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.

