# Networks, scheduling and assignment - Test 1

Name: _____ Date: _____

10 questions | 58 marks | 65 minutes

A balanced first paper covering project scans, critical paths, assignment reductions and sensible recommendations.

A scientific calculator may be used.

**1.** Use the display-project precedence table. [6 marks]

A school display project. Times are in days.

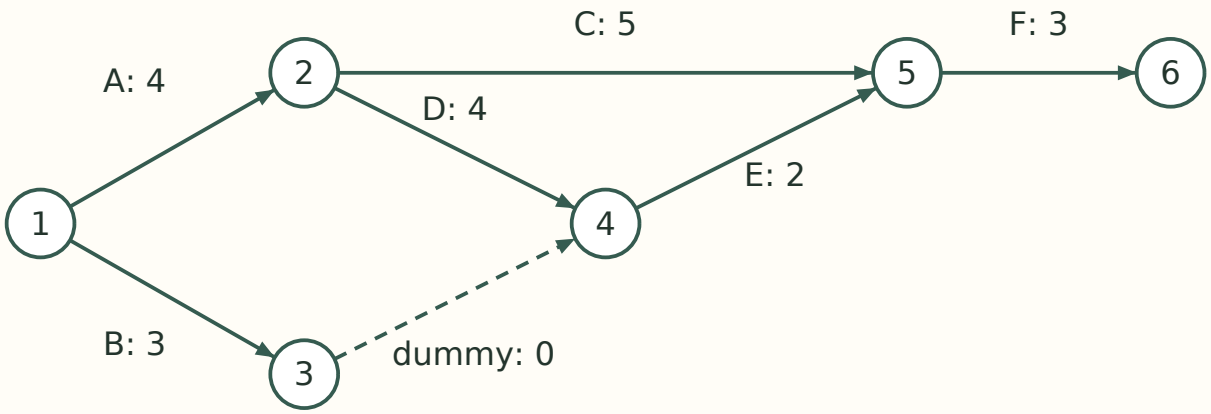
| Activity | Duration | Immediate predecessors |
|---|---|---|
| A | 4 | None |
| B | 3 | None |
| C | 5 | A |
| D | 4 | A |
| E | 2 | B and D |
| F | 3 | C and E |

**(a)** Name the activities that can begin immediately. [2 marks]

**(b)** State the immediate predecessors of F, then give one indirect predecessor. [2 marks]

**(c)** Explain why a single chain A-B-C-D-E-F would not represent this project. [2 marks]

**2.** Use this activity-on-arrow network. Durations are in days. [6 marks]

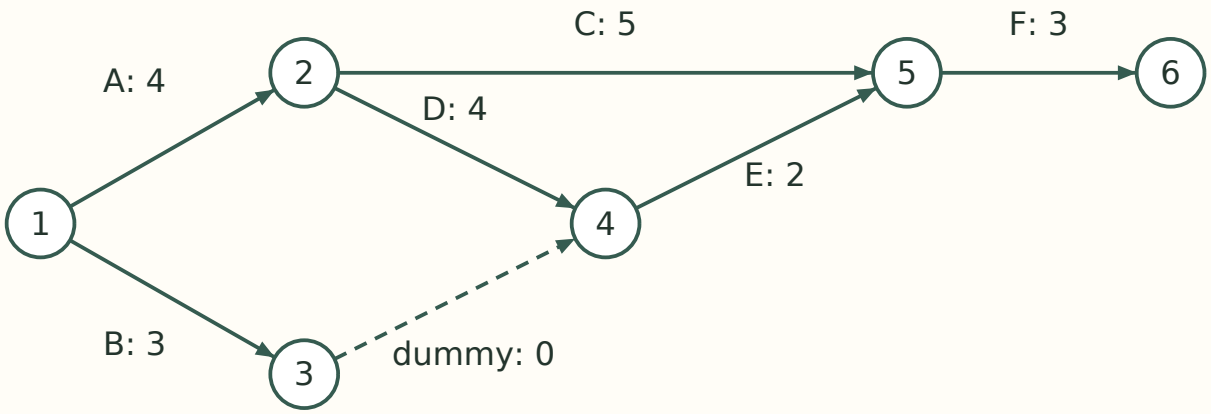



Activity-on-arrow network; durations are in days.

