GCST

2.3.3
ALGORITHMS - PATH FINDING
TOPIC WISE EXAM QUESTIONS

A-LEVEL OCR

1 **(b)** A graph is another type of data structure.

An example graph is shown in **Fig. 1**.

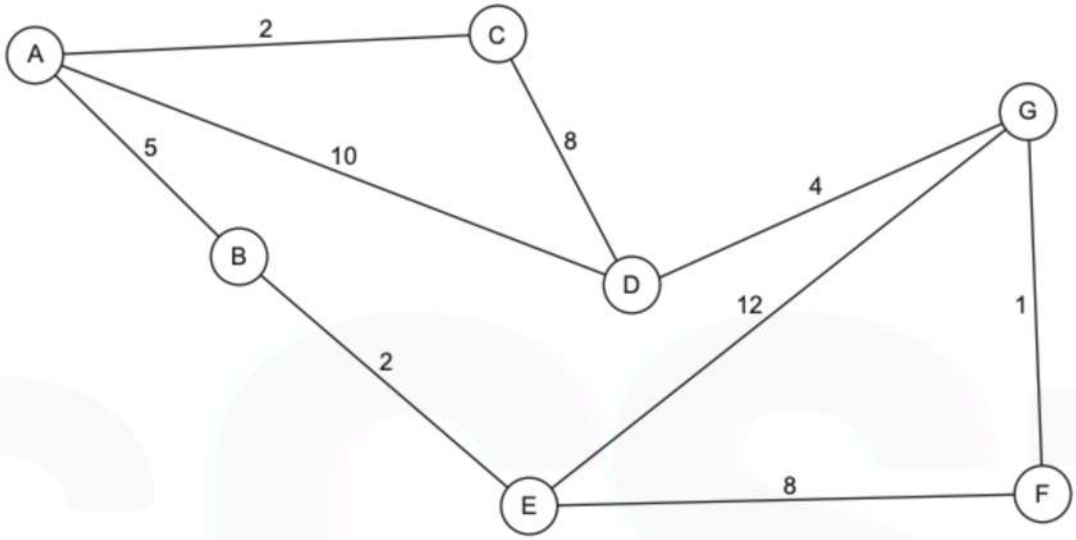

Fig. 1

Show how Dijkstra's algorithm can be used on the graph shown in **Fig. 1** to find the shortest path from start node A to end node G.

You must state the nodes on the final path and the distance of this path. Show your working.

You may use the table below to give your answer.

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Node	Distance travelled	Previous node

Final path: .....

Distance: .....

[6]

5 **Fig. 5** shows a graph data structure representing a small section of a parcel delivery network. Each node represents an address where deliveries need to be made. The edges show the possible routes and distances between these deliveries.

