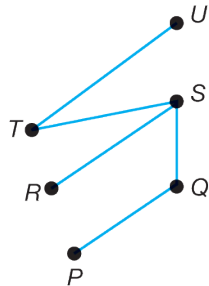


**Form 4 Chapter 5**  
**Network in Graph Theory**  
**Fully-Worked Solutions**

**UPSKILL 5.1a**

4

1

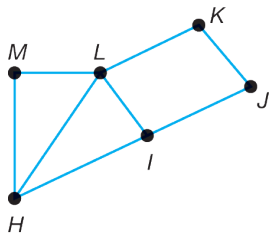


(a)  $V = \{P, Q, R, S, T, U\}$   
 $n(V) = 6$

$n(E) = 5$

(c)  $\sum d(v) = 2 \times n(E) = 2 \times 5 = 10$

2

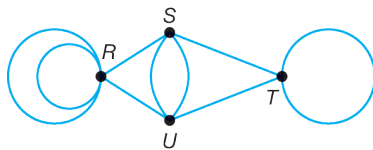


(a)  $V = \{H, I, J, K, L, M\}$   
 $n(V) = 6$

$n(E) = 8$

(c)  $\sum d(v) = 2 \times n(E) = 2 \times 8 = 16$

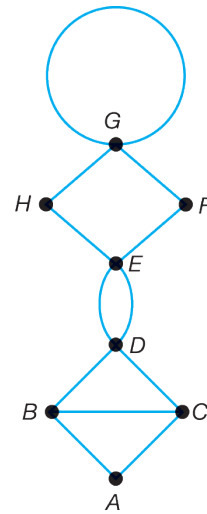
3



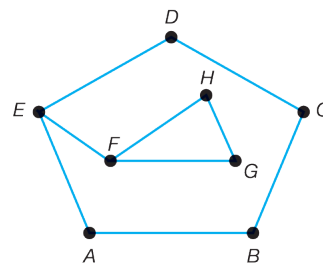
(a)  $V = \{R, S, T, U\}$   
 $n(V) = 4$

$n(E) = 9$

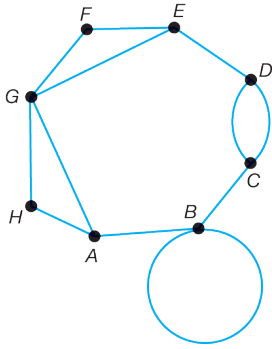
(c)  $\sum d(v) = 2 \times n(E) = 2 \times 9 = 18$



	Graph A
(a) Is the graph a simple graph?	No
(b) Degree of the vertex A	2
(c) Degree of the vertex B	3
(d) Degree of the vertex C	3
(e) Degree of the vertex D	4
(f) Degree of the vertex E	4
(g) Degree of the vertex F	2
(h) Degree of the vertex G	4
(i) Degree of the vertex H	2
(j) Number of edges	12
(k) Sum of degrees	24

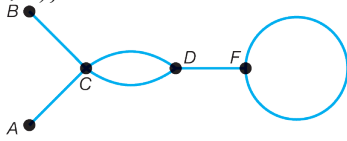


	Graph B
(a) Is the graph a simple graph?	Yes
(b) Degree of the vertex A	2
(c) Degree of the vertex B	2
(d) Degree of the vertex C	2
(e) Degree of the vertex D	2
(f) Degree of the vertex E	3
(g) Degree of the vertex F	3
(h) Degree of the vertex G	2
(i) Degree of the vertex H	2
(j) Number of edges	9
(k) Sum of degrees	18



	Graph C
(a) Is the graph a simple graph?	No
(b) Degree of the vertex A	3
(c) Degree of the vertex B	4
(d) Degree of the vertex C	3
(e) Degree of the vertex D	3
(f) Degree of the vertex E	3
(g) Degree of the vertex F	2
(h) Degree of the vertex G	4
(i) Degree of the vertex H	2
(j) Number of edge	12
(k) Sum of degrees	24

