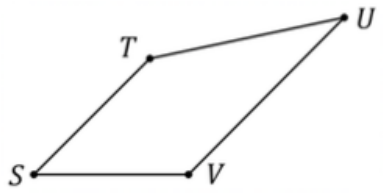
Networks – ACE

1.

3.

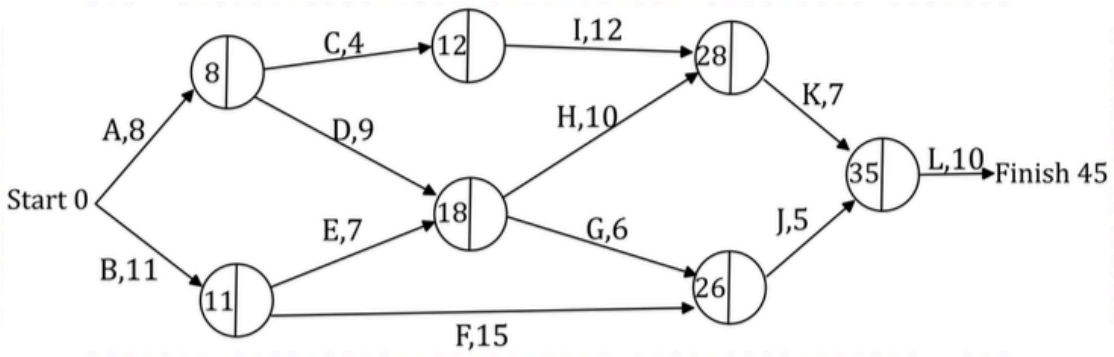


Which of the following walks is a path in the above network diagram?

(A) S–T–S–V
(B) S–T–U–V
(C) S–T–V–S
(D) S–T–U–V–S

2.

11.

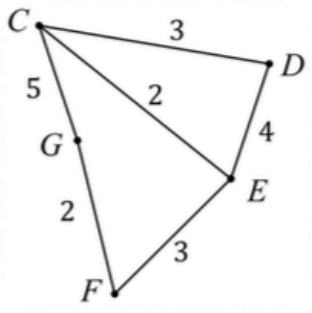


What is the float time of activity *I*?

(A) 4
(B) 6
(C) 8
(D) 12

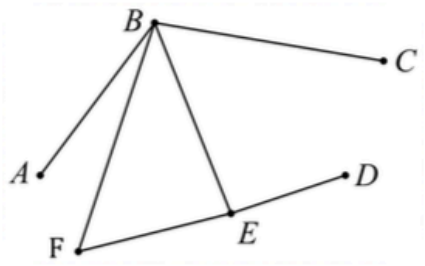
3.

The network diagram below shows the possible paths (in km) for laying gas pipes between five locations. **2**



What is the minimum length of pipes required to provide gas to all locations?

4.

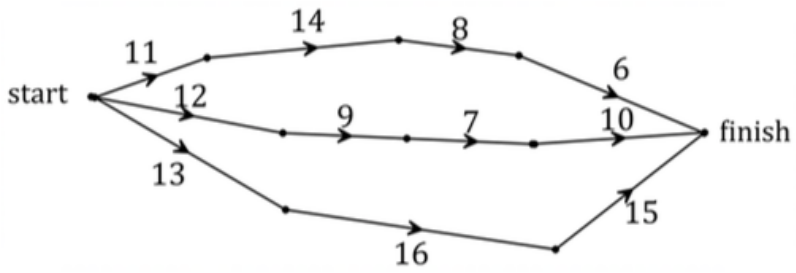


(a) Complete the table of vertex degrees for the network diagram. **1**

Vertex	*A*	*B*	*C*	*D*	*E*	*F*
Degree						

(b) Is there a path in the network that visits every edge exactly once? Give a reason for your answer. **1**

5.



