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| **Name:**  **Sequence Number:**  **Teacher's Name:**  **Section:** |

***Note*: *The exam consists of 11 pages.***

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| **Question** | **Mark** |
| **Question I** |  |
| **Question II** |  |
| **Question III** |  |
| **Question IV** |  |
| **Question V** |  |
| **Total** |  |

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Then are  (a) Comparable (b) Incomparable (c) None of the previous (7) The Hasse graph  represents the poset on given by:  (a) (b) ) (c) (d) None of the previous  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  (8) For the equivalence relation on defined by 5),  (a) (b)  (c) (d) None of the previous  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  (9) There exists a graph with vertices of degrees  (a) 1,2,3,3 (b) 3,2,4,6 (c) (d) None of the previous  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  (10) The graph is  (a) Not connected (b) Not Bipartite (c) Bipartite (d) None of the previous  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  (11) A tree with 50 vertices has  (a) 51 edges (b) 49 edges (c) 50 edges (d) None of the previous  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  (12) The dual of the Boolean expression is  (a) ( (b)  (c) (d) None of the previous  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_     |  | | --- | | **Question II:**   1. Without using truth tables prove that     is a tautology. | | B. Prove by contradiction that if is any rational number and is any irrational number then is an irrational number.    C. Using Mathematical Induction prove that  . | | **Question III:**  A. Prove that the relation defined by:  is an equivalence relation on the set .  B. Let be a relation on the set Then draw the diagraph representing the relation . Is the relation antisymmetric? Justify your answer.  C. Answer the following questions about the following graph    G  (i) Is the graph connected? Justify your answer.  (ii) Find Find a path from What is its length?  (iii) Draw the subgraph of induced by the vertices  (iv) Draw a planar representation of the graph and find how many regions does it have? Justify your answer.  (v) Is the graph isomorphic to the graph below? Justify your answer.    **Question IV:**  A. Answer the following questions about the tree below:    (i) Which vertex is the root? Which vertices are internal? Which vertices are leaves?  (ii) Which vertex is the parent of ? Which vertices are siblings of ?  (iii) Is the tree a 3-ary tree? Is it a full 3-ary tree? Justify your answer.  (iv) Find the level of the vertex and the vertex . What is the height of the tree? Is the tree balanced? Justify your answer.  B. Draw a spanning tree of the graph below:    C. Draw a binary search tree for the words: **mango, banana, peach, apple, coconut, pear, papaya** (using alphabetical order). |   **Question V:**  A. Find a Boolean expression for the function that has the values in the following table:   |  |  |  |  | | --- | --- | --- | --- | |  |  |  |  | | 1 | 1 | 1 | 1 | | 1 | 1 | 0 | 0 | | 1 | 0 | 1 | 1 | | 1 | 0 | 0 | 0 | | 0 | 1 | 1 | 0 | | 0 | 1 | 0 | 1 | | 0 | 0 | 1 | 0 | | 0 | 0 | 0 | 1 |   B. Find the **sum of product** expansion for the following Boolean function:    Find **the value** of. | |
| C. Construct a circuit from inverters, AND gates, and OR gates to produce the output  D. Use K-maps to minimize the sum of product expansion  .  Good Luck ☺ |