    - **4%**
    - **8%**
    - **16%**
    - **32%**

    Because these two events are independent, and we're looking for the probability of occurrence of both events, we can use the Multiplication Rule for Independent Events:

    The Multiplication Rule for Independent Events: P(A ∩ B) = P(A) * P(B)

    We can also define our Events as:

    Event A: Coin lands on Heads, P(A) = 50%

    Event B: Die lands on a 4, P(B) = 1/6 = 16%

    P(A ∩ B) = 50% * 16% = 8%

15. **If the probability of event A is P(A) = 70% and the probability of event B is P(B) = 40% and the intersection of A &B is P(A ∩ B) = 30%. If I told you that Event B had occurred, what is the probability that Event A has also occurred?**
    - **30%**
    - **45%**
    - **50%**
    - **75%**

    This is a conditional probability problem that can be read as the Probability of A given that B has occurred. We can solve this problem using the equation below:

$$P(A|B) = \frac{P(A \text{ and } B)}{P(B)} = \frac{30\%}{40\%} = \frac{3}{4} = 75\%$$