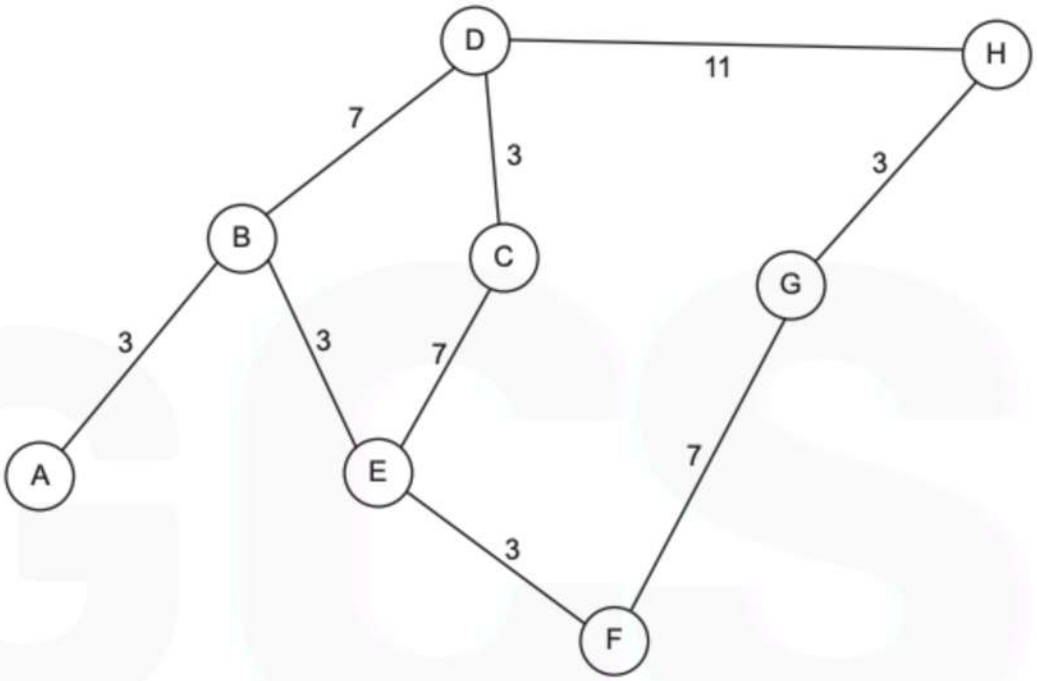

Fig. 5

(c) (i) Show how Dijkstra's algorithm can be used on the graph shown in **Fig. 5** to find the shortest path from the start node A and the end node H.

You should state the nodes on the final path and the overall distance. Show your working.

You may choose to use the table below to give your answer.

Node	Distance travelled	Previous node

Final path: .....

Distance: .....

[6]

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1 **(c)** Some of the characters in the game will move and interact independently. Taylor is going to use graphs to plan the movements that each character can take within the game.

DancerGold is one character. The graph shown in **Fig. 1** shows the possible movements that DancerGold can make.

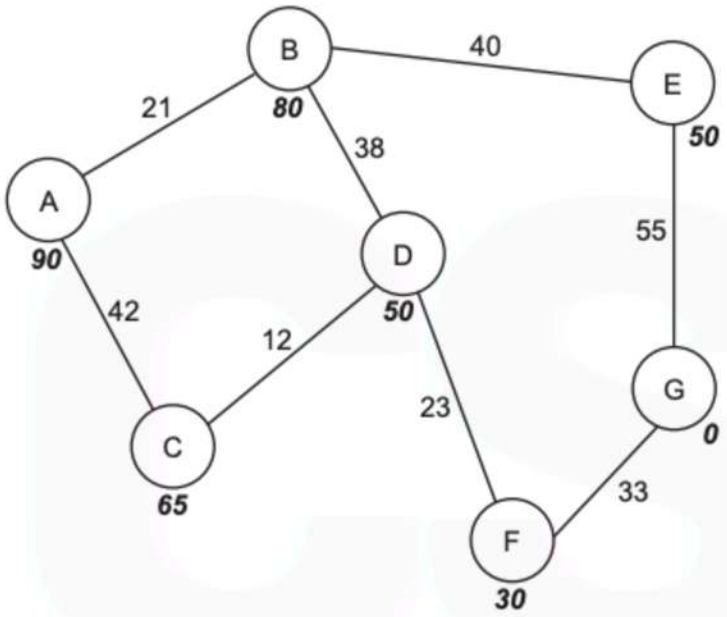

Fig. 1

DancerGold's starting state is represented by node A. DancerGold can take any of the paths to reach the end state represented by node G.

The number on each path represents the number of seconds each movement takes.

The number in bold below each node is the heuristic value from A.

(i) Define the term heuristic in relation to the A* algorithm.

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(ii) Perform an A* algorithm on the graph shown in **Fig. 1** to find the shortest path from the starting node to the end node. Show your working, the nodes visited and the distance. You may choose to use the table below to give your answer.

