

--Question Starting--

Match the following digital logic components with their respective Boolean simplifications or functions:

1. Logic Gate Expression/Function

- I. NAND A. Produces high output only when all inputs are high
- II. XOR B. Output is true when an odd number of inputs are true
- III. NOR C. Outputs true only when all inputs are false
- IV. AND D. Outputs true only when all inputs are true

Choose the correct answer from the options given below:

- (1) I-D, II-B, III-C, IV-A
- (2) I-A, II-C, III-D, IV-B
- (3) I-B, II-A, III-C, IV-D
- (4) I-C, II-D, III-A, IV-B

Answer Key: 3

Solution:

? NAND: The negation of AND, which outputs false only when all inputs are true, thus its Boolean expression is $(AB)'$.

? XOR: Outputs true when an odd number of inputs are true; its Boolean function is $A \oplus B$.

? NOR: Outputs true only when all inputs are false; its Boolean expression is $(A+B)'$.

? AND: Outputs true only when all inputs are true; Boolean expression is AB .

Matching these, option (3) correctly aligns each component with its function.

Hence, Option (3) is the right answer.

--Question Starting--

2. Match the following counting principles and probability concepts with their descriptions:

A. Pigeonhole Principle B. Mathematical Induction C. Bayes' Theorem D. Inclusion-Exclusion Principle

- 1. States that if n objects are placed into m boxes, and $n > m$, then at least one box contains more than one object.
- 2. A method for proving the truth of an infinite sequence of propositions by verifying a base case and an inductive step.
- 3. Provides a way to update the probability estimate for an event based on new evidence.
- 4. Calculates the size of the union of multiple sets by subtracting overlaps.

Choose the correct answer from the options given below:

- (1) A-2, B-1, C-3, D-4
- (2) A-1, B-2, C-4, D-3
- (3) A-1, B-2, C-3, D-4
- (4) A-2, B-1, C-4, D-3

Answer Key: 2

Solution:

? Pigeonhole Principle (A): Asserts that placing n objects into m boxes with $n > m$ guarantees at least one box contains multiple objects.

? Mathematical Induction (B): A proof technique establishing the truth for all natural numbers via base case and inductive step.

? Bayes' Theorem (C): Updates prior probabilities based on new evidence, enabling posterior probability calculation.

? Inclusion-Exclusion (D): A combinatorial formula for calculating the union of multiple sets by accounting for overlaps.

Matching these descriptions, option (2) correctly pairs each concept.

Hence, Option (2) is the right answer.

--Question Starting--

3. Match the following control unit design aspects with their descriptions:

- 1. Control Memory A. Stores the microinstructions governing control signals
- 2. Address Sequencing B. Determines the order of microinstructions execution

3. Design of Control Unit C. Involves creating logic circuits for generating control signals

Choose the correct answer from the options given below:

(1) 1-C, 2-B, 3-A

(2) 1-B, 2-C, 3-A

(3) 1-A, 2-B, 3-C

(4) 1-C, 2-A, 3-B

Answer Key: 3

Solution:

? Control Memory: Stores microinstructions that specify control signals at each step.

? Address Sequencing: Manages the order in which microinstructions are fetched and executed.

? Design of Control Unit: Involves designing the logic circuits such as finite state machines to generate control signals based on microinstructions.

Matching these, option (3) correctly aligns each aspect.

Hence, Option (3) is the right answer.