UTM

UNIVERSITI TEKNOLOGI MALAYSIA

FACULTY OF COMPUTING

SEMESTER 1 2023/2024

SECI1013 – DISCRETE STRUCTURE

SECTION 3

ASSIGNMENT 3 – CHAPTER 1

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1) a) From 0 to 100 points, there are 101 possible different scores. Hence, pigeonholes is 101 different scores. Then pigeons is 102 students or more because it would be impossible for all students to have different scores and at least two students will receive the same score. Therefore, the number of students must be 102 or more.

b) Pigeons - number of students (n)
Pigeonholes - number of letter grade (m = 5)

$k = 6$ $\qquad m(k-1) = 5(6-1)$

$\frac{n}{m} = 6$ $\qquad = 25$

$\qquad n > 25$

$\frac{n}{5} = 6$

$\therefore$ Minimum number of students must be 26 because

$\left\lceil \frac{26}{5} \right\rceil = \lceil 5.2 \rceil = 6$

2) a) $P(B1) = \frac{70}{100} = 0.70$

b) $P(B2) = \frac{30}{100} = 0.30$

c) $P(W|B1) = \frac{P(W \cap B1)}{P(B1)} = \frac{\frac{70}{100} \times \frac{20}{100}}{\frac{70}{100}}$

$= 0.2$

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

$= \frac{P(W \cap B1)}{P(B1)}$

$P(W \cap B1) = P(W|B1) \cdot P(B1)$

$= 0.2 \times 0.7$

$= 0.14$

e. $P(W|B2) = \frac{P(W \cap B2)}{P(B2)}$

$P(W \cap B2) = P(W|B2) \cdot P(B2)$

$= 0.4 \times 0.3$

$= 0.12$

f. $P(W) = (0.7 \times 0.2) + (0.3 \times 0.4)$

$= 0.26$

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

$= \frac{0.14}{0.26}$

$= 0.5385$

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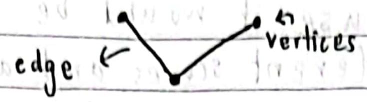
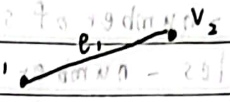
3. a) Vertices is one of the objects that are connected together

b) Edges are connections between the vertices.

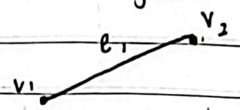


c) Adjacent vertices : If two vertices in a graph are connected by an edge, we say that vertices are adjacent



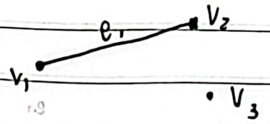
(v_1 and v_2 are adjacent)

d) Incident edge : Edges are incident if there is a vertex between these edges.



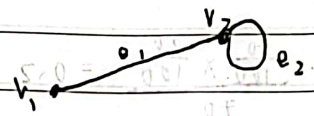
(e_1 is incident to v_1 and v_2)

e) Isolated vertex : Vertex that is not incident with any edge.



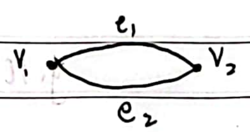
(v_3 is isolated vertex)

f) Loop : An edge incident on a single vertex.



(e_2 is loop)

g) Parallel edges : Two or more distinct edges with same set of endpoints



(e_1 and e_2 are parallel)

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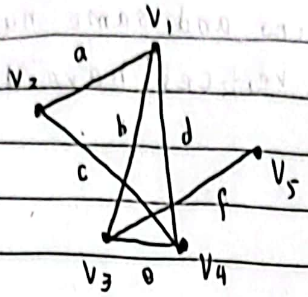
4. 

$deg(v_1) = 3$
$deg(v_2) = 2$
$deg(v_3) = 3$
$deg(v_4) = 3$
$deg(v_5) = 1$

5i) Incidence matrix =

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

ii) Adjacency matrix =

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

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6. Both graphs have same number of vertices and same number of edges. For both graphs, there are 2 vertices have degree 3 and 2 vertices have degree 4.

$f: Y \to Z$ is defined.

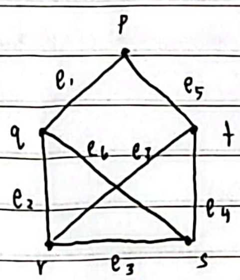
$f(A) = 6$ $\quad f(C) = 4$ $\quad f(E) = 2$

$f(B) = 5$ $\quad f(D) = 3$ $\quad f(F) = 1$

$\therefore$ Hence it is isomorphic because Y and Z are same

$$Y = \begin{array}{c} \\ A \\ B \\ C \\ D \\ E \\ F \end{array} \begin{array}{c} \begin{array}{cccccc} A & B & C & D & E & F \end{array} \\ \begin{bmatrix} 0 & 1 & 0 & 1 & 0 & 0 \\ 1 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 & 1 \\ 1 & 1 & 1 & 0 & 0 & 1 \\ 0 & 1 & 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 1 & 0 & 0 \end{bmatrix} \end{array} \qquad Z = \begin{array}{c} \\ 6 \\ 5 \\ 4 \\ 3 \\ 2 \\ 1 \end{array} \begin{array}{c} \begin{array}{cccccc} 6 & 5 & 4 & 3 & 2 & 1 \end{array} \\ \begin{bmatrix} 0 & 1 & 0 & 1 & 0 & 0 \\ 1 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 & 1 \\ 1 & 1 & 1 & 0 & 0 & 1 \\ 0 & 1 & 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 1 & 0 & 0 \end{bmatrix} \end{array}$$

7.



i) possible path $p \to t$

$(p, e_5, t), (p, e_1, q, e_6, s, e_4, t), (p, e_1, q, e_2, r, e_7, t),$
$(p, e_1, q, e_2, r, e_3, s, e_4, t), (p, e_1, q, e_6, s, e_3, r, e_7, t)$

ii) possible trails $p \to t$

$(p, e_5, t), (p, e_1, q, e_6, s, e_4, t), (p, e_1, q, e_2, r, e_7, t),$
$(p, e_1, q, e_2, r, e_3, s, e_4, t), (p, e_5, t, e_4, s, e_3, r, e_7, t),$
$(p, e_1, q, e_6, s, e_3, r, e_7, t), (p, e_5, t, e_7, r, e_2, q, e_6,$
$s, e_4, t)$

iii. shortest

p, e_5, t

longest

$p, e_1, q, e_2, r, e_3, s, e_4, t$

$p, e_1, q, e_6, s, e_3, r, e_7, t$

iv. Shortest

p, e_5, t

longest

$p, e_5, t, e_7, r, e_2, q, e_6,$
s, e_4, t

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