What is the maximum flow for this network? **3**

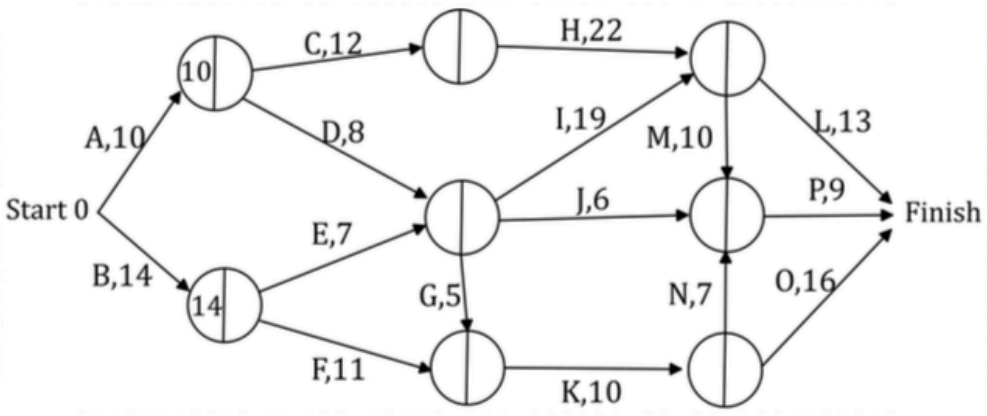
6.

2

	W	*X*	*Y*	*Z*
W	–	3	9	8
X	3	–	6	1
Y	9	6	–	2
Z	8	1	2	–

Represent the table shown above as a weighted network.

7.



(a) Write the earliest starting times (EST) and latest staring times (LST) on the above network diagram. **3**

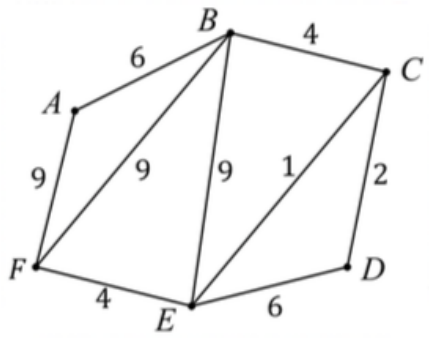
(b) What is the critical path? **1**

8.

Activity	*Duration (min)*	*Immediate predecessors*
A	12	–
B	17	*A*
C	27	*A*
D	14	*B*
E	7	*C*
F	12	*D, E*

Construct a network diagram using the activity chart. Show the earliest staring times (EST) and latest staring times (LST). **3**

9.

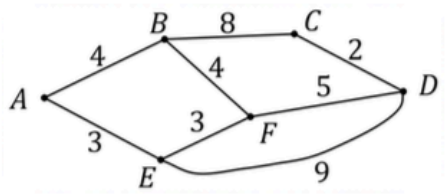


(a) Find the length of the shortest path from *A* to *E*. **2**

(b) Find a walk that visits every edge of the network only once, starting at *C*. **2**

10.

Prim's algorithm, beginning with vertex *A*, will be used to find the minimal spanning tree for the network below.



Which vertex will be added last?

(A) *D*

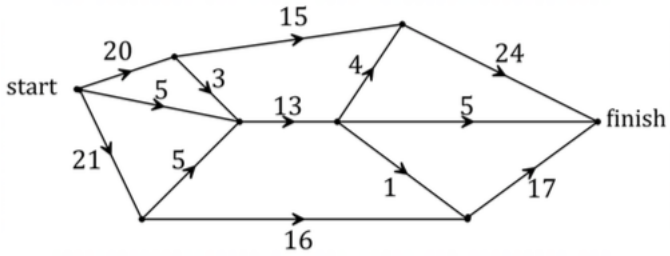
(B) *C*

(C) *B*

(D) *F*

11.

11.



What is the maximum flow in the network diagram?

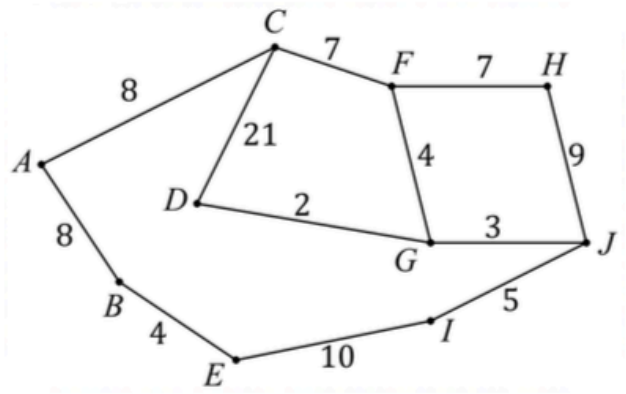
(A) 40

(B) 41

(C) 42

(D) 43

12.



(a) List the vertices with an odd degree. **1**

(b) What is length of the shortest path from *A* to *J*? **2**

13.

