

Solutions

2.1 Events: start s; A: s→e1 (2), B: s→e2 (5); C: e1→e3 (3); D: e1→e3 and e2→e3 – D depends on both A and B, so e1 must connect to e3 and e2 to e3 (a dummy from e2 to e1 if drawn with D leaving a shared node). Durations: A–C = 2 + 3 = 5; B = 5; D needs both done: D's earliest start = max(2, 5) = 5. Project duration = max(5, 5 + 1) = 6 days.

2.2 Earliest = latest at every event: every activity on the chain is critical, float 0.

2.3 Float = 16 – 5 – 6 = 5 days.

3.1 (a) Arcs: A from start to event 2; B from start to event 3; C from event 2 to event 4. D depends on A and B, so a dummy (duration 0) runs from event 2 to event 3 and D leaves event 3 for event 4. E and F both follow C and D (event 4); since two parallel arcs cannot share both endpoints, E runs from event 4 to event 5 and F from event 4 to event 6, with a dummy from event 5 to event 6 giving the single finish. (b) Forward: event 1 (start) 0; event 2 = 4 (after A); event 3 = max(4 + 0, 3) = 4 (B finishes at 3, dummy carries 4); event 4 = max(4 + 6, 4 + 2) = 10; finish = max(10 + 5, 10 + 3) = 15. Backward: finish 15; event 4 = min(15 – 5, 15 – 3) = 10; event 3 = 10 – 2 = 8; event 2 = min(8 – 0, 10 – 6) = 4; start = min(4 – 4, 8 – 3) = 0 ✓. (c) Critical events: start 0/0, event 2 4/4, event 4 10/10, finish 15/15: critical path A–C–E, duration 15 days. (d) Float of F = latest finish – earliest start – duration = 15 – 10 – 3 = 2 days.

3.2 (a) Bars: A from 0 for 4; B from 0 for 3; C from 4 for 6; D from 4 for 2; E from 10 for 5; F from 10 for 3 with 2 days slack after it. Critical activities A, C, E on one unbroken chain. (b) One worker suffices for the critical chain if nothing else overlaps it in time – but B (0–3) and D (4–6) overlap A (0–4) and C (4–10): at least 2 workers are needed. (c) F's latest finish is 15 and it lasts 3 days, so it can start as late as 15 – 3 = 12 (its earliest start is 10, giving the 2-day float).

Local review guidance: dummies carry exactly the dependency that shared endpoints cannot; forward pass takes maxima, backward pass minima; float from latest finish – earliest start – duration; Gantt bars from earliest starts with slack trailing. This is authored classroom guidance.