Roll Number:

Name:

Section:

Indian Institute of Information Technology, Sri City, Chittoor

Monsoon Semester Schedule Quiz 1, October-2024

UG1, First Sem

Name of the Exam: DSMA SQ1 S1 **Duration: 20 Minutes**

October 3, 2024 **Max. Marks:** 15

Instructions:

1. *Calculators are allowed.*
2. *All questions are mandatory and carry equal mark.*
3. *Tick only the right option. If we find two ticks for one question, '0' marks will be awarded.*
4. *Rough work should not be done in the question paper.*
5. *Return the question paper along with the rough sheet before leaving the exam hall.*

---

1. **Given two sets A and B such that $|A| = |B| = n$ and $A \cap B = \emptyset$, what is the cardinality of the set $A \cup B$?**

   (a) n

   (b) $2n$

   (c) n^2

   (d) $n(n-1)$

2. **If $f : A \to B$ and $g : B \to C$ are both injective functions, which of the following is necessarily true about $g \circ f$?**

   (a) $g \circ f$ is injective but not surjective

   (b) $g \circ f$ is surjective but not injective

   (c) $g \circ f$ is both injective and surjective

   (d) $g \circ f$ is injective

3. **Which of the following is a characteristic of a countable set?**

(a) Every subset of a countable set is finite
(b) A countable set must be finite
(c) A countable set is either finite or has a bijection with $\mathbb{N}$
(d) A power set of a countable set is countable

4. **Consider the following recursive definition of a function: $f(0) = 1$, and $f(n) = 3f(n-1) + 1$. What is $f(n)$ in terms of n?**

   (a) $f(n) = 3^n + n$
   (b) $f(n) = 3^{n+1} - 2$
   (c) $f(n) = 3n + 1$
   (d) $f(n) = 3^n - 1$

5. **Consider a recursively defined set S such that:**

   - $1 \in S$
   - If $x \in S$, then $x + 1 \in S$

   Which of the following is true about the set S?

   (a) S contains only even numbers.
   (b) $S = \mathbb{N}$, the set of natural numbers.
   (c) S is finite.
   (d) S contains only powers of 2.

6. **Which of the following statements about recursive algorithms is false?**

   (a) A recursive algorithm must always have a base case.
   (b) A recursive algorithm can always be transformed into an iterative algorithm.
   (c) Recursive algorithms can solve problems where the problem size is reduced at each step.
   (d) Recursive algorithms are always faster than their iterative counterparts.

7. **In a proof by strong induction, which of the following steps is necessary but not in a standard proof by induction?**

   (a) Prove the base case for $n = 1$.
   (b) Assume the statement is true for $n = k$.
   (c) Assume the statement is true for all $k \leq n$ when proving for $n + 1$.
   (d) Prove that $P(k + 1)$ follows from $P(k)$.

8. **Which of the following statements about structural induction is true?**

   (a) Structural induction is commonly used to prove sequences of real numbers.

   (b) Structural induction is a variation of mathematical induction that applies to recursively defined structures.

   (c) Structural induction requires proving a property for all elements less than n.

   (d) Structural induction can only be applied to finite sets of numbers.

9. **Let p and q be two propositional variables, then which of the following is a tautology?**

   (a) $p \wedge q$

   (b) $p \implies q$

   (c) $p \vee q$

   (d) $(p \vee q) \vee \neg q$

10. **Let p and q be two propositional variables, when will $p \wedge q$ and $p \vee q$ have same truth value?**

    (a) p and q are having same truth value

    (b) p and q are having different truth value

    (c) p is negation of q

    (d) none of the above

11. **The premises $(p \wedge q) \vee r$ and $r \implies s$ imply which of the conclusion?**

    (a) $p \vee r$

    (b) $q \vee s$

    (c) $q \vee r$

    (d) $p \vee q$

12. **Inverse of conditional statement is _____ of converse**

    (a) negation

    (b) equivalence

    (c) contrapositive

    (d) none of the above

13. $\vee$ **has precedence over**

    (a) $\wedge$

    (b) $\neg$

    (c) $\implies$

(d) none of the above

14. **Which of the following can only be used in disproving the statements?**

  (a) Direct proof
  (b) Contrapositive proofs
  (c) Counter Example
  (d) Mathematical Induction

15. **Express "The difference of a real number and itself is zero" using required operators.**

  (a) $\forall x \exists y (x - y = 0)$
  (b) $\forall x \forall y (x - y = 0)$
  (c) $\exists x (x - x = 0)$
  (d) $\forall x (x - x = 0)$

******