Solutions

Marking: **M1** a correct method, **A1** the correct answer, **B1** an independent mark.

Each answer shows the steps, then the **result**.

2.1

sum of degrees $= 9$; the sum must be even (twice the number of edges) (R1)

2.2

$\mathbf{M} = \begin{pmatrix} 0 & 1 & 1 & 0 \\ 1 & 0 & 1 & 0 \\ 1 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 \end{pmatrix}$; **1** walk ($A$–$C$–$D$)

2.3

degrees $A2$, $B2$, $C3$, $D1$; two odd vertices (R1); an Eulerian **trail** from C to D, but no circuit

2.4

BC 2, AC 3, DE 3; reject AB 4 (cycle); CD 5; total **13**

3.1

(a) **25** km

(b) A and C, each of degree 3

(c) AC direct $= 7$; via B or $D = 9$; **7** km

(d) $25 + 7 =$ **32** km

(e) e.g. A–B–C–A–C–D–A

3.2

(a) P–Q 8, Q–R 7, R–S 10, S–P 9; upper bound **34**

(b) minimum spanning tree of Q, R, S: QR 7, RS 10; 17; two shortest edges from P: $8+9$; lower bound **34**

(c) the bounds are equal (R1), so the tour $PQRSP$ of 34 km is optimal

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