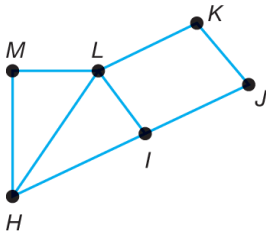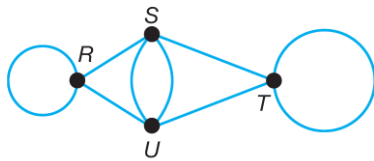**UPSKILL 5.1a**

**1**



(a) $V = \{P, Q, R, S, T, U\}$
$n(V) = 6$
(b) $E = \{(P, Q), (Q, S), (R, S), (S, T), (T, U)\}$
$n(E) = 5$
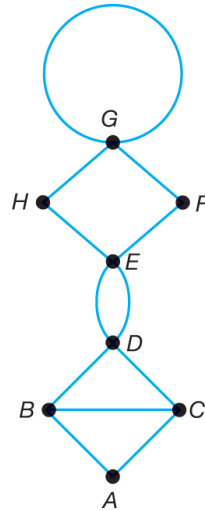(c) $\sum d(v) = 2 \times n(E) = 2 \times 5 = 10$

**2**



(a) $V = \{H, I, J, K, L, M\}$
$n(V) = 6$
(b) $E = \{(H, I), (H, L), (H, M), (M, L), (L, I),$
$(L, K), (K, J), (I, J)\}$
$n(E) = 8$
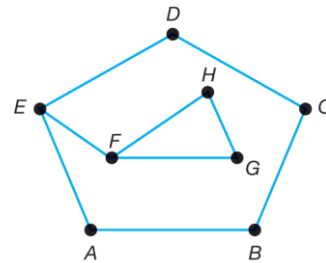(c) $\sum d(v) = 2 \times n(E) = 2 \times 8 = 16$

**3**



(a) $V = \{R, S, T, U\}$
$n(V) = 4$
(b) $E = \{(R, R), (R, S), (R, U), (S, U), (S, U),$
$(S, T), (U, T), (T, T)\}$
$n(E) = 8$
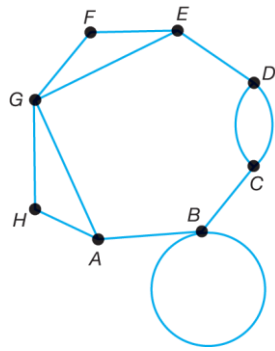(c) $\sum d(v) = 2 \times n(E) = 2 \times 9 = 16$

**4**



|  |  | 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 |

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|  |  | 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 |

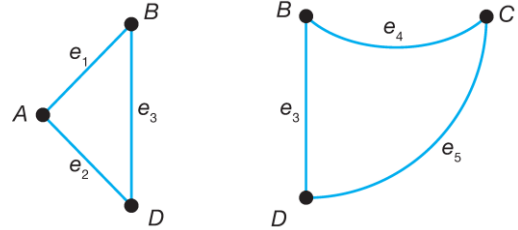**5** $V = \{A, B, C, D, E\}$
$E = \{(A, C), (B, C), (C, D), (C, D), (D, F), (F, F)\}$
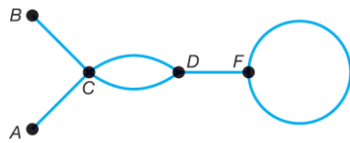


(a) $n(V) = 5$

(b) $n(E) = 6$

(c) $\sum d(v) = 2 \times n(E) = 2 \times 6 = 12$

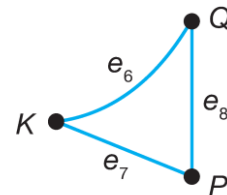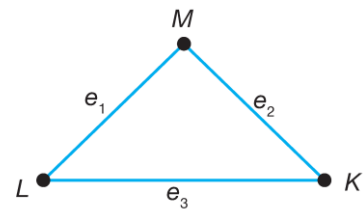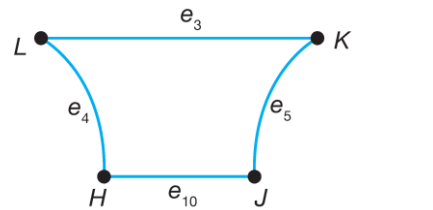*Success Plus Mathematics SPM*

