

MACM 201 Homework 1 - Solutions

1. List all strings of size 3 over the alphabet $\{A, B\}$.

Solution: $AAA, AAB, ABA, ABB, BAA, BAB, BBA, BBB$

2. Find all permutations of $\{X, Y, Z\}$.

Solution: $XYZ, XZY, YXZ, YZX, ZXY, ZYX$

3. Find all strings of length 4 over the alphabet $\{0, 1, 2\}$ with the property that there are no 10, 21, or 20 substrings.

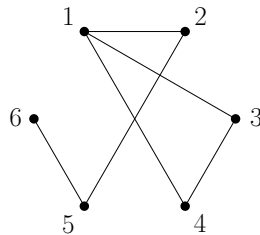
Solution: Observe that a string satisfying these properties is a non-decreasing sequence. It will consist of a string of 0's then a string of 1's, then a string of 2's (any one of which might be empty). Therefore, the valid strings are:

0000, 0001, 0002, 0011, 0012, 0111, 0112, 0122, 0222, 1111, 1112, 1122, 1222, 2222

4. Draw the graph $G = (V, E)$ given by

$$V = \{1, 2, 3, 4, 5, 6\} \quad \text{and} \quad E = \{\{1, 2\}, \{1, 3\}, \{1, 4\}, \{2, 5\}, \{3, 4\}, \{5, 6\}\}.$$

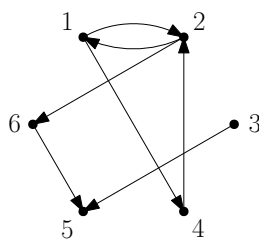
Solution:



5. Draw the directed graph $G = (V, E)$ given by

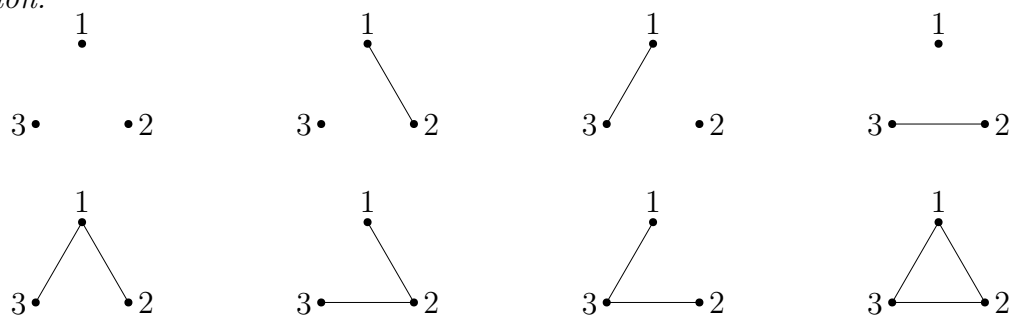
$$V = \{1, 2, 3, 4, 5, 6\} \quad \text{and} \quad E = \{(1, 2), (2, 1), (1, 4), (2, 6), (4, 2), (3, 5), (6, 5)\}.$$

Solution:



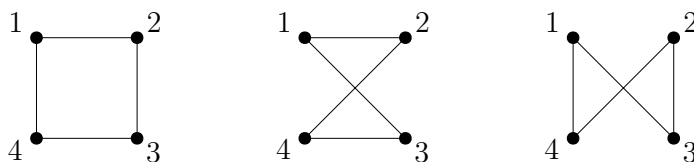
6. Find all 8 graphs with vertex set $V = \{1, 2, 3\}$.

Solution:



7. Find all graphs with vertex set $V = \{1, 2, 3, 4\}$ that are cycles.

Solution:



8. Draw a rooted tree with 9 vertices and no vertex of level 3.

Solution: There are many correct answers to this, below are two possibilities.