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Node	Distance travelled	Heuristic	Distance travelled + Heuristic	Previous node

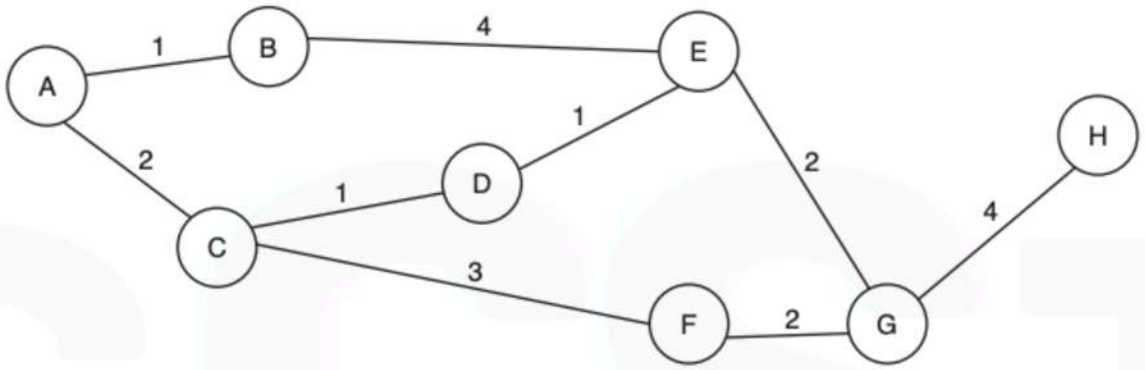
Final path: .....

Distance: .....

[8]

4 **(c)** The game's 'challenging' level has intelligent enemies that hunt down the character in an attempt to stop the user from winning. The program plans the enemies' moves in advance to identify the most efficient way to stop the user from winning the game.

The possible moves are shown in a graph. Each node represents a different state in the game. The lines represent the number of moves it will take to get to that state.



Show how Dijkstra's algorithm would find the shortest path from A to H.

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3 A puzzle has multiple ways of reaching the end solution. Fig. 3 shows a graph that represents all possible routes to the solution. The starting point of the game is represented by A, the solution is represented by J. The other points in the graph are possible intermediary stages.

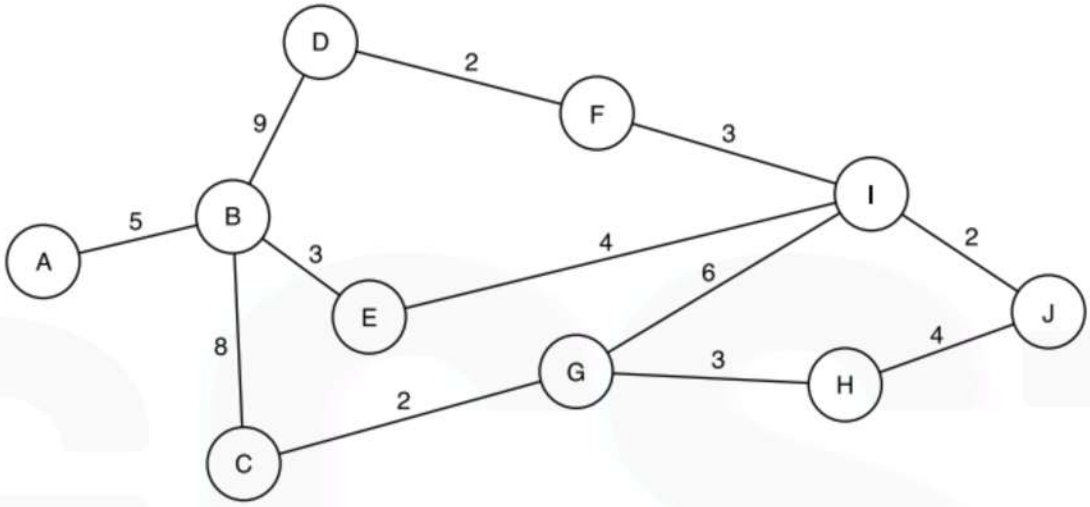

Fig. 3

(b) Demonstrate how Dijkstra's algorithm would find the shortest path to the solution in Fig. 3.

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(c)* The creator of the puzzle has been told that the A* algorithm is more efficient at finding the shortest path because it uses heuristics.

Compare the performance of Dijkstra's algorithm and the A* search algorithm, making reference to heuristics, to find the shortest path to the problem.

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If you found this useful, drop a follow to help me out!

THANK YOU!

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