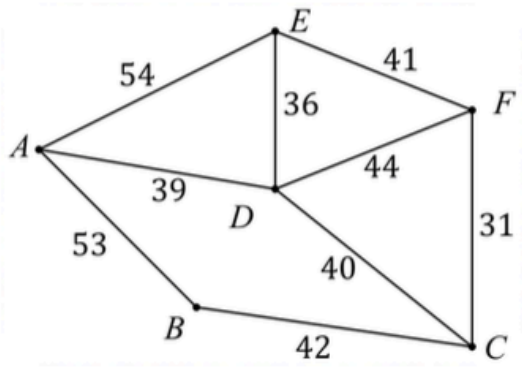
Activity	*Duration (min)*	*Immediate predecessors*
A	8	–
B	13	*A*
C	23	*A*
D	10	*B*
E	3	*C*
F	8	*D*
G	18	*E, F*

(a) Construct a network diagram using the activity chart. Show the earliest starting times (EST) and latest starting times (LST). **3**

(b) Find the critical path and minimum completion time. **2**

14.

There are five towns (*B*,*C*,*D*,*E* and *F*) that need to be linked by pipelines to a natural gas supply (*A*). The existing road links and the distance (in km) between the towns is shown in the network diagram below.



(a) Draw a minimum spanning tree that will ensure that all the towns are connected to the network, but that also minimises the amount of pipelines required. **2**

(b) What is the minimum length of pipeline to supply all the towns? **1**

15.

There are five motorways between five cities labelled *A*, *B*, *C*, *D* and *E*. The table below shows which cities are linked by the motorways and the length of each one in kilometres.

	A	*B*	*C*	*D*	*E*
A	–	–	–	22	46
B	–	–	43	19	–
C	–	43	–	7	–
D	22	19	7	–	–
E	46	–	–	–	–

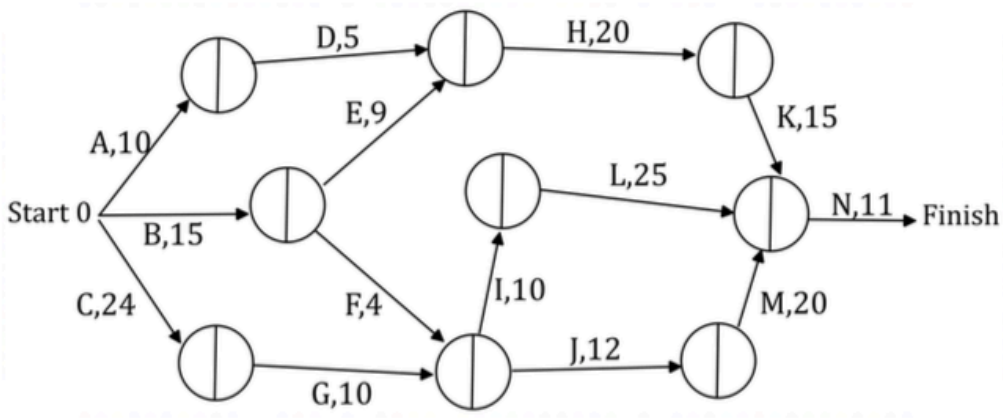
(a) Represent the table shown above as a weighted network. **2**

(b) How would you travel from city *E* to city *C*? **1**

(c) What is the distance of the longest journey from city *E* to city *C*? **1**

16.

The network diagram for a project is shown below. The duration for each activity is in days.

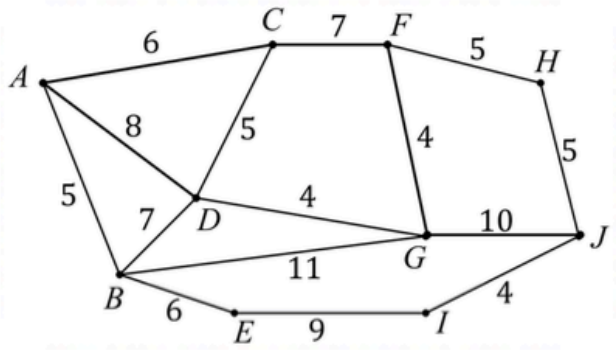


(a) Write the earliest starting times (EST) and latest starting times (LST) on the above network diagram. **3**

(b) What is the minimum completion time for the project? **1**

17.

