

part 1 // Question 1

$$0 \leftrightarrow 9$$

$$1 \leftrightarrow 55$$

$$2 \leftrightarrow 56$$

$$3 \leftrightarrow 30$$

$$4 \leftrightarrow 40$$

$$5 \leftrightarrow 14$$

$$6 \leftrightarrow 15 \leftrightarrow 6$$

$$7$$

$$8 \leftrightarrow 8$$

part 2 // Question 1

$$i) d_{out}(v_3) = 4$$

$$d_{in}(v_8) = 2$$

$$ii) v_1 \leftrightarrow \text{head} \leftrightarrow v_2 \leftrightarrow v_6 \leftrightarrow \text{tail}$$

$$v_2 \leftrightarrow \text{head} \leftrightarrow v_5 \leftrightarrow \text{tail}$$

$$v_3 \leftrightarrow \text{head} \leftrightarrow v_1 \leftrightarrow v_5 \leftrightarrow v_6 \leftrightarrow v_8 \leftrightarrow \text{tail}$$

$$v_4 \leftrightarrow \text{head} \leftrightarrow v_2 \leftrightarrow v_3 \leftrightarrow \text{tail}$$

$$v_5 \leftrightarrow \text{head} \leftrightarrow v_1 \leftrightarrow v_2 \leftrightarrow v_4 \leftrightarrow \text{tail}$$

$$v_6 \leftrightarrow \text{head} \leftrightarrow v_8 \leftrightarrow \text{tail}$$

$$v_7 \leftrightarrow \text{head} \leftrightarrow v_6 \leftrightarrow \text{tail}$$

$$v_8 \leftrightarrow \text{head} \leftrightarrow v_7 \leftrightarrow \text{tail}$$

Question 2

$$i) 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, v_1, v_2, v_3, v_4, v_5, v_6, v_7, v_8$$

$$45, 2, 57, 35, 27, 5, 51, 19, 53$$

$$v_1, 0, 1, 0, 0, 0, 1, 0, 0, 0$$

$$v_2, 0, 0, 0, 0, 0, 1, 0, 0, 0$$

$$v_3, 1, 0, 0, 0, 0, 1, 1, 0, 1$$

$$v_4, 0, 1, 1, 0, 0, 0, 0, 0, 0$$

$$v_5, 1, 1, 0, 1, 0, 0, 0, 0, 0$$

$$v_6, 0, 0, 0, 0, 0, 0, 0, 0, 1$$

$$v_7, 0, 0, 0, 0, 0, 0, 1, 0, 0$$

$$v_8, 0, 0, 0, 0, 0, 0, 0, 1, 0$$

Question 3

$$i) 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10$$

$$34, 12, 35, 15, 2, 29, 7, 20$$

$$v_1, 0, 0, 0, 0, 0, 0, 0, 0, 0$$

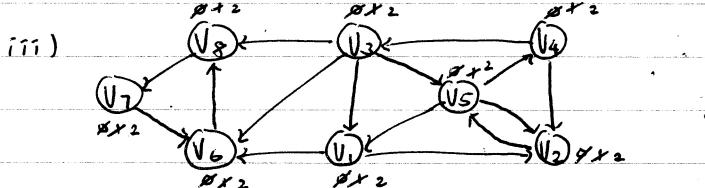
$$v_2, 0, 0, 0, 0, 0, 0, 0, 0, 0$$

$$v_3, 0, 0, 0, 0, 0, 0, 0, 0, 0$$

$$v_4, 0, 0, 0, 0, 0, 0, 0, 0, 0$$

$$ii) d = \frac{8}{10}$$

$$= 0.8$$



$$iii) 2, 29, 7$$

$$Q = (v_1)$$

$$Q = (v_8, v_4)$$

$$Q = (v_2, v_6)$$

$$Q = (v_4, v_7)$$

$$Q = (v_6, v_5)$$

$$Q = (v_7, v_3)$$

$$Q = (v_5, v_8)$$

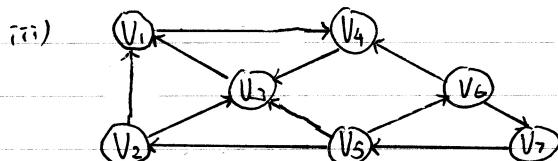
$$Q = ()$$

$$iv) v_1, v_2, v_3, v_4, v_5, v_6, v_7, v_8$$

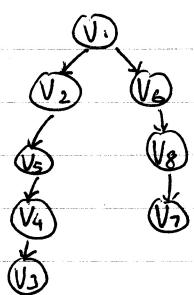
$$\text{minlength } 0, 1, 4, 3, 2, 1, 3, 2$$

$$\text{prev nil, } v_4, v_1, v_5, v_2, v_1, v_8, v_6$$

v) the previous node of v_4 is v_5 ;
 the previous node of v_5 is v_2 ;
 the previous node of v_2 is v_1 .
 \Rightarrow the minimum length path is
 $\{ \langle v_1, v_2 \rangle, \langle v_2, v_5 \rangle, \langle v_5, v_4 \rangle \}$



vi)



forward edge:

$$\langle v_2, v_1 \rangle, \langle v_1, v_4 \rangle, \langle v_4, v_3 \rangle, \langle v_3, v_2 \rangle$$

backward edge:

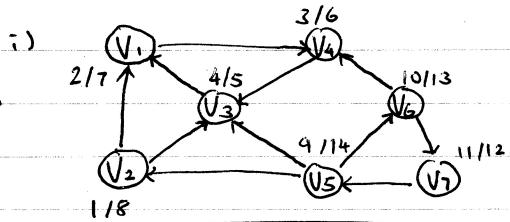
$$\langle v_3, v_1 \rangle$$

$$\langle v_7, v_5 \rangle$$

cross edge:

$$\langle v_5, v_2 \rangle, \langle v_5, v_3 \rangle, \langle v_6, v_4 \rangle$$

Question 2



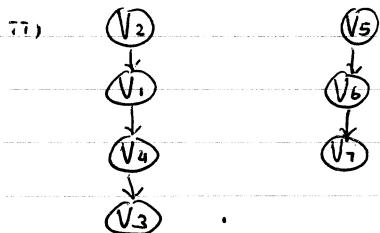
$$S = [V_2 | V_1 | V_4 | V_3]$$

$$S = [\quad]$$

$$S = [V_5 | V_6 | V_7]$$

$$S = [\quad]$$

ii) Since there are 2 backward edges in G_2 , G_2 contains cycles. It violates the definition of DAG. Thus, G_2 is not a DAG.



DFS tree rooted
at v_2

DFS tree rooted
at v_5