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MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL UNIVERSITY, MANIPAL - 576 104
THIRD SEMESTER B.E DEGREE MAKEUP EXAMINATION – DECEMBER, 2012
Sub: MAT 209 - ENGG. MATHEMATICS III (CS/IT)
(REVISED CREDIT SYSTEM – 2011)

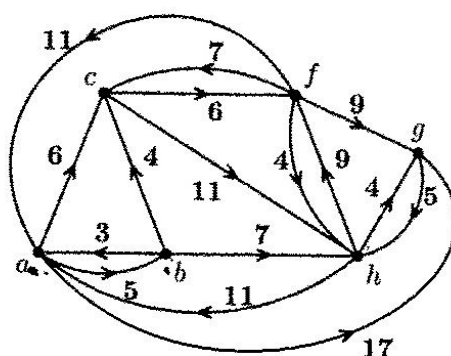


Time: 3 Hrs.

Max. Marks: 50

Note: a). Answer any FIVE full questions b). All questions carry equal marks

- 1A. A shop sells 6 different flavours of ice-cream. In how many ways, a customer can choose 4 ice-cream cones if
- They are all of different flavours
 - They are not necessarily of different flavours
 - They contain only 2 or 3 flavours.
 - They contain three flavours.
- 1B. Implement Dijkstra's algorithm to find shortest path from 'c' to all other vertices , for the following network.



- 1C. If A works hard, then either B or C will enjoy themselves. If B enjoys himself, then A will not work hard. If D enjoys himself, then C will not. If A works hard, then show that D will not enjoy himself, using inference theory of propositional calculus. (3+3+4)
- 2A. Show that a subgroup of a cyclic group is cyclic.
- 2B. Let $E(x_1, x_2, x_3) = \overline{(\overline{x_1} \vee x_2)} \vee (\overline{x_1} \wedge x_3)$ be a Boolean expression over the two valued Boolean algebra. Write $E(x_1, x_2, x_3)$ in both disjunctive and conjunctive normal forms.

- 2C. Let H and K be subgroups of a group G . Show that $H \cap K$ is also a subgroup of G . (3+3+4)
- 3A. Show that a graph is Eulerian if and only if it is connected and all its vertices have even degree.
- 3B. Define normal subgroup of a group. Show that the kernel of any homomorphism of a group is a normal subgroup.
- 3C. Show that the proportion of permutations of $\{1, 2, 3, \dots, n\}$ which contain no consecutive pair $(i, i + 1)$, for any i is approximately $\frac{(n+1)}{ne}$. (3+3+4)
- 4A. Let a, b, c be elements of a lattice $\langle A, \leq \rangle$. Show that
 i. $a \vee (b \wedge c) \leq (a \vee b) \wedge (a \vee c)$
 ii. $(a \wedge b) \vee (a \wedge c) \leq a \wedge (b \vee c)$
- 4B. How many ways are there to distribute 25 identical balls into 7 distinct boxes if the first box can have no more than 10 balls and any amount can roll into each of the other six boxes.
- 4C. Symbolize the predicate
 (i) "x is the father of the mother of y".
 (ii) Using inference theory of Predicate calculus prove that
 $(\forall x)(H(x) \rightarrow M(x)) \wedge H(J) \Rightarrow M(J)$ (3+3+4)
- 5A. Let $(G, *)$ be a group. Let H be a non empty subset of G . Show that H is a subgroup of G if and only if $a * b^{-1} \in H$, for all $a, b \in H$.
- 5B. If G is a graph, show that either G or \bar{G} is connected.
- 5C. Find the 55th and 95th permutations of the five marks 1, 2, 3, 4, 5 in
 (i) Reverse lexicographical order (ii) Fike's order (3+3+4)
- 6A. i) Symbolize the predicate,
 If x is the father of y then y is the child of x .
 ii) Show that $(\exists x) M(x)$ follows logically from the premises,
 $(\forall x)(H(x) \rightarrow M(x))$ and $(\exists x)H(x)$.
- 6B. Let $\langle A, \leq \rangle$ be a distributive lattice. Show that if $a \wedge x = a \wedge y$ and $a \vee x = a \vee y$ for some a , then $x = y$.
- 6C. Define self-complementary graph. Show that every self-complementary graph has $4n$ or $4n + 1$ vertices. (3+3+4)