5  $V = \{A, B, C, D, E\}$   
 $E = \{(A, C), (B, C), (C, D), (C, D), (D, F), (F, F)\}$



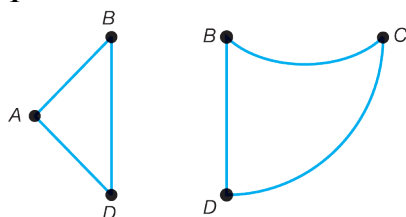
- (a)  $n(V) = 5$   
 (b)  $n(E) = 6$   
 (c)  $\sum d(v) = 2 \times n(E) = 2 \times 6 = 12$

**UPSKILL 5.1b**

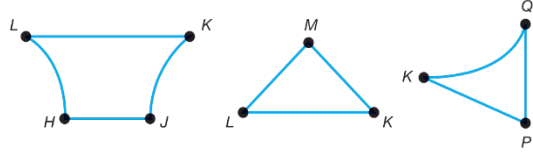
- (b) Not a directed graph  
 2 (a) Weighted graph  
 (b) Not a directed graph

**UPSKILL 5.1c**

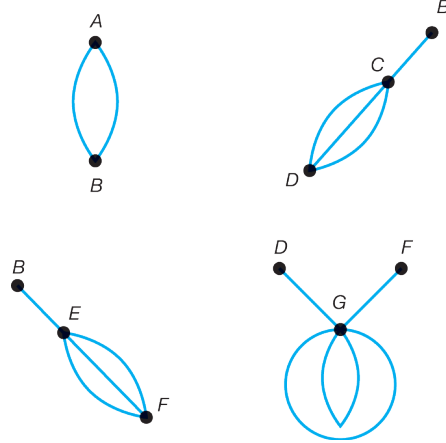
1



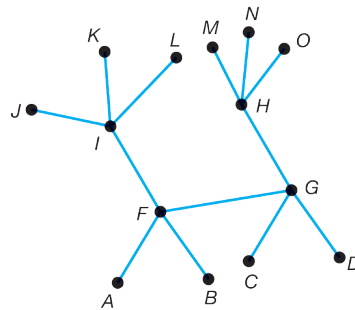
2



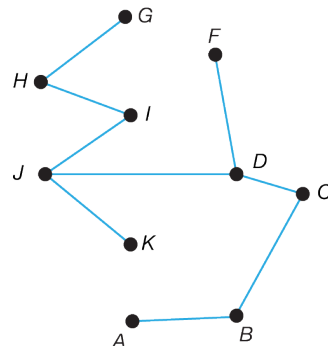
3



- 4 (a) It is not a tree because:  
 (i) there is a cycle  $FGHI$ .  
 (ii)  $n(V) = 14$  and  $n(E) = 14$ . It does not satisfy  $n(V) - n(E) = 1$ .  
 (b) Extra one edge. The edge  $HI$  has to be removed.

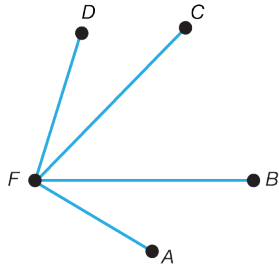


- 5 (a) It is not a graph because:  
 (i) there are cycles  $ABCJK$ ,  $JDFIJ$  and  $HIFG$ .  
 (ii)  $n(V) = 10$  and  $n(E) = 12$ . It does not satisfy  $n(V) - n(E) = 1$ .  
 (b) Extra three edges. The edges  $AK$ ,  $IF$  and  $GF$  have to be removed.



- 6 (a) It is not a tree because:  
 (i) there are cycles  $ABF$ ,  $FBC$  and  $FCD$   
 (ii)  $n(V) = 5$  and  $n(E) = 7$ . It does not satisfy  $n(V) - n(E) = 1$ .

