FACULTY OF COMPUTING

SEMESTER 1

2023/2024

SECI 1O13 - DISCRETE STRUCTURE

ASSIGNMENT 3 (CHAPTER 3 AND CHAPTER 4)

SECTION 02

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No: Date:

Question 1

a. pigeons - students

pigeonholes - scores on scale from 0 to 100 points.

let set x ~~is~~ be the scores on scale from 0 to 100 points,

$x = \{ x \in N \mid 0 \leq x \leq 100 \}$ while N is natural numbers.

$|x| = 101$

Number of students in a class to guarantee that at least two students received the same score.

$$|x| + 1 = 101 + 1$$
$$= 102 \text{ students}$$

b. pigeons - students

pigeonholes - grade

let set x be the grade for Discrete Structure class.

$x = \{A, B, C, D, F\}$ $|x| = 5$

Minimum number of students required in Discrete Structure class so that at least 6 students received the same grade, N :

$\left\lceil \frac{n}{m} \right\rceil = k$	$m(k-1) < m\frac{n}{m} = n$	$N = 25 + 1$ $= 26$ students
$\left\lceil \frac{N}{5} \right\rceil = 6$	$5(6-1) < N$ $5(5) < N$ $N > 25$	

Question 2

a) $P(B1) = 0.70$

b) $P(B2) = 0.30$

c) $P(W|B1) = 0.20$

d) $P(B1 \cap W) = P(B1) \times P(W|B1)$

$= 0.70 \times 0.20$

$= 0.14$

e) $P(B2 \cap W) = P(B2) \times P(W|B2)$

$= 0.30 \times 0.40$

$= 0.12$

f) $P(W) = P(B1 \cap W) + P(B2 \cap W)$

$= 0.14 + 0.12$

$= 0.26$

g) $$P(B1|W) = \frac{P(B1 \cap W)}{P(W|B1)P(B1) + P(W|B2)P(B2)}$$

$$= \frac{0.14}{0.20(0.70) + 0.40(0.30)}$$

$= 0.5385$

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Question 3

a. Vertices - Vertices is plural for vertex. Vertex represents a point in the graph.

b. Edges - Edges is the connection between vertices in the graph. An edge can connects two vertices or to itself.

c. Adjacent vertices - For edge that connect two vertices, these vertices are called adjacent. For loop, edge that start and end in the same vertex, is called adjacent to itself.

d. Incident edge - when a vertex have multiple edges, these edges are called incident edges.

e. Isolated vertex - Vertex that does not have any edges. This vertex is not connected to itself or another vertices.

f. Loop - Loop is a vertex that is connected to itself.

g. Parallel edges - multiple edges that connect the same pair of vertices

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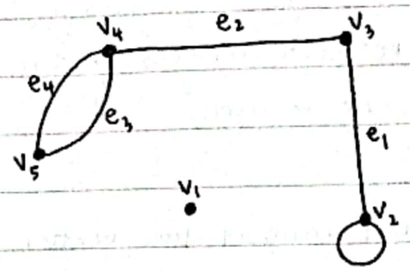
Graph:



Example:

1. Vertices, $V = \{v_1, v_2, v_3, v_4, v_5\}$

2. Edges, $E = \{e_1, e_2, e_3, e_4\}$

3. v_3 and v_4 are adjacent $\quad$ v_2 and v_3 are adjacent
   v_2 are adjacent to itself $\quad$ v_5 and v_4 are adjacent

4. For vertex 3, incident edges are (v_3, v_4) and (v_3, v_2)

5. v_1 is the isolated vertex

6. v_2 is loop

7. e_3 and e_4 are parallel edges

STANDARD

Question 4.

$G = \{V, E\}$

$V = \{v1, v2, v3, v4\}$

$E = \{a, b, c, d, e, f\}$

$a = \{v1, v2\}$

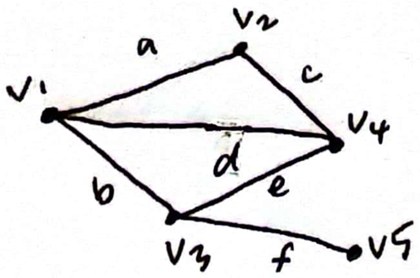
$b = \{v1, v3\}$

$c = \{v2, v4\}$

$d = \{v1, v4\}$

$e = \{v3, v4\}$

$f = \{v3, v5\}$



Vertex	v1	v2	v3	v4	v5
Degree	3	2	3	3	1

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Question 5

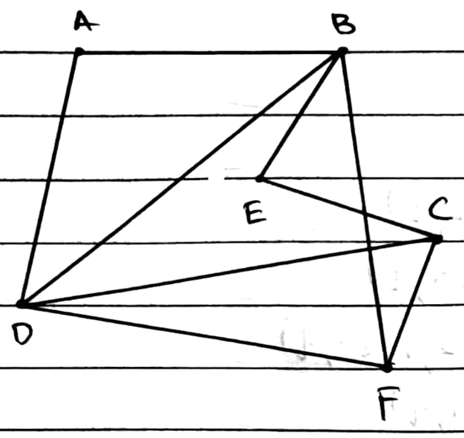
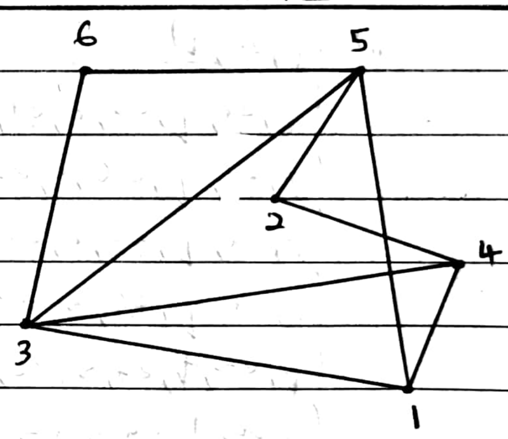
i. Incidence matrix

