**APTITUDE QUESTIONS**

**PROBABILITY**

Probability is a branch of study that deals with the quantification and analysis of uncertainty and randomness.

Probability is often represented as a number between 0 and 1, where 0 indicates impossibility and 1 indicates certainty.

The theory of probability involves analysing the underlying principles and rules that govern random events.

It utilizes mathematical tools, such as combinatorics, set theory, and calculus, to model and calculate probabilities.

**QUESTIONS**

1. Question about Probability of an Event:
   * A fair six-sided die is rolled. What is the probability of rolling an even number?

Solution: The total number of possible outcomes is 6 (since there are 6 sides on the die), and the favourable outcomes are 3 (the even numbers 2, 4, and 6). Therefore, the probability of rolling an even number is:

P(Even) = Number of favourable outcomes / Total number of possible outcomes

= 3 / 6

= 1/2 or 0.5

1. Question about Complementary Probability:
   * In a deck of 52 playing cards, what is the probability of drawing a card that is not a heart?

Solution: There are 52 cards in a deck, and 13 of them are hearts. So, the number of cards that are not hearts is 52 - 13 = 39. Therefore, the probability of drawing a card that is not a heart is:

P(Not Heart) = Number of favourable outcomes / Total number of possible outcomes

= 39 / 52

= 3/4 or 0.75

1. Question about Addition Rule for Disjoint Events:
   * A bag contains 5 red marbles and 3 blue marbles. What is the probability of drawing either a red or a blue marble?

Solution: The probability of drawing a red marble is 5/8, and the probability of drawing a blue marble is 3/8. Since red and blue marbles are mutually exclusive (disjoint), the probability of drawing either a red or a blue marble is simply the sum of their individual probabilities:

P(Red or Blue)

= P(Red) + P(Blue)

= 5/8 + 3/8

= 8/8

= 1

1. Question about Addition Rule for Independent Events:
   * A jar contains 10 red balls and 8 blue balls. If two balls are drawn without replacement, what is the probability of drawing at least one red ball?

Solution: To find the probability of drawing at least one red ball, we can find the probability of drawing two blue balls and subtract it from 1. When drawing without replacement, the probability of drawing a blue ball on the first draw is 8/18, and the probability of drawing another blue ball on the second draw (since there are now 17 balls remaining, with 7 of them being blue) is 7/17.

Therefore, the probability of drawing two blue balls is (8/18) \* (7/17) = 56/306.

Thus, the probability of drawing at least one red ball is:

P(At least one red)

= 1 - P(Two blue)

= 1 - (56/306)

= 250/306

≈ 0.817

1. Question about Multiplication Rule for Independent Events:
   * A fair coin is flipped twice. What is the probability of getting heads on both flips?

Solution: Since each flip of the coin is independent, the probability of getting heads on each flip is 1/2. Applying the multiplication rule, the probability of getting heads on both flips is:

P(Heads on both flips)

= P(Heads on the first flip) \* P(Heads on the second flip)

= 1/2 \* 1/2

= 1/4 or 0.25

**TIME AND WORK**

1. Question on Individual Work Rate:
   * John can complete a task in 6 hours. What is John's work rate?

Solution: John's work rate is calculated using the formula:

Work Rate = 1 / Time Given that John can complete the task in 6 hours, his work rate is:

Work Rate = 1 / 6

= 1/6 or 0.1667

1. Question on Combined Work Rate:
   * If two workers, A and B, can complete a task in 4 hours and 6 hours respectively, what is their combined work rate when they work together?

Solution: The combined work rate is calculated using the formula: Combined Work Rate = (1 / Time1) + (1 / Time2)

Given that worker A can complete the task in 4 hours and worker B can complete it in 6 hours, their combined work rate is:

Combined Work Rate = (1 / 4) + (1 / 6)

= (3/12) + (2/12)

= 5/12 or 0.4167

1. Question on Time Required for Combined Work:
   * If the combined work rate of three workers, A, B, and C, is 1/4, 1/6, and 1/8 respectively, how long will it take them to complete the task if they work together?

Solution: The time required for the combined work is calculated using the formula:

Time = 1 / Combined Work Rate Given that the combined work rate of workers A, B, and C is 1/4, 1/6, and 1/8 respectively, the time required to complete the task when they work together is:

Time = 1 / (1/4 + 1/6 + 1/8)

= 1 / (3/12 + 2/12 + 1/12)

= 1 / (6/12)

= 2 hours

1. Question on Efficiency Comparison:
   * Worker A completes a task in 5 days, and worker B completes the same task in 8 days. Whose efficiency is higher?

Solution: Efficiency is calculated using the formula:

Efficiency = Work Done / Time Taken Comparing worker A and worker B, their efficiencies can be calculated as follows:

Efficiency of worker A = 1 / 5

= 1/5 or 0.2

Efficiency of worker B = 1 / 8

= 1/8 or 0.125

Since 0.2 > 0.125, worker A has a higher efficiency than worker B.

1. Question on Ratio of Work:
   * Worker X completes a task in 10 days, while worker Y completes the same task in 12 days. What is the ratio of their work rates?

Solution: The ratio of work rates can be calculated using the formula: Ratio of Work Rates = Work Done by Worker X / Work Done by Worker Y Given that worker X completes the task in 10 days and worker Y completes it in 12 days, the ratio of their work rates is:

Ratio of Work Rates = 12 / 10

= 6/5 or 1.2

**SYLLOGISM**

1. Question on Categorical Syllogism: Premise 1: All mammals are animals. Premise 2: All dogs are mammals. Conclusion: Therefore, all dogs are animals. Determine whether the conclusion follows logically from the premises.

Solution: This syllogism follows the standard form and is a valid categorical syllogism. The conclusion logically follows from the premises because it combines the information that all mammals are animals and all dogs are mammals. Therefore, the conclusion is true.

1. Question on Validity: Premise 1: All birds can fly. Premise 2: Penguins are birds. Conclusion: Therefore, penguins can fly. Determine whether the conclusion follows logically from the premises.

Solution: This syllogism follows the standard form but is invalid. The conclusion does not logically follow from the premises because while all birds can fly, penguins are an exception as they cannot fly. Therefore, the conclusion is false.

1. Question on Mood and Figure: Premise 1: No reptiles are mammals. Premise 2: All snakes are reptiles. Conclusion: Therefore, no snakes are mammals. Identify the mood and figure of this syllogism.

Solution: The mood of this syllogism is EAE (E: No reptiles are mammals, A: All snakes are reptiles, E: No snakes are mammals), and the figure is Figure I. Identifying the mood and figure helps in evaluating the validity of the syllogism.

1. Question on Middle Term: Premise 1: All doctors are professionals. Premise 2: Some professionals are wealthy. Conclusion: Therefore, some doctors are wealthy. Identify the middle term in this syllogism.

Solution: The middle term in this syllogism is "professionals." It appears in both premises but not in the conclusion. The middle term connects the major term ("wealthy") and the minor term ("doctors").

1. Question on Invalid Syllogism: Premise 1: Some cats are mammals. Premise 2: All mammals can swim. Conclusion: Therefore, some cats can swim. Determine whether this syllogism is valid or invalid.

Solution: This syllogism is invalid. While it follows the standard form, the conclusion does not logically follow from the premises. The fact that some cats are mammals and all mammals can swim does not guarantee that some cats can swim. Therefore, the conclusion is not necessarily true.

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