Solutions

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

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

2.1

(1, 4), then (5, 7)

then (8, 11), then (12, 16)

4 activities

2.2

e.g. (0, 5), (4, 7), (6, 11): the shortest, (4, 7), overlaps both others

greedy picks 1 activity; (0, 5) and (6, 11) give 2

2.3

merge 5+9, 12+13, 14+16, 25+30, 45+55

lengths: f 1; c, d, e 3; a, b 4

$45 + 3(12 + 13 + 16) + 4(5 + 9) =$ **224** bits

2.4

for any split of the vertices into two groups, the cheapest edge crossing it is in some MST

Kruskal's edge joins two different components, and it is the cheapest edge leaving either of them

3.1

(a) add B–C 1, B–D 2, E–F 2; add A–C 3; skip C–D 4 and A–B 4 (cycles); add C–E 5: 5 edges, done

(b) $1 + 2 + 2 + 3 + 5 =$ **13**

(c) each added edge is the cheapest edge leaving its component, so by the cut property it is in some MST; the skipped edges would make cycles

(d) yes: every MST of a graph has the same total weight, 13

3.2

(a) £6, £5, £4 per kg: A, B, then 20 of C's 30 kg; $60 + 100 + 80 =$ £**240**

(b) greedy: A and B, £160; best: B and C, £**220**

(c) taking the best item first can leave space that no whole item fits, wasting it

3.3

(a) finishes 3, 5, 6, 10, 13, 15; only job 4 is late, by $10 - 9 = 1$; maximum lateness **1**

(b) order lengths 1, 2, 2, 3, 3, 4: the deadline-6 job finishes at 8, and the deadline-9 job of length 4 at 15; maximum lateness **6**

(c) take any order with two adjacent jobs out of deadline order; swapping them does not raise the maximum lateness, so repeated swaps turn any optimal order into deadline order

(d) earliest deadline first: it keeps the worst delay as small as possible

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