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220201

May, 2019
MCA - 2nd Semester
Data Structures (MCA-17-102)

Time : 3 Hours] [Max. Marks : 75

Instructions:

1. *It is compulsory to answer all the questions (1.5 marks each) of Part-A in short.*
2. *Answer any four questions from Part-B in detail.*
3. *Different sub-parts of a question are to be attempted adjacent to each other.*

PART–A

1. (a) Define Isomorphism using suitable example. (1.5)

(b) Is $[(p \bullet q) \rightarrow (p \bullet q)]$ a tautology? Use logical equivalence. (1.5)

(c) Explain in-degree and out-degree of each of the vertex in a graph using example. (1.5)

(d) Find the generating function for the finite sequence 1, 4, 16, 64, 256. (1.5)

(e) Determine whether the poset $(\{1, 2, 3, 4, 5\})$ and $(\{1, 2, 4, 8, 16\})$ are lattices. (1.5)

(f) Draw the Hasse diagram for the partial ordering $\{(A, B)\} \mid A \leq B\}$ on the power set P(S), where $S = \{a, b, c\}$. (1.5)

(g) Write three rules of Hasse diagram? (1.5)

(h) Is $\sim(p \bullet (\sim p \bullet q))$ and $\sim p \bullet \sim q$ logical equivalent? Use logical equivalence. (1.5)

(i) Define Homomorphism using suitable example. (1.5)

(j) Give two differences between Euler circuit and Hamiltonian graph. (1.5)

PART–B

2. (a) Prove that the argument is valid without using truth tables :

   (i) $(p \rightarrow q) \bullet (r \rightarrow s), (p \bullet r) \bullet (q \bullet r) \bullet q \bullet s.$

   (ii) $P \bullet (p \rightarrow q), \sim p \bullet r \bullet \sim q.$

   (iii) $p \rightarrow (q \bullet r), (s \bullet t) \rightarrow q, (q \bullet r) \rightarrow (s \bullet t) \bullet p \rightarrow q.$

   (iv) $p \rightarrow q, q \rightarrow r, r \rightarrow s, \sim s, p \bullet t \bullet t.$ (10)

   (b) Show that a Hamiltonian path is a spanning tree? (5)

3. (a) Solve the following characteristic equation for two roots r1 and r2.

   (i) $y'' + 3y' - 10y = 0 \quad y(0) = 4, \quad y(0) = -2.$

   (ii) $4y'' - 5y' = 0 \qquad y(-2) = 0, \quad y(-2) = 7.$ (5)

   (b) List all the rules of inferences using suitable examples with tautology. (10)

4. Determine whether the following are tautology, contingency, and contradictions? Using truth table

   (a) $\alpha = (p \rightarrow (q \bullet r)) \bullet ((\sim q) \rightarrow (p \rightarrow r)).$

   (b) $(H \rightarrow (I \bullet J)) \rightarrow \sim(H \rightarrow I).$

   (c) $q \bullet (p \bullet \sim q) \bullet (\sim p \bullet \sim q).$ (15)

5. (a) Which of these relations on $\{0, 1, 2, 3\}$ are equivalence relations?

   (i) $\{(0, 0), (1, 1), (2, 2), (3, 3)\}$

   (ii) $\{(0, 0), (0, 1), (0, 2), (1, 0), (1, 1), (1, 2), (2, 0), (2, 2), (3, 3)\}.$ (5)

   (b) Explain chromatic number of the graph c_n where $n \geq 3$? write each step. (10)

6. (a) Find the coefficients of x^5y^8 in $(x + y)^{13}$. (5)

   (b) Give any two differences between Prim's and Kruskal's algorithm using a suitable example. (5)

7. Use depth first search to produce a spanning tree of a given graph. Write each step. (15)