

The Open University of Sri Lanka
 B.Sc. Degree Programme: Level 05
 Department of Computer Science
 CSU 5304- Mathematics for Computing
 Final Examination-2025/26
 Duration: Two Hours Only (2 Hours)



Date: 09.01.2026

Time: 2.00 pm-4.00 pm

Answer Four (04) Questions only.

QUESTION 1

- i. Give the definition of a **function** in the context of mathematics.
- ii. A function is defined by $f(x)=2x^2-2x^3$; $x \in \mathbb{R}$. Calculate the value of $f(-5)$.
- iii. Given that $h(x)=\frac{2x}{5}+7$ and $g(x)=10x^2-15$ for all $x \in \mathbb{R}$. Find $h \circ g(x)$. Give your answer in the form of ax^2+b where a and b are integers.
- iv. Given below are the coordinates of a graph.
 $\{(2, -3), (4,6), (3, -1), (6,6), (2,3)\}$
 - a) Write the two sets domain and image set.
 - b) Is the relation given above a function? Justify your answer.
- v. If $k(x)=(x-9)$; $x \in \mathbb{R}$. Find $k^{-1}(x)$. What is the domain and the codomain of $k^{-1}(x)$?

(25 marks)

QUESTION 2

- i. What is meant by:
 - a) A rectangular matrix
 - b) Row vector
 - c) Column vector
 - d) Orthogonal matrix

(Warning: Do not take any examples for explanation)
- ii. What are the conditions for:
 - a) Addition of two matrices
 - b) Multiplication of two matrices

- iii. Two matrices P and Q are given by:

$$P = \begin{bmatrix} x & 2 \\ -5 & -1 \end{bmatrix} \quad \text{and} \quad Q = \begin{bmatrix} 2 & -3 \\ 4 & 1 \end{bmatrix}; \quad x \in \mathbb{R}$$

Also given that the determinant of P is 2. Obtain:

- The value of x.
- PQ^T (where Q^T is the transpose of Q).

- iv. Given that $D = \begin{bmatrix} 0 & 1 & -1 \\ 4 & 3 & -4 \\ 3 & 3 & -4 \end{bmatrix}$, find D^2 . Hence show that $D^{-1} = D$.

(25 marks)

QUESTION 3

- Describe the main three steps that you follow in the principle of Mathematical Induction for a statement $P(n)$, where $n \in \mathbb{N}$.
- Use Mathematical Induction to prove $1^2 + 2^2 + 3^2 + \dots + n^2 = \frac{n}{6} (n+1) (2n+1)$ where $n \in \mathbb{N}$.
- Verify that for any $n \in \mathbb{N}$, $(6^n - 1)$ is divisible by 5.

(25 marks)

QUESTION 4

- Using truth tables, explain the following.
Conjunction, Disjunction, Negation, and Conditional Implication.
 - Using the truth tables that you gave as answers to part i (a), construct the truth table for $[\neg p \wedge (p \vee q)] \rightarrow q$ and verify whether it is a tautology or contingency. Justify your answer.
- If p and q are statements, give the definition of Inverse and Converse in terms of p and q.
 - State the Inverse and Converse of the following implications.
 - We will come for the practical session, if it is a holiday.
 - If it rains tomorrow, I will not come for the trip.

(25 marks)

QUESTION 5

- i. If A and B are any two sets, write the following using set notation.
 - a) Identity laws
 - b) Compliment laws
 - c) Distributive laws
- ii. Using the above laws, prove the identity $(A \cup B) \cap (A \cup B^c) = A$
- iii. In a group of 60 students, 27 like to drink tea and 42 like to drink coffee and each person likes at least one of the two drinks. How many like both tea and coffee.
- iv. Give the interval notation to represent the sets given below.
 - a) The set of all numbers from 3 through 8 inclusive
 - b) The set of all numbers greater than or equal to 4 and less than 13.
 - c) The set of all numbers is greater than -5 and less than or equal to 14.

(25 marks)

QUESTION 6

- i. Write the definition of a **Proposition**, in regard to mathematics. Give the truth values of the propositions given below.
 - a) $2+1=3$
 - b) Toronto is the capital of Canada
 - c) $x+1=2$
- ii. What do you mean by a **Predicate** in mathematics?
- iii. Why are Quantifiers important in mathematics and computer science?
 - a) What are the two main types of quantifiers?
 - b) Which quantifier is used to assert that a property holds for every element in a set?
 - c) What does the expression $\exists x P(x)$ mean in predicate logic?
- iv.
 - a) Give the negation of the statement $\forall x P(x)$.
 - b) In the expression " $\forall x(P(x) \rightarrow Q(x))$ ". What is the scope of " $\forall x$ "?
 - c) Let $P(x)$ denote the statement $x > 7$ give values for x within the closed interval $[0,9]$, where the truth value is true.

- v. Let $R(x)$ be the statement " $x=x^2$ ". If the universe of discourse consists of all the integers, what are the truth values of the following?

$R(0)$, $\exists x R(x)$ and $\forall x (P(x))$

(25 marks)

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