**(a)** Complete the forward scan for events 1-6. [4 marks]

**(b)** State the earliest completion and explain the max calculation at event 5. [2 marks]

**3.** Use the same displayed network, reproduced here. [6 marks]




Activity-on-arrow network; durations are in days.

**(a)** Carry out a backward scan for a day-13 finish. [4 marks]

**(b)** Find the latest start and total float of B. [2 marks]

**4.** Consider changes to the display project; each change is made separately. [5 marks]

A school display project. Times are in days.

| Activity | Duration | Immediate predecessors |
|---|---|---|
| A | 4 | None |
| B | 3 | None |
| C | 5 | A |
| D | 4 | A |
| E | 2 | B and D |
| F | 3 | C and E |

**(a)** Find its critical path before any change. [2 marks]

**(b)** Reduce D from 4 to 1 day. Find the new completion and explain why the saving is not 3 days. [3 marks]

**5.** Two independent tasks P and Q take 5 and 8 hours. R takes 2 hours and follows both. [5 marks]

**(a)** Find total task-hours and the minimum elapsed duration with separate workers. [3 marks]

**(b)** Find the duration if the same sole worker must do P and Q before R. [2 marks]

**6.** Use the technician cost table. [6 marks]

Cost ($) of assigning one technician to each job.

| Technician | Job 1 | Job 2 | Job 3 |
|---|---|---|---|
| Ali | 9 | 2 | 7 |
| Bea | 6 | 4 | 3 |
| Chen | 5 | 8 | 1 |

**(a)** Calculate the total for Ali→3, Bea→2, Chen→1. [2 marks]

**(b)** Find a minimum complete assignment and justify its minimum by comparing all six totals. [4 marks]

**7.** The time table below is to be minimised. [7 marks]

Times in hours for one person to perform one task.

| Person | X | Y | Z |
|---|---|---|---|
| Amy | 4 | 1 | 3 |
| Ben | 2 | 0 | 5 |
| Cal | 3 | 2 | 2 |

**(a)** Show row reduction followed by column reduction. [3 marks]

**(b)** Cover column Y and row Cal, adjust by the smallest uncovered value, then state the optimum. [4 marks]

**8.** Use the team profit table; table units are $100. [6 marks]

Profit ($100 units) from assigning each team to one distinct contract.

| Team | Contract 1 | Contract 2 | Contract 3 |
|---|---|---|---|
| P | 18 | 14 | 13 |
| Q | 15 | 17 | 12 |
| R | 16 | 11 | 19 |

**(a)** Form the opportunity-loss matrix with K=19. [3 marks]

**(b)** State a maximum-profit assignment and the profit in dollars. [3 marks]

**9.** Four workers cover three jobs; idling is free. [6 marks]

Costs ($) for four workers and three required jobs. A worker may remain idle at no cost.

| Worker | Job 1 | Job 2 | Job 3 |
|---|---|---|---|
| A | 4 | 8 | 7 |
| B | 6 | 3 | 8 |
| C | 5 | 7 | 2 |
| D | 9 | 4 | 6 |

**(a)** Describe the dummy entries needed. [2 marks]

**(b)** Find the cheapest assignment, identify the idle worker and give a lower-bound justification. [4 marks]

**10.** The display-project model predicts 13 days. A manager wants a promise of completion in 13 days. [5 marks]

A school display project. Times are in days.

| Activity | Duration | Immediate predecessors |
|---|---|---|
| A | 4 | None |
| B | 3 | None |
| C | 5 | A |
| D | 4 | A |
| E | 2 | B and D |
| F | 3 | C and E |

**(a)** State two assumptions needed before making that promise. [2 marks]

**(b)** B is revised from 3 to 9 days. Find the new project finish and controlling sequence. [3 marks]