

Ve203 Discrete Mathematics (Fall 2020)

Assignment 9: Graphs

Date Due: 12:10 PM, Thursday, the 19th of November 2020

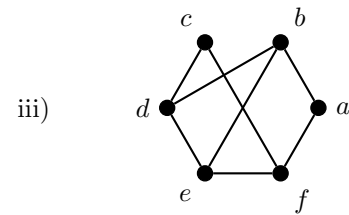
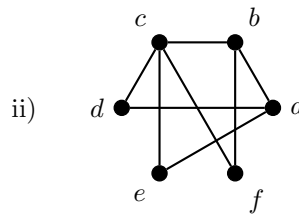
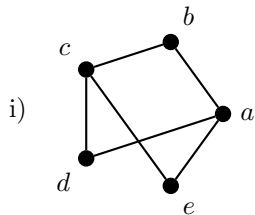


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This assignment has a total of (18 Marks).

Exercise 9.1

In the following graphs, determine which ones are bipartite and give a bipartition for those that are.



(3 Marks)

Exercise 9.2

For which values of n are the following graphs bipartite?

i) K_n

ii) C_n

iii) W_n

iv) Q_n

(2 Marks)

Exercise 9.3

An *intersection graph* for a collection of sets A_1, \dots, A_n is the graph $G = (V, E)$ with $V = \{A_1, \dots, A_n\}$ and $E = \{\{A_i, A_j\} : A_i \cap A_j \neq \emptyset\}$. Draw the intersection graphs for the followings sets:

i) $A_1 = \{0, 2, 4, 6, 8\}$, $A_2 = \{0, 1, 2, 3, 4\}$, $A_3 = \{1, 3, 5, 7, 9\}$, $A_4 = \{5, 6, 7, 8, 9\}$, $A_5 = \{0, 1, 8, 9\}$.

(1 Mark)

ii) $A_1 = \mathbb{Z} \setminus \mathbb{Z}_+$, $A_2 = \mathbb{Z}$, $A_3 = 2\mathbb{Z}$, $A_4 = 2\mathbb{Z} + 1$, $A_5 = 3\mathbb{Z}$. (Notation is analogous to Example 1.3.5 in the lecture slides.)

(1 Mark)

iii) $A_1 = (-\infty, 0)$, $A_2 = (-1, 0)$, $A_3 = (0, 1)$, $A_4 = (-1, 1)$, $A_5 = (-1, \infty)$, $A_6 = \mathbb{R}$. (All sets are intervals in \mathbb{R} .)

(1 Mark)

Exercise 9.4

Draw undirected graphs for the given adjacency matrices:

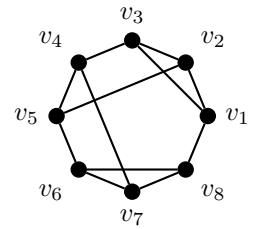
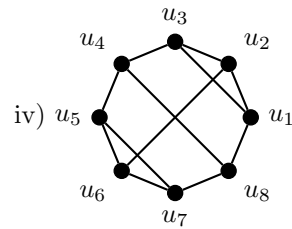
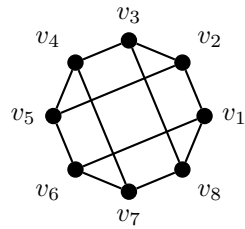
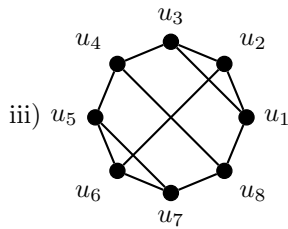
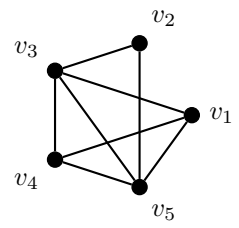
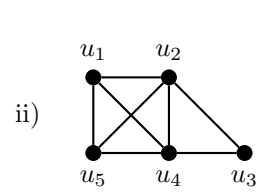
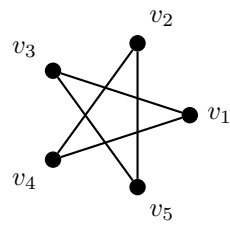
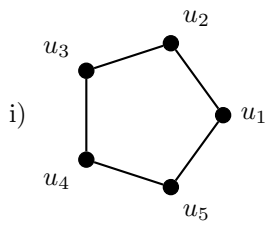
i)
$$\begin{pmatrix} 1 & 3 & 2 \\ 3 & 0 & 4 \\ 2 & 4 & 0 \end{pmatrix}$$

ii)
$$\begin{pmatrix} 0 & 1 & 3 & 0 & 4 \\ 1 & 2 & 1 & 3 & 0 \\ 3 & 1 & 1 & 0 & 1 \\ 0 & 3 & 0 & 0 & 2 \\ 4 & 0 & 1 & 2 & 3 \end{pmatrix}$$

(2 Marks)

Exercise 9.5

Determine whether each given pair of graphs is isomorphic. Exhibit an isomorphism (and prove that it actually is an isomorphism) or prove that no isomorphism exists.



(8 Marks)