**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 tree because:
    (i) there are cycles *IFGH, JDFI* and
      *ABCDJK,*
    (ii) $n(V) = 10$ and $n(E) = 12$. It does not
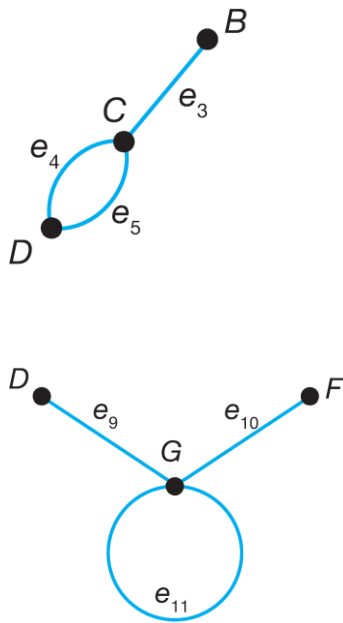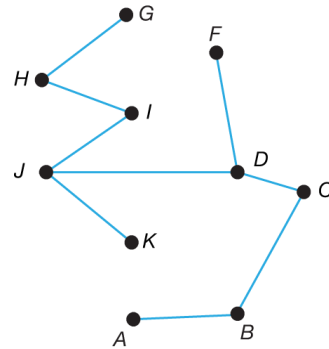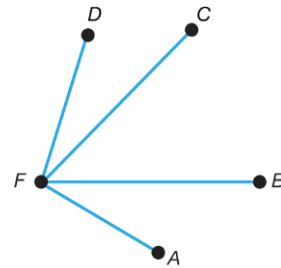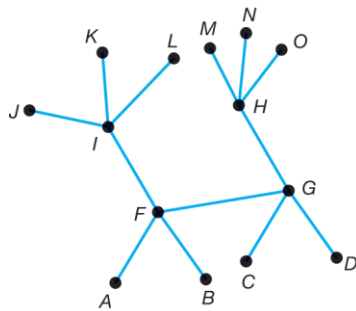      satisfy $n(V) - n(E) = 1$.
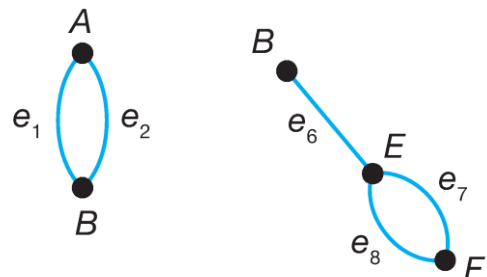
(b) Extra three edges. The edges *AK*, *IF* and
    *GF* have to be removed.



**6**   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 $n(V) - n(E) = 1$.

    Extra three edges. The edges *DC*, *CB*
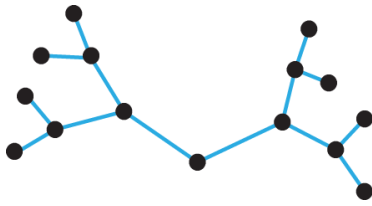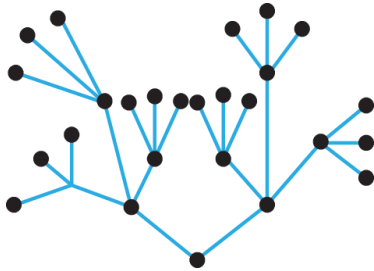    and *AB* have to be removed.



**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
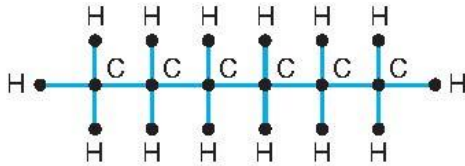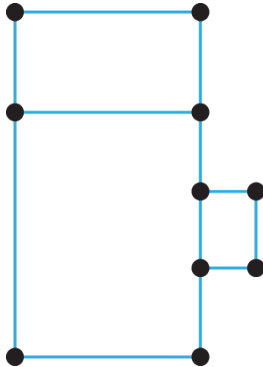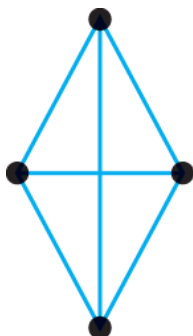   any two vertices must be linked by exactly
   one edge.

