5.5 Graphs and traversal

Name: _____ Class: _____ Date: _____ **Total: 24 marks**

KEY WORDS adjacency list • adjacency matrix

Objective

Store a graph both ways, and run both traversals by hand.

1 Key knowledge and worked examples

■ The two stores

The course graph: 8 nodes, 10 undirected edges – the adjacency list holds 20 entries, the matrix 64 cells ✓. Both traversals are $O(V+E)$ on the list, $O(V^2)$ on the matrix ✓.

■ Worked example: the two orders

BFS from A reads A, B, C, D, E, F, G, H in layers $A \mid B, C \mid D, E \mid F, G \mid H$ ✓. DFS from A reads A, B, D, C, E, F, H, G – deep with backtracks ✓.

2 Practice

2.1 An undirected graph has 12 edges. Give its adjacency-list entry count and its matrix size for 9 nodes. [3]

2.2 What does a node's BFS layer equal, and under what weight assumption? [3]

2.3 State the one marking rule both traversals share, and what breaks without it. [3]

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3 Exam-style questions

3.1 A graph has vertices P, Q, R, S, T and undirected edges PQ, PR, QS, RS, ST.

Write its adjacency list. Run BFS from P with neighbours visited alphabetically: give the visit order and each node's layer. Run DFS from P the same way and give the visit order. State the cost of each traversal on your list, and on the adjacency matrix of this graph. [8]

3.2 Choose the storage for each scenario and justify: a social network with 10^6 users and average degree 50; a timetable lookup asking only whether station X connects directly to station Y among 300 stations, half the pairs connected.

Compute the list-entry count and the matrix-cell count for the network case, and state which store wins each scenario by comparing the counts. [7]

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