

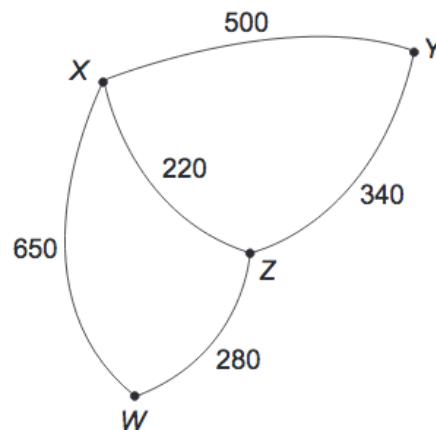
Answers and Bands

1. D (Band 2-3)
2. B (Band 2-3)
3. B (Band 2-3)
4. B (Band 2-3)
5. B (Band 5-6)
6. D (Band 5-6)
- 7.
- a) (Band 2-3)

Marking guidelines Question 7 (a):

Criteria	Marks
• Constructs a correct network diagram	2
• Provides some relevant information	1

Sample answer:



- b) (Band 2-4)

Marking guidelines Question 7 (b):

Criteria	Marks
• Calculates the shortest distance	2
• Identifies the order that the petrol stations are refilled	
• Provides some relevant information	1

Sample answer:

Order = W – Z – X – Y

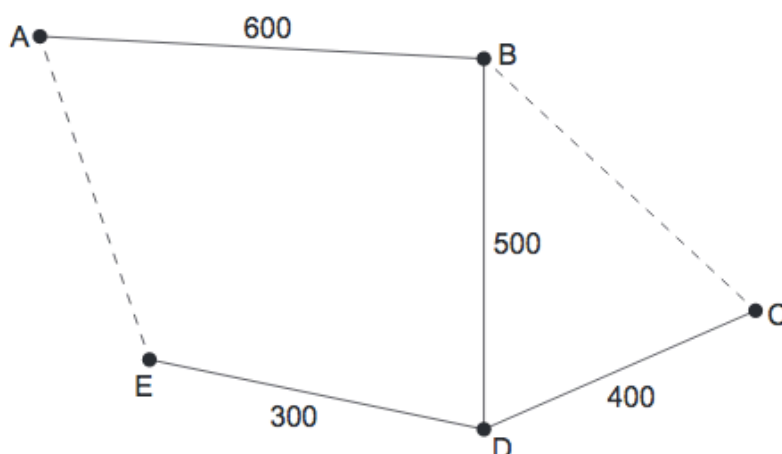
$$\begin{aligned} \text{Distance} &= 280 + 220 + 500 \\ &= 1000 \text{ m} \end{aligned}$$

8. (Band 2-5)

Marking guidelines:

Criteria	Marks
<ul style="list-style-type: none"> • Correctly completes the network diagram • Provides a correct possible value for each of the edges <i>AE</i> and <i>BC</i> • Demonstrates understanding of the conditions for a minimum spanning tree related to cycles and to the connection of vertices 	4
<ul style="list-style-type: none"> • Correctly completes the network diagram • Provides a correct possible value for <i>AE</i> and/or <i>BC</i> • Demonstrates some understanding of the conditions for a minimum spanning tree related to cycles and/or to the connection of vertices 	3
<ul style="list-style-type: none"> • Correctly completes the network diagram • Provides a correct possible value for <i>AE</i> and/or <i>BC</i> 	2
<ul style="list-style-type: none"> • Demonstrates some understanding of network diagrams 	1

Sample answer:



AE – any value greater than or equal to 600

BC – any value greater than or equal to 500

AE and *BC* were not part of the spanning tree because they were either greater than other edges or they would have created a cycle within the network. Given that *DE*, *DB* and *DC* had been chosen (the smallest values), then *AE* would have created a cycle and *BC* was not required as each of the vertices had been connected. Similarly, *BC* would have created a cycle and *AE* was not required as the vertices had been connected.

9. (Band 3-6)

Marking guidelines:

Criteria	Marks
<ul style="list-style-type: none"> Identifies additional road(s) that can maximise the network capacity Relates the additional road(s) to maximising the capacity 	3
<ul style="list-style-type: none"> Demonstrates some understanding of maximising network capacity and/or identifies areas where capacities are not maximised 	2
<ul style="list-style-type: none"> Provides some relevant information 	1

Sample answer:

A road from *Q* to *U* and a road from *S* to *U*, each with a capacity of 20 vehicles per hour, can be added to maximise the capacity.

Q can handle 65 vehicles per hour travelling into it but only has 45 vehicles per hour travelling out of it. Building a road directly from *Q* to *U* with a capacity of 20 vehicles per hour will rectify this shortfall and maximise the capacity.

Similarly, *S* can handle 50 vehicles per hour travelling into it but only 30 vehicles per hour travelling out of it. Building a road directly from *S* to *U* with a capacity of 20 vehicles per hour will rectify the shortfall and maximise the capacity.