**1**



**2**



**3**



**4**



**5**



**6** (a) $A \rightarrow B \rightarrow C$

(b) $A \rightarrow F \rightarrow E \rightarrow D \rightarrow C$

**UPSKILL 5.1e**

**1** (a) (i) *Petrol*

6 km $\rightarrow$ 1 litre

133 km $\rightarrow \dfrac{133}{6}$ litres

1 litre $\rightarrow$ 2.20

$\dfrac{133}{6}$ litres $\rightarrow \dfrac{133}{6} \times 2.20 =$ RM48.75

(ii) Toll $= 0.136 \times 133 =$ RM18.10

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

(c) Kota Bahru $\rightarrow$ Merang $\rightarrow$ Pulau Redang (Car followed by ferry)
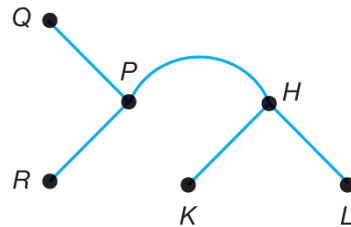
**Summative Practice 5**
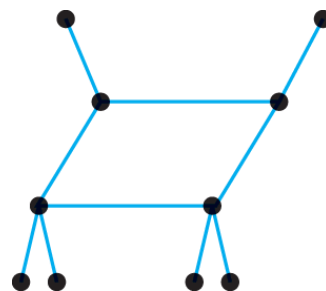
**Multiple-Choice Questions**
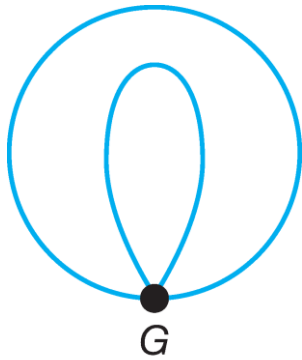
**1** Degree of the vertex $A$ is 6.
*Answer*: B

**2** The simple graph is



*Answer*: D

**3** A tree cannot have cycle.



*Answer*: C

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**4** The incorrect subgraph is



$G$

*Answer*: D

**5** The graphs that represents the given diagram are directed and weighted graph.
*Answer*: C

**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 $B$ | 4 |
| (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 | 14 |
| (k) | Sum of degrees | 28 |

**2** (a) Directed     (b) Not directed
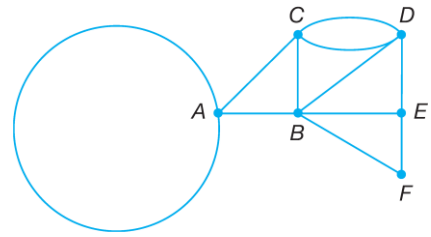
**3** (a) Weighted
   (b) Not weighted

**4**
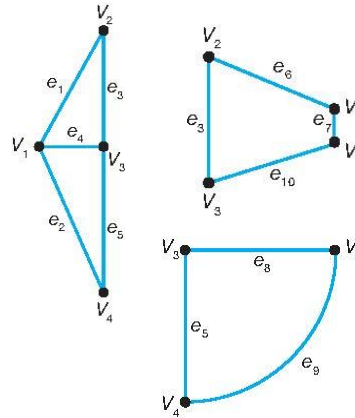


**5**
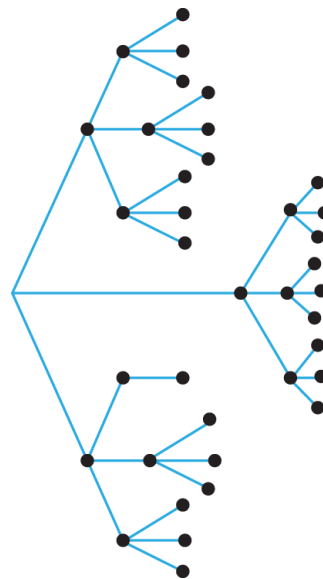
**6** $n(V) = 6$
   $n(E) = 8$
   Extra three edges
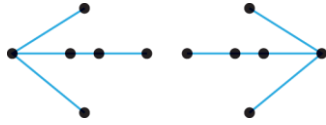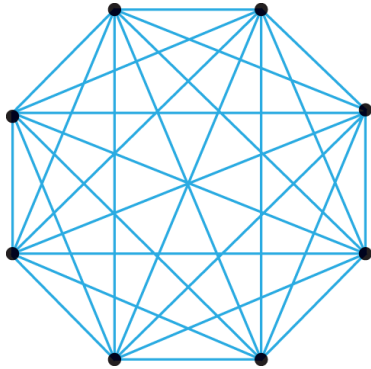


**3** (a)



(b) (i), (ii)

| Vertex | $n(v)$ |
|:---:|:---:|
| $A$ | 4 |
| $B$ | 5 |
| $C$ | 4 |
| $D$ | 5 |
| $E$ | 4 |
| $F$ | 2 |
| $\sum d(v)$ | 24 |
| $n(E)$ | 12 |

**7**



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

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### SPM SPOT

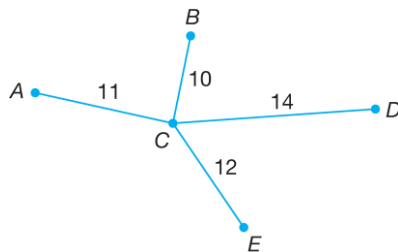**1** A tree must satisfy the following:
   (a) It cannot have any cycle,
   (b) $n(E) = n(V) - 1$

   *Answer*: B

**2** Number of vertices = 5
   Number of edges = 8 (extra by 4)
   The edges that have to be removed are *ED*, *BD*, *AE* and *AB*.



   Minimum weight = 11 + 10 + 12 + 14 = 47
   *Answer*: D