UNIVERSITY COMPUTER SCIENCE • EXERCISE SHEET

9.3 Routing

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

KEY WORDS routing table • longest prefix match

Objective

Run longest-prefix matching and Dijkstra by hand on the course data.

1 Key knowledge and worked examples

■ The rules

Longest prefix match: the most specific route wins; the default catches the rest ✓. Dijkstra: settle the nearest unsettled node – settled is final ✓.

■ Worked example: the tree

Course weights from A settle C 2, B 3, D 8, E 10, F 13; F's path is A C B D E F at $2+1+5+2+3=13$ ✓.

2 Practice

2.1 Only `10.0.0.0/8 → X` and default → W exist. Where does `10.2.3.4` go? [3]

2.2 Course graph: what is the direct A–B cost, and what is A to B through C? [3]

2.3 Which node settles second from A, at what distance? [3]

3 Exam-style questions

3.1 A routing table holds `10.0.0.0/8 → P`, `10.4.0.0/16 → Q`, `10.4.7.0/24 → R`, plus a default route to D.

Give the next hop for each of: `10.4.7.9`, `10.4.9.9`, `10.9.9.9`, `172.16.1.1`, with the reason. Add one entry that hijacks `10.4.7.128` away from R; state its prefix length and why it wins. State what the default is for, in one line. [8]

3.2 Course graph, from A.

Give the settle order with each distance. Trace why B settles at 3, not 4. Give F's shortest path and its total. State which single edge deletion would change F's distance, and the new distance. [7]

Solutions

2.1

- P – the /8 matches; the default is only for non-matches ✓.

2.2

- Direct A–B = 4; via C = 2 + 1 = 3 ✓.

2.3

- C, at 2 ✓.

3.1

- `10.4.7.9` → R (the /24 matches and is longest) ✓.
- `10.4.9.9` → Q (only the /16 matches) ✓.
- `10.9.9.9` → P (only the /8) ✓.
- `172.16.1.1` → D (nothing matches; the default) ✓.
- Hijack: `10.4.7.128/25 → H` – /25 > /24, so it wins for addresses 128–255 of that block ✓.
- The default exists so the table need not hold a route for every possible destination ✓.

3.2

- Settle order: C 2, B 3, D 8, E 10, F 13 ✓.
- B settles at 3 because settling C (2) relaxes B through the C–B edge of weight 1: $2 + 1 = 3 < 4$ ✓.
- F: A C B D E F, total $2 + 1 + 5 + 2 + 3 = 13$ ✓.
- Deleting D–E (weight 2) forces E via C at 12, so F becomes $\min(8 + 6, 12 + 3) = 14$ via D ✓.