MA102: MATHEMATICS II: INTRO. TO DISCRETE MATHEMATICS

ENDSEM (PEN-PAPER) EXAMINATION MARKS: 60

QUESTION PAPER: **Right** DATE: August 12, 2022

Instructions: Clearly write Left/Right, your name and roll number on the top of question paper and Answersheet. Solutions must be written clearly. Each question carries 5 marks.

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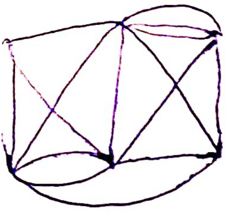
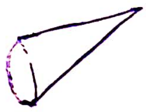
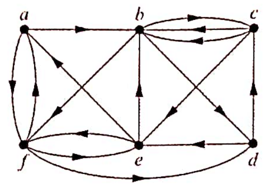
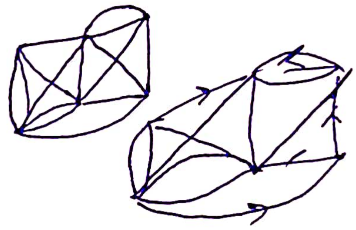
1. Determine whether the picture shown below can be drawn with a pen in a continuous motion without lifting the pen or retracing part of the picture. If yes then give path. Follow the directions while drawing. Give justification.



2. Determine whether this argument, taken from Kalish and Montague is valid. Explain. If Superman were able and willing to prevent evil, he would do so. If Superman were unable to prevent evil, he would be impotent; if he were unwilling to prevent evil, he would be malevolent. Superman does not prevent evil. If Superman exists, he is neither impotent nor malevolent. Therefore, Superman does not exist.

3. A tree is a connected graph without cycles/loops. Find no. of edges of a tree with 10+i no. of vertices, where i is the last digit of your student id. Generalise your observation?

4. Find a recurrence relation for the number of bit strings of length n with three consecutive ones.

5. Prove that [-i, i] and (-i, i) have same cardinality, where $i = 2+$ last digit of your student id. What kind of proof did you use?

6. Write down an algorithm for printing all permutations of $1, 2, 3, \ldots, n$. Apply it to $n = 3$.

7. Display all the partial orders on a set with four elements with the help of Hasse diagram. How many of them are lattices, well ordered set, linearly ordered set?

8. How many solutions in positive integers are there to the equation given below. Give justifiation.

$$x_1 + x_2 + x_3 = 10 \text{ with } 2 < x_1 < 6, 3 < x_2 < 10, 0 < x_3 < 5$$

9. A simple directed graph is called special if for all u and v distinct vertices in the graph, exactly one of (u, v) and (v, u) is an edge of the graph. Show that every special graph has a Hamilton path.

10. How many nonisomorphic simple connected graphs with four vertices are there? Draw all of them and give justification.

11. Find a bijective function between $\mathbb{Z} \times \mathbb{Z}$ and $\mathbb{Z}$.

12. Using generating function solve $(n+1)a_{n+1} = a_n + \frac{1}{n!}$ with $a_0 = 1$.