1. The network diagram below shows the kilometres between towns.



What is length of the shortest path from *A* to *J*?

(A) 21 km

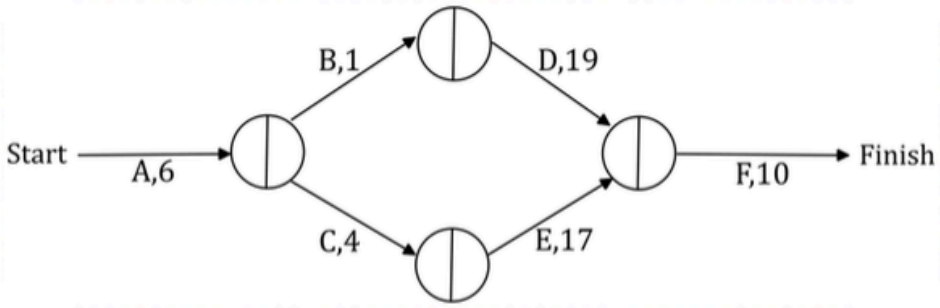
(B) 22 km

(C) 23 km

(D) 24 km

18.

13.



What is the critical path in the above network?

(A) *ABDF*

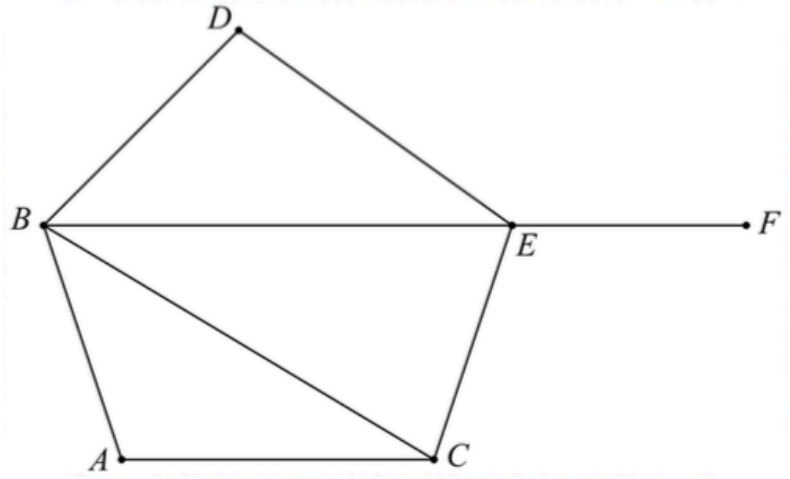
(B) *ABEF*

(C) *ACDF*

(D) *ACEF*

19.

Consider the following network.



(a) How many edges are there? **1**

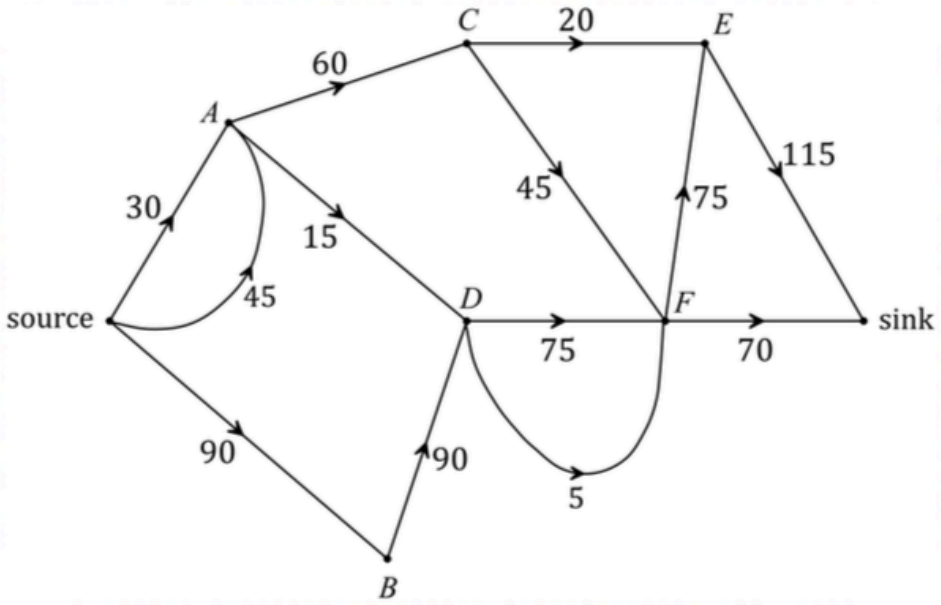
(b) How vertices have degree 3? **1**

(c) Is this a connected graph? Justify your answer. **1**

(d) List three different cycles that begin at vertex *D*? **1**

20.