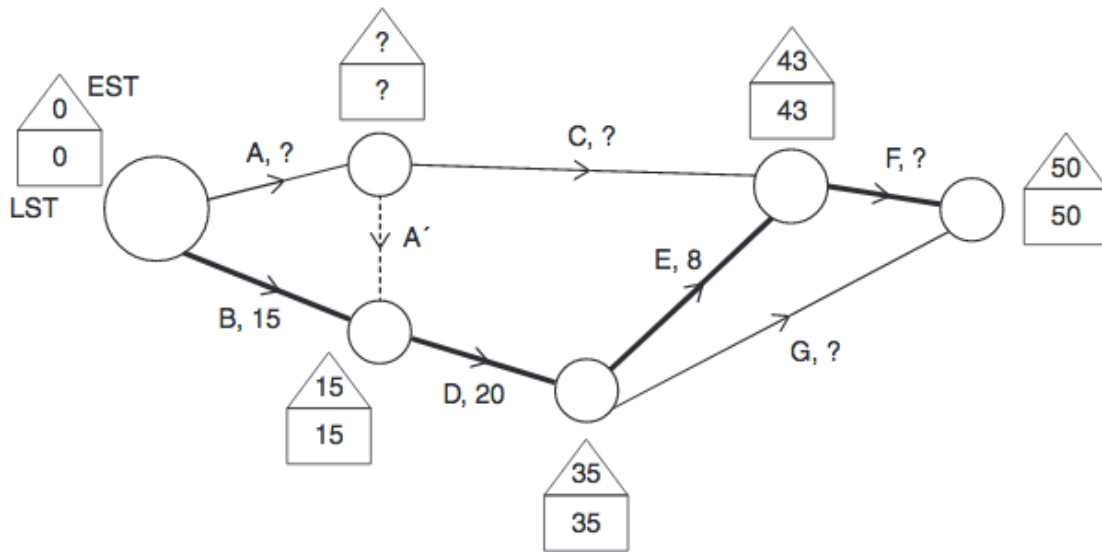
U is capable of taking on 40 extra vehicles per hour since it can handle 155 vehicles per hour ($63 + 92$) into the on-ramp but there are only 115 vehicles entering it. The two additional roads, each with a capacity of 20 vehicles per hour, will maximise the capacity at *U*.

10. (Band 2-6)

Marking guidelines:

Criteria	Marks
<ul style="list-style-type: none"> Finds possible values for the missing entries Supports the solution with a correct network diagram 	5
<ul style="list-style-type: none"> Finds possible values for some of the missing entries Supports the solution with a relevant network diagram 	4
<ul style="list-style-type: none"> Finds a value for a missing entry and supports the solution with a relevant network diagram <p>OR</p> <ul style="list-style-type: none"> Correctly represents all the given information on a network diagram and demonstrates some understanding of critical path / LST / EST / float 	3
<ul style="list-style-type: none"> Shows the relationship between some of the activities using a diagram and/or calculations 	2
<ul style="list-style-type: none"> Provides some relevant information 	1

Sample answer:



F is on critical path and so has no float.
 \therefore duration of F is $50 - 43 - 0 = 7$ days

Float = LST of next activity - EST of this activity - duration of this activity
 \therefore duration = LST of next activity - EST of this activity - Float

The float of G is 3 days.
 \therefore duration of G = $50 - 35 - 3 = 12$ days

The float of C is 8 days.
 \therefore duration of C = $43 - \text{EST for C} - 8$

But EST for C is equal to the duration of A since A has no prerequisites.
 \therefore duration of C = $43 - \text{duration of A} - 8$

So, duration of A + duration of C = $43 - 8 = 35$ days
 \therefore possible durations for A and C may be A = 1 day and C = 34 days.

11.

a) (Band 3-4)

Marking guidelines Question 11 (a):

Criteria	Marks
• Identifies the TWO activities	1

Sample answer:

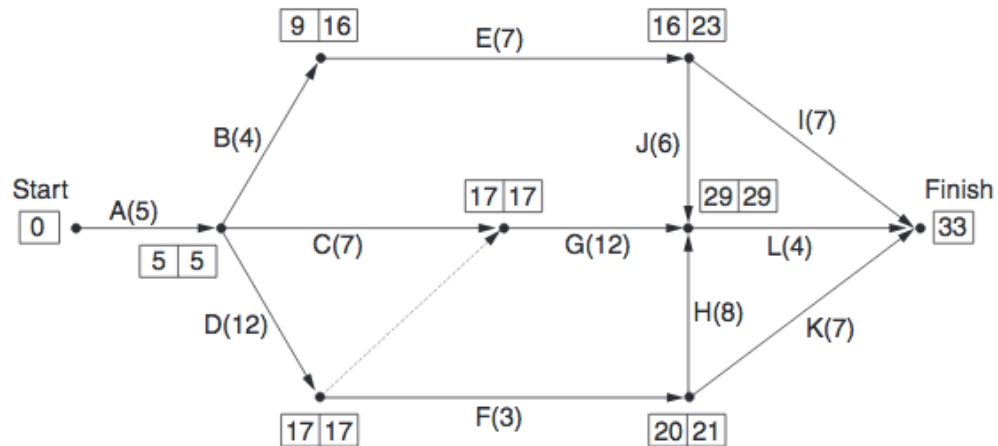
Activity C and Activity D

b) (Band 4-6)

Marking guidelines Question 11 (b):

Criteria	Marks
• Completes the diagram	2
• Determines the minimum time required	1
• Provides some relevant information	

Sample answer:



A – D – G – L 33 days

c) (Band 5-6)

Marking guidelines Question 11 (c):

Criteria	Marks
• Correctly determines the float time for activity E	1

Sample answer:

7 days