FYCS - (59) - 05-12-2018

Paper / Subject Code: 82105 / Discrete Mathematics.

(Time: 2 ½ Hours) **[Total Marks: 75]**

N.B. 1) All questions are compulsory.
2) Figures to the right indicate marks.
3) Illustrations, in-depth answers and diagrams will be appreciated.
4) Mixing of sub-questions is not allowed.

Q. 1 Attempt All(Each of 5Marks) **(15M)**

(a) Choose the best choice for the following questions: **(5 M)**

(i) The number of equivalence relations of the set {1,2,3,4} is
a) 4 b) 15 c) 16 d) 24

(ii) Let S={1,2,3,4}. A relation R defined in S as , R= {(1,2)},(4,3),(2,2),(2,1),(3,1)) is __
a) Transitive b) symmetric c) anti-symmetric d) none of the above

(iii) The set {1,2,3} is not equal to
a) {2,1,3} b) {3,2,1} c) {1,2,3,4} d) {1,2,3,1}

(iv) Which of the following regular expressions identifiers are true?
a) $(r^*)^*=r^*$ b) $(r+s)^*=r^*+s^*$ c) $r^*.s^*=r^*+s^*$ d) All of these

(v) In any undirected graph, the sum of degrees of all the nodes ____
a) Must be even b) Need not be odd c) Must be odd d) Need not be even

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(b) Fill in the blanks. Use following pool to answer question. **(5M)**
Pool(two, zero, universal, warshall's, simple, closed, equal,onto,invertible)

(i) A ___ path has the same first and last vertices.
(ii) ____ Algorithm is use to find shortest path.
(iii) A function f: A--> B is said be _____function if each element of B is the image of some element of A.
(iv) A Type ___grammar has no restrictions on its production.
(v) The sum of the degrees of the vertices of a graph G is _____to twice the number of edges in G.

(c) Answer the following questions: **(5M)**

(i) If ${}^nC_{12}={}^nC_8$, then n is equal to?
(ii) Define: Complete Graph.
(iii) In How many ways can five examinations be scheduled in a week so that no two examinations are scheduled on the same day considering Sunday as holiday?
(iv) Which of the traversal technique lists the nodes of binary search tree in ascending order?
(v) What is n, if n is minimum number of integers to be selected from I={1,2,3,...9} such that the sum of two of the n integers is even?

Q. 2 Attempt the following (Any THREE)(Each of 5Marks)

(a) Determine whether the relation R on the set A is an equivalence relation.
$A=\{1,2,3\}$ $R=\{(1,1), (1,2), (2,1), (3,3)\}$

(b) State whether given functions are invertible or not.
(i)A function $f : Z \rightarrow Z$, $f(x) = x + 5$
(ii) A function $f : Z \rightarrow Z$, $f(x) = x^2$

(c) Given $A=\{1,2,3,4\}$ and $B=\{x,y,z\}$. Let R be the following relation from A to B:
$R=\{(1,y),(1,z),(3,y),(4,x),(4,z)\}$
(i) determine matrix of relation (ii) Draw the arrow diagram of R
(iii) Find the inverse relation of R (iv) Determine the domain and range of R.

(d) Let R and S be the following relations on $A = \{1, 2, 3\}$:
$R = \{(1, 2), (2, 3), (3, 1)\}$, $S= \{(1, 2), (2, 1), (3, 3)\}$
Find (i) $R \cup S$ (ii) $R \cap S$ (iii) R^{-1}

(e) Consider the relation $R = \{(1, 3), (1, 4), (3, 2), (3, 3), (3, 4)\}$ on $A = \{1, 2, 3, 4\}$.
(i) Draw its directed graph. (ii) Find the matrix M_R of R

(f) f,g,h are functions on $X=\{1,2,3\}$as
$f=\{(1,2),(2,3),(3,1)\}$; $g=\{(1,2),(2,1),(3,3)\}$; $h=\{(1,1),(2,2),(3,1)\}$
Compute (i) fog (ii) fogoh

Q. 3 Attempt the following (Any THREE) (Each of 5Marks) **(15M)**

(a) In a certain programming language, variable should be of length three ad should be made up of two letters followed by a digit or of length two made up of a letter followed by a digit. How many possible variables? What if letters are not to be repeated?

(b) How many distinguishable permutations of the letters in the word RADAR are there?

(c) Of 32 people who save paper or bottles (or both) for recycling, 30 save paper and 14 save bottles. Find the number m of people who (i)save both,(ii)save only paper, and (iii)save only bottles.

(d) Find the number of ways that a party of seven persons can arrange themselves:
(i) in a row of seven chairs (ii)around a circular table

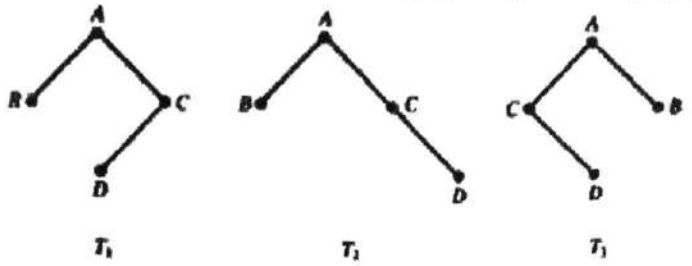
(e) Let $L=\{a^2, ab\}$ and $M=\{a, ab, b^2\}$ be languages over $A= \{a, b\}$.
Find (i) LM (ii) ML

(f) Let G be a grammar where $T=\{a,b\}$and $N=\{S,A,B\}$ with starting symbol S.
The set of production
$P=\{S\rightarrow AB, B\rightarrow Bb, B\rightarrow b, A\rightarrow Aa, A\rightarrow a\}$. Find L(G).

Q. 4 Attempt the following (Any THREE) (Each of 5Marks) **(15)**

(a) Consider the trees T_1, T_2, T_3 in figure. Identify those which represents the same:

(i)rooted tree (ii)ordered rooted tree (iii)binary tree



(b) Construct a preorder sequence for given inorder: 1 2 4 7 3 5 6 8 9

(c) Draw a tree for the given polish form : E=/- a b + * c d

(d) Draw a multigraph G corresponding to the following adjacency matrix.

$$A = \begin{bmatrix} 0 & 2 & 0 & 1 \\ 2 & 1 & 1 & 1 \\ 0 & 1 & 0 & 1 \\ 1 & 1 & 1 & 0 \end{bmatrix};$$

(e) Let G be a graph. Find all simple paths from A to C and all cycles.

(f) Find the indegree and outdegree of the vertices given in the figure.

Q. 5 Attempt the following (Any THREE) (Each of 5Marks) **(15)**

(a) Give first four terms for the given recurrence relation as linear homogenous and fid its degree.

$b_n = -3b_{n-1} - 2b_{n-2}$, $b_1 = -2$, $b_2 = 4$.

(b) In how many ways can a committee consisting of three men and two women be chosen from seven men and five women?