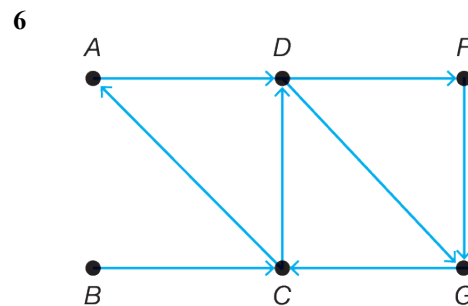
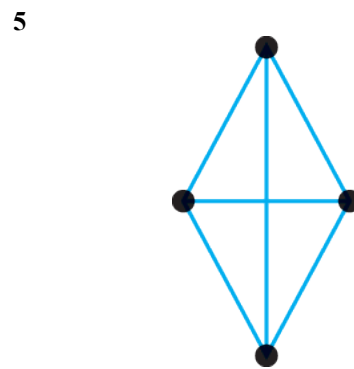
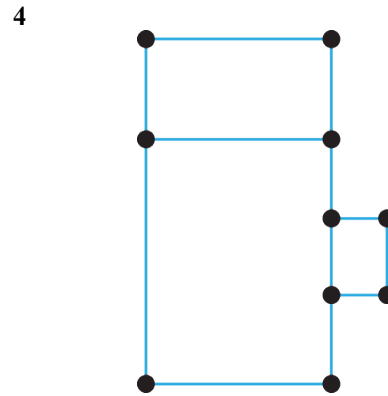
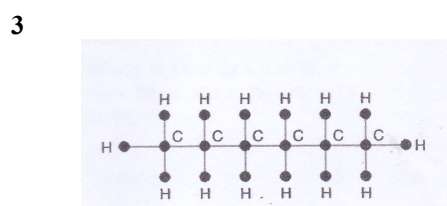
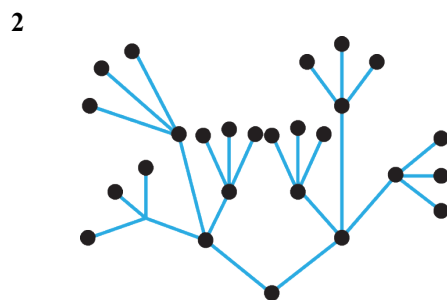
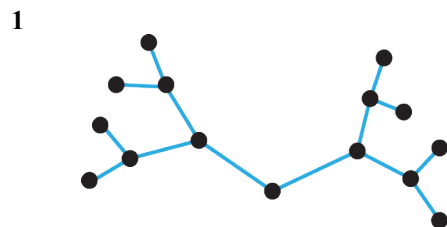
(b) Extra three edges. The edges  $DC$ ,  $CB$  and  $AB$  have to be removed.



- 7 Yes because all the three properties are satisfied:  
 (i) any two vertices are linked by exactly one edge.  
 (ii) there are no cycles.  
 (iii)  $n(V) = 14$  and  $n(E) = 13$ . Hence, the condition  $n(E) = n(V) - 1$  is satisfied.

- 8 Not a tree because there are multiple edges between two Cs. The property of a tree is any two vertices must be linked by exactly one edge.

**UPSKILL 5.1d**



- 7 (a)  $A \rightarrow D \rightarrow C$   
 (b)  $A \rightarrow F \rightarrow E \rightarrow D \rightarrow C$

**UPSKILL 5.1e**

1 (a) *Petrol*

$$133 \text{ km} \rightarrow \frac{133}{6} \text{ litres}$$

$$1 \text{ litre} \rightarrow 2.20$$

$$\frac{133}{6} \times 2.20 = \text{RM}48.75$$

$$\text{Toll} = 0.136 \times 133 = \text{RM}18.10$$

- (b) Kota Bahru  $\rightarrow$  Kuala Terengganu  $\rightarrow$  Pulau Redang (Bus followed by ferry)

