Total number of printed pages: 2 **PG/I/PCSE101**

2023
Mathematical Foundation in Computer Science

Full Marks : 100
Time : Three hours

Answer question number 1 and any *four* from the rest

1. Answer all the questions

   i) S = {{{}}, {}}, the number of elements in P(S) is .....

   ii) A, B and C are three sets, where |A| = |B| = |C| = 5 and $|A \cap B| = |A \cap C| = |B \cap C| = |A \cap B \cap C| = 2$. Then $|A \cap B \cap C| = ?$

   iii) Draw the venn diagram of $A^c - B^c$

   iv) In a group of 15 students; 10 like mathematics and 10 like machine learning and 3 like none of these. How many of them like both?

   v) Explain that the *friendship* relation is not transitive.

   vi) The inverse element of - i in the multiplicative group, {1, -1, i , -i} is

   vii) Write a recurrence relation for the sequence $1, a, a^2, a^3, a^4, ..$

   viii) What is the criteria that a poset become lattice?

   ix) Find the solution of the recurrence relation $t_n = at_{n-1} (t_0 = 1)$

2 x 10

2. a) Prove that $p \leftrightarrow q$ and $(p \wedge q) \vee (\sim q \rightarrow \sim p)$ are logically equivalent.
b) Given that P(x): "x+2 > x", then find the truth value of $\forall P(x)$. State the difference between $\exists x \forall y P(x, y)$ and $\forall y \exists x P(x, y)$ with an example.
c) Express the statement "Every student in this class has studied MFCS" into logical expression. Write the negation of the above statement.

6 + 6 + 4 + 4

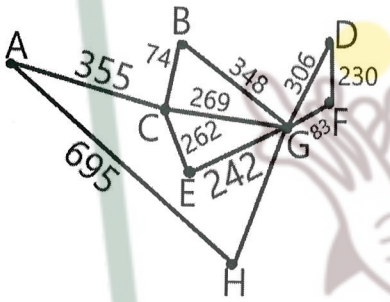
3. a) Prove that for all sets A and B, if $B \subseteq A^c$ then $A \cap B = \phi$.
b) Prove that ${}^{n+1}C_r = {}^{n}C_r + {}^{n}C_{r-1}$
c) Find the minimum number of students in a class such that three of them are born in the same month?

8 + 6 + 6

4. a) Define the partial order set. When a partial order set become a lattices?
b) Draw the Hasse diagram representing the partial ordering {(a, b) | a divides b} on {1, 2, 3, 4, 6, 8, 12}. Is this Hasse diagrams a lattice?

10 + 10

5. a) Define spanning tree. Find the minimum spanning tree of the given graph using Kruskal's Algorithm.



b) Describe the breadth-first search algorithm. Do the depth-first search on the above graph

10 + 10

6. Write a short note on the following (any four)
(i) Modus ponens
(ii) Crisp set and Fuzzy set
(iii) Hamiltonian path and Euler graph
(iv) Tower of Hanoi problem
(v) Recursive function for (x + y)

5 x 4

( )