

1.4 DATA TYPES & STRUCTURES · 1.4.2

Graphs

Original practice questions · 30 marks · about 40 minutes · spec 1.4.2(b)(c)

Instructions. Answer all questions. Marks are shown in brackets [].**1** Total: 5 marks

(a) Describe what is meant by a *graph* data structure. [2]

(b) Explain the difference between a *directed* and an *undirected* graph. [2]

(c) State what is meant by a *weighted* graph. [1]

2 Total: 8 marks

An undirected graph has nodes P, Q, R, S with the edges: P–Q, P–R, Q–S and R–S.

(a) Complete the adjacency matrix for this graph (use 1 for an edge, 0 otherwise). [4]

	P	Q	R	S
P				
Q				
R				
S				

(b) Write the adjacency list for this graph. [3]

(c) Explain why the adjacency matrix for this graph is symmetrical. [1]

3

Total: 6 marks

- (a) Describe **two** differences between using an adjacency matrix and an adjacency list to store a graph. [4]

- (b) A graph has 1000 nodes but only a few hundred edges. State which representation is more suitable and justify your answer. [2]

4

Total: 6 marks

A program models a city's one-way street system, where each road connects two junctions and can only be travelled in one direction.

- (a) State which type of graph should be used, and justify your choice. [2]

- (b) Explain how the adjacency matrix of this graph would differ from that of an undirected graph. [2]

- (c) The program is extended to store the length of each road. State the type of graph now required, and where the length would be stored in the matrix. [2]

5

Total: 5 marks

A graph is stored as the adjacency list:

$A \rightarrow [B, C]$ $B \rightarrow [A, C]$ $C \rightarrow [A, B, D]$ $D \rightarrow [C]$

- (a) List all the edges in this graph. [2]

- (b) State how many edges the graph has. [1]

- (c) State which node has the most connections, and how many. [1]

- (d) State whether this is a directed or undirected graph, giving a reason from the list. [1]

END OF QUESTIONS