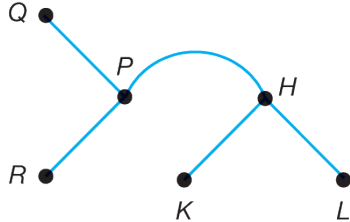
## Summative Practice 5

### Multiple-Choice Questions

1 Degree of the vertex  $A$  is 8.

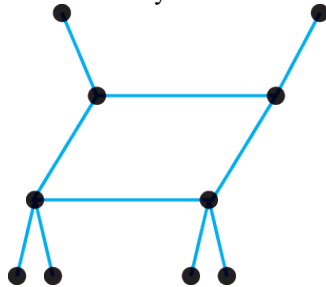
*Answer: B*

2 The simple graph is



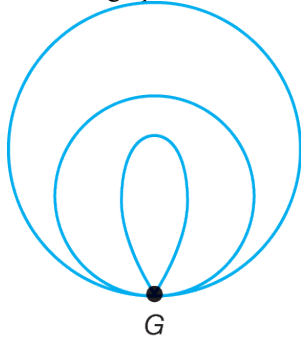
*Answer: D*

3 A tree cannot have cycle.



*Answer: C*

4 The incorrect subgraph is



*Answer: D*

5 The graphs that represents the given diagram are directed and weighted graph.

*Answer: C*

### Structured Questions

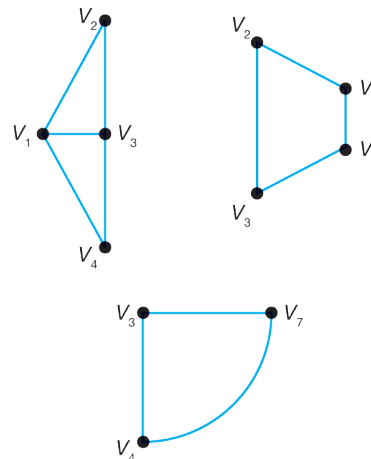
1

(a)	Is the graph a connected graph?	Yes
(b)	Is the graph a simple graph?	No
(c)	Degree of the vertex $A$	4
(d)	Degree of the vertex $B$	8
(e)	Degree of the vertex $C$	4
(f)	Degree of the vertex $D$	6
(g)	Degree of the vertex $E$	4
(h)	Degree of the vertex $F$	4
(i)	Degree of the vertex $G$	2
(j)	Total number of edges	16
(k)	Sum of degrees	32

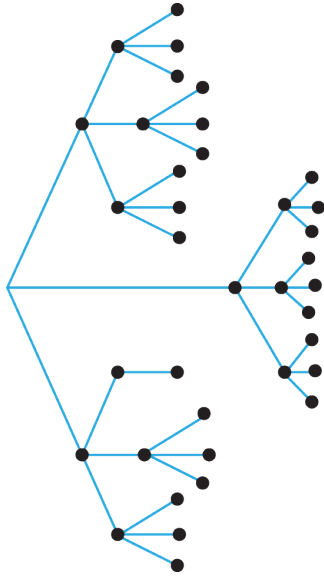
2 (a) Directed (b) Not directed

3 (a) Weighted (b) Not weighted

4



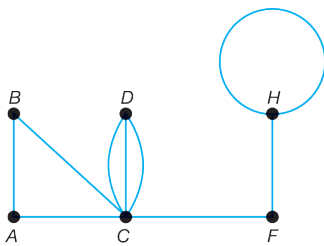
5



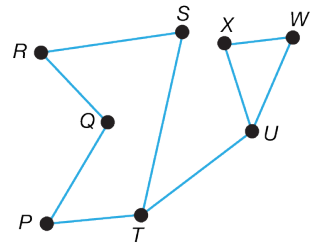
6  $n(V) = 6$   
 $n(E) = 8$   
 Extra three edges



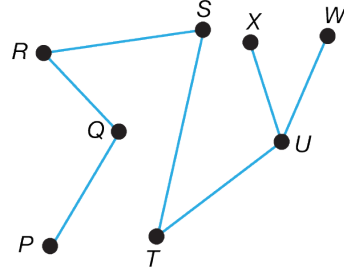
7



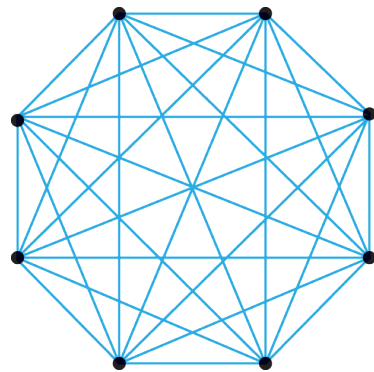
8 (a)



- (b) (i) There are two cycles,  $PQRST$  and  $UWX$ .
- (ii)  $n(V) = 8, n(E) = 9$   
 The condition  $n(V) - 1 = n(E)$  is not satisfied.
- (c) Extra two edges. The edges  $PR$  and  $XW$  have to be removed.



9



10 The graph that can be used to represent the food chain is a directed graph.