$$
\begin{array}{c}
\\ 1 \\ 2 \\ 3 \\ 4 \\ 5 \\ 6
\end{array}
\begin{array}{c}
\begin{array}{cccccccccc} a & b & c & d & e & f & g & h & i & k \end{array} \\
\begin{bmatrix}
1 & 2 & 1 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\
1 & 0 & 1 & 0 & 0 & 1 & 1 & 1 & 0 & 0 \\
0 & 0 & 0 & 1 & 1 & 1 & 0 & 0 & 1 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1
\end{bmatrix}
\end{array}
$$

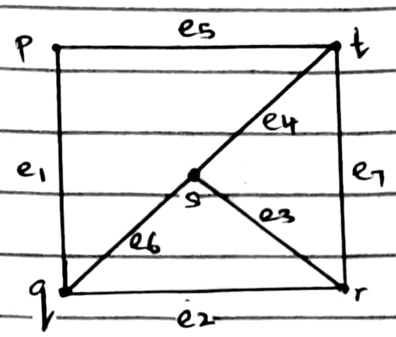
ii. Adjacency matrix

$$
\begin{array}{c}
\\ 1 \\ 2 \\ 3 \\ 4 \\ 5 \\ 6
\end{array}
\begin{array}{c}
\begin{array}{cccccc} 1 & 2 & 3 & 4 & 5 & 6 \end{array} \\
\begin{bmatrix}
1 & 0 & 2 & 1 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 0 \\
2 & 0 & 0 & 1 & 1 & 1 \\
1 & 1 & 1 & 0 & 0 & 1 \\
0 & 0 & 1 & 0 & 0 & 1 \\
0 & 0 & 1 & 1 & 1 & 0
\end{bmatrix}
\end{array}
$$

6.

	Graph Y	Graph Z
Number of vertices	6	6
Number of edges	9	9
Degree of each vertex	d(A) = 2 d(B) = 4 d(C) = 3 d(D) = 4 d(E) = 2 d(F) = 3	d(1) = 3 d(2) = 2 d(3) = 4 d(4) = 3 d(5) = 4 d(6) = 2
Number of loops	0	0
Number of parallel edges	0	0
Graph type	Connected	Connected
Pairs of connected vertices		
Conclusion	Graph Y and Z are isomorphic.	
Adjacency matrix	$A_Y = \begin{array}{c} \\ A \\ B \\ C \\ D \\ E \\ F \end{array} \begin{array}{c} \begin{array}{cccccc} A & B & C & D & E & F \end{array} \\ \begin{bmatrix} 0 & 1 & 0 & 1 & 0 & 0 \\ 1 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 & 1 \\ 1 & 1 & 1 & 0 & 0 & 1 \\ 0 & 1 & 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 1 & 0 & 0 \end{bmatrix} \end{array}$	$A_Z = \begin{array}{c} \\ 6 \\ 5 \\ 4 \\ 3 \\ 2 \\ 1 \end{array} \begin{array}{c} \begin{array}{cccccc} 6 & 5 & 4 & 3 & 2 & 1 \end{array} \\ \begin{bmatrix} 0 & 1 & 0 & 1 & 0 & 0 \\ 1 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 & 1 \\ 1 & 1 & 1 & 0 & 0 & 1 \\ 0 & 1 & 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 1 & 0 & 0 \end{bmatrix} \end{array}$

7.



i) $(p, e5, t)$
$(p, e1, q, e2, r, e7, t)$
$(p, e1, q, e6, s, e4, t)$
$(p, e1, q, e2, r, e3, s, e4, t)$
$(p, e1, q, e6, s, e3, r, e7, t)$

ii) $(p, e5, t)$
$(p, e1, q, e2, r, e7, t)$
$(p, e1, q, e6, s, e4, t)$
$(p, e1, q, e2, r, e3, s, e4, t)$
$(p, e1, q, e6, s, e3, r, e7, t)$
$(p, e5, t, e4, s, e6, q, e2, r, e7, t)$
$(p, e5, t, e4, s, e3, r, e7, t)$
$(p, e5, t, e7, r, e3, s, e4, t)$
$(p, e5, t, e7, r, e2, q, e6, s, e4, t)$

iii) Shortest path from vertex p to vertex t $= (p, e5, t)$
Longest path from vertex p to vertex t $= (p, e1, q, e2, r, e3, s, e4, t)$ or
$(p, e1, q, e6, s, e3, r, e7, t)$

iv) Shortest trail from vertex p to vertex t $= (p, e5, t)$
Longest trail from vertex p to vertex t $= (p, e5, t, e4, s, e6, q, e2, r, e7, t)$ or
$(p, e5, t, e7, r, e2, q, e6, s, e4, t)$