RAMAKRISHNA MISSION VIDYAMANDIRA
(Residential Autonomous College affiliated to University of Calcutta)
B.A./B.Sc. THIRD SEMESTER EXAMINATION, DECEMBER 2018
SECOND YEAR [BATCH 2017-20]

Date : 15/12/2018

Time : 11 am – 1 pm

COMPUTER SCIENCE (Honours)

Paper : III [Gr- A]

Full Marks : 40

(Use a separate Answer book for each Unit)

Unit-I

Answer **any one** question from **Question Nos. 1 & 2**:　　　　　　　　　　　　　　1 X 5

1.　a)　Find a closed form for the generating function for the following sequence:　　　2½

　　　　　　　0.1, –2, 4, –8, 16, –32, 64, …..

　　b)　Prove that every field is an integral domain.　　　　　　　　　　　　　　　　2½

2.　a)　State and prove Pigeon Hole principle.　　　　　　　　　　　　　　　　　　4

　　b)　What is Hasse Diagram?　　　　　　　　　　　　　　　　　　　　　　　　1

Answer **any two** questions from **Question Nos. 3 to 6**:　　　　　　　　　　　　　2 X 10

3.　a)　For three non-empty sets A, B and C prove that $(A\cup B)\times C=(A\times C)\cup(B\times C)$.　　3

　　b)　What do you mean by equivalence class? Explain with an example.　　　　　　2

　　c)　If $f:A\to B$ and $g:B\to C$ be one-to-one, onto functions, then show that $(g_0 f)$ is bijective

　　　　function and $(g\circ f)^{-1}=f^{-1}{}_0 g^{-1}$.　　　　　　　　　　　　　　　　5

4.　a)　Define Field with example.　　　　　　　　　　　　　　　　　　　　　　　2

　　b)　Draw the hasse diagram of the poset (S,l) where $S=\{1,2,3,4,6,8,8,12,18\}$ and relation 'l' is

　　　　defined such that a/b means b is divisible by a.

　　　　Also find the maximal, minimal, greatest and least elements of this poset.　　2+2

　　c)　A computer system considers a string of decimal digits as a valid codeword if it contains
　　　　even number of 0 (zero)'s. Find a recurrence relation to find the number of valid n-digit
　　　　codewords.　　　　　　　　　　　　　　　　　　　　　　　　　　　　　4

5.　a)　Find the number of non-negative integral solutions of $x_1+x_2+x_3+x_4=10$, where

　　　　$x_1\le 5, x_2\le 4, x_3\le 5$ and $x_4\le 7$.　　　　　　　　　　　　　　　　　4

　　b)　Prove that the set {0, 1, 2, 3, 4} is a finite abelian group under addition modulo 5 as
　　　　composition.　　　　　　　　　　　　　　　　　　　　　　　　　　　　　3

　　c)　Prove that the necessary and sufficient condition for a non-empty subset H of a group $(G,*)$

　　　　to be a subgroup is $a\in H, b\in H\Rightarrow a*b^{-1}\in H$.　　　　　　　　　　3

6. a) In a book of 400 pages, a proof reader finds no error in 230 pages, in 120 pages one error on each page, in 45 pages two errors on each page and in 5 pages 3 errors on each page. Fit a Poisson Distribution to the data and calculate the theoretical frequencies. **4**

b) The probability of a man hitting a target is $\frac{1}{4}$. If he fires 7 times, find the probability of his hitting the target at least twice. **4**

c) Define Normal distribution. **2**

Unit-II

Answer **any one** question from **Question Nos. 7 to 8**: **1 X 5**

7.
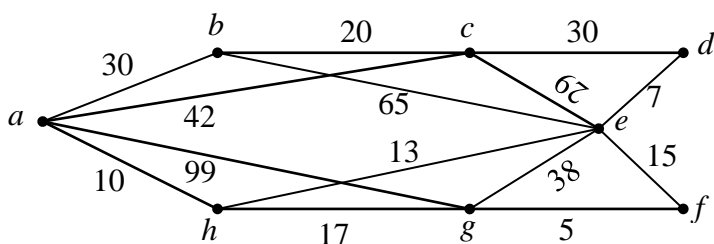
From vertex 'a', show the BFS and DFS of the graph. **2½+2½**

8. a) "A simple graph with n vertices and k components can have at most $(n-k)(n-k+1)/2$ edges" – prove it. **3**

b) "Any connected graph with n vertices and $(n-1)$ edges is a tree" – prove it. **2**

Answer **any one** question from **Question Nos. 9 to 10**: **1 X 10**

9. a) What do you mean by arbitrarily traceable graph? Given the set of all spanning trees of a graph as input, how will you generate the graph? **1+3**

b) Prove that for a tree with n_i number of nodes of degree i, where $0 \le i \le m$, m being the maximum degree of a node, the total number of leaf nodes will be, **4**

$$n_0 = 1 + \sum_{K=2}^{m}(K-1)n_K$$

c) Define Hamiltonian path of a graph. **2**

10. a) Prove that the number of odd-degree services in a simple connected graph is always even. **4**

b) When are two graphs G and $G*$ said to be isomorphic? **3**

c) State and prove the necessary and sufficient conditions for a graph G to be an Euler graph. **3**

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