The network diagram below shows the flow of water (in litres) through a series of pipes from the source to the sink.



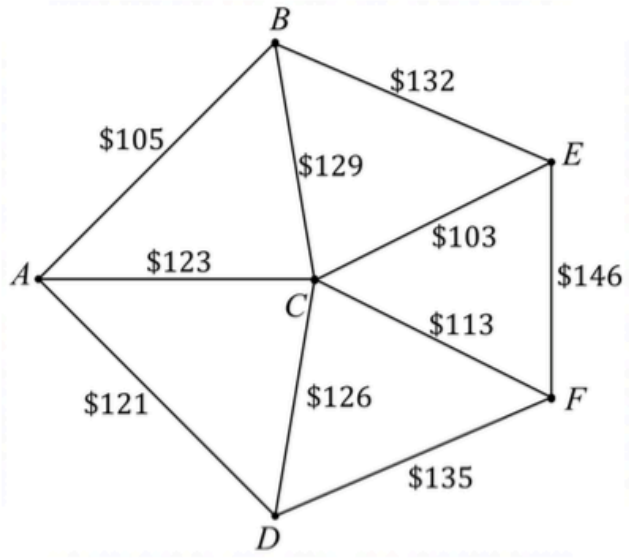
(a) What is the outflow of vertex *C*? **1**

(b) Find the minimum cut for this network **2**

(c) What is the maximum flow for this network? **1**

21.

The network diagram below shows the cost to lay pipes to certain parts of a garden.



(a) Draw a network table to represent the network. **1**

(b) Draw a minimum spanning tree that will ensure all parts of the garden are connected by pipes, but also minimises the amount of pipes required. **2**

(c) What is the minimum cost of pipes to connect all parts of the garden? **1**

22. **2**

	A	*B*	*C*	*D*	*E*
A	–	1	–	5	4
B	1	–	3	–	–
C	–	3	–	2	6
D	5	–	2	–	7
E	4	–	6	7	–

Represent the table shown above as a weighted network.

23.

Activity	*Duration (min)*	*Immediate predecessors*
A	7	–
B	2	–
C	12	*A*
D	9	*B*
E	22	*B*
F	17	*C, D*
G	4	*E*
H	12	*E*
I	8	*F, G*
J	5	*H*

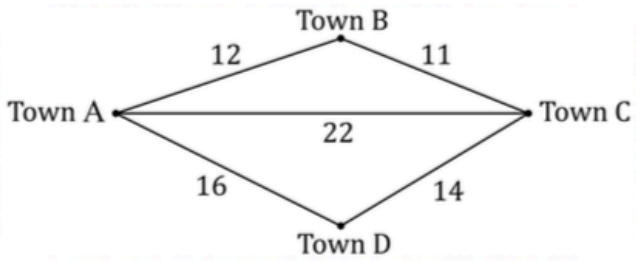
(a) Construct a network diagram using the activity chart. Show the earliest starting times (EST) and latest starting times (LST). **3**

(b) What is the critical path? **1**

(c) What is the minimum time needed to complete the project? **1**

24.

The network diagram below shows the distance by road (in km) between four towns.



What is the length of the minimum spanning that connects all the towns?

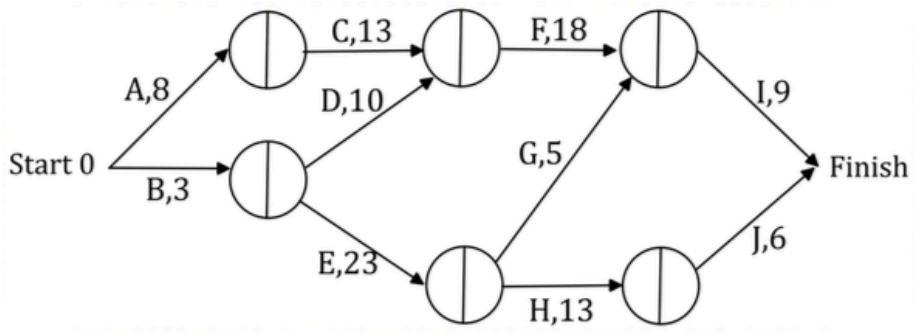
(A) 37 km

(B) 39 km

(C) 47 km

(D) 53 km

25.



What is the minimum completion time for the above network?

(A) 40

(B) 44

(C) 48

(D) 52

26. **2**

	A	*B*	*C*	*D*
A	–	4	10	11
B	4	–	9	4
C	10	9	–	2
D	11	4	2	–

Represent the table shown above as a weighted network.

27.

Activity	*Duration (min)*	*Immediate predecessors*
A	10	–
B	6	–
C	7	*A*
D	11	*A, B*
E	8	*D*
F	?	*C, E*
G	2	*D*

(a) Construct a network diagram using the activity chart. Show the earliest starting times (EST) and latest starting times (LST). **3**

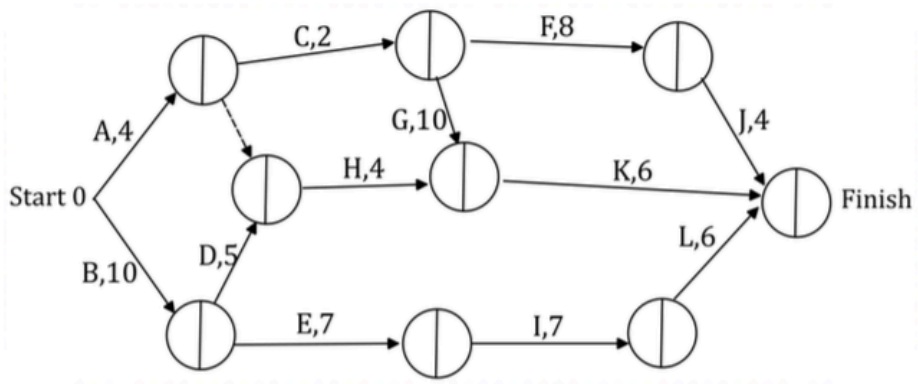
(b) The critical path is *ADEF*. It has a critical time of 38 minutes. What is weight of activity *F*? **1**

(c) What is the float time of activity *G*? **1**

28.

A spanning tree contains six edges. How many vertices are in the network? **1**

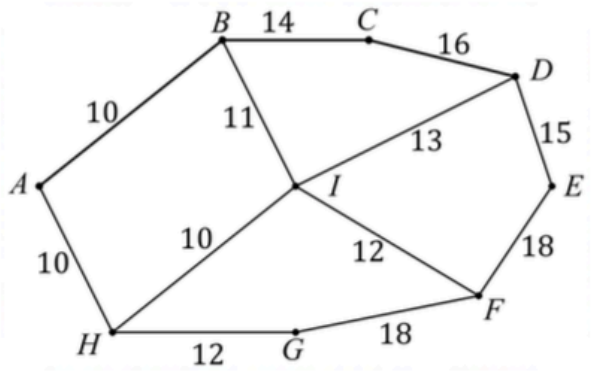
29.



Write the earliest starting times (EST) and latest starting times (LST) on the above network diagram. **2**

30.

The network below shows the time (in minutes) taken to travel between towns.



(a) What is the time taken to travel *ABCDI*? **1**

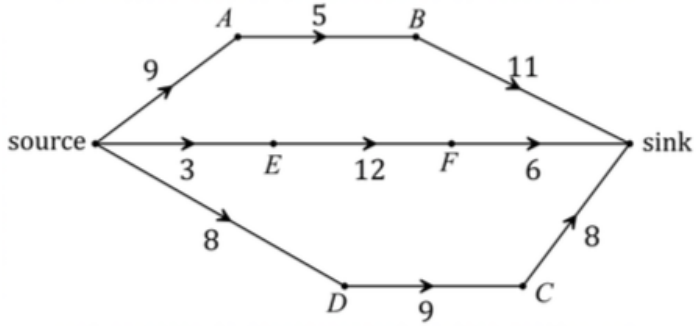
(b) List the vertices with an even degree? **1**

(c) Does this network contain a walk that visits every edge exactly once? Give a reason for your answer. **1**

(d) Find the shortest time it would take to travel from *A* to *E*? **2**

(e) Find a minimum spanning tree for this network. **1**

31.



What is the maximum flow for this network? **2**