Solutions

2.1

- A–B 4: after C–B, A–C, D–E and E–F are accepted, A and B are already connected – taking A–B would close a cycle ✓.

2.2

- Strictly the smallest weight among edges with one endpoint on each side of the cut ✓.

2.3

- Bellman-Ford, $\Theta(VE)$ – and it detects negative cycles ✓.

3.1

- Sorted: C–B 1, A–C 2, D–E 2, E–F 3, A–B 4, B–D 5, D–F 6, C–D 8, C–E 10 ✓.
- Accept C–B, A–C, D–E, E–F; reject A–B 4 (A, B, C already connected – cycle); accept B–D 5; reject D–F 6, C–D 8, C–E 10 (cycles) ✓.
- MST weight $1 + 2 + 2 + 3 + 5 = 13$, edges {C–B, A–C, D–E, E–F, B–D} ✓.
- Cut for C–B: $S = \{C\}$, $V - S =$ the rest – C–B is the lightest edge crossing (weight 1), so some MST contains it ✓.

3.2

- Settle A (0); nearest is C at 1 – settle C; C relaxes B to $1 + 1 = 2$; settle B at 2 ✓.
- Textbook order: A, C, B with distances 0, 1, 2 – the correct answer; the failure mode appears when B settles BEFORE C: settle order A, B (5), C – then B's 5 is final and wrong ✓.
- The light-edge argument for Dijkstra needs non-negative weights: with them, a settled node's distance can never improve; here the A–B 5 edge is heavier than the two-step path, and if B settles first the improvement through C arrives too late ✓.
- Bellman-Ford: $\Theta(VE)$ rounds of relaxation over all edges – and it detects negative cycles by still relaxing after $V - 1$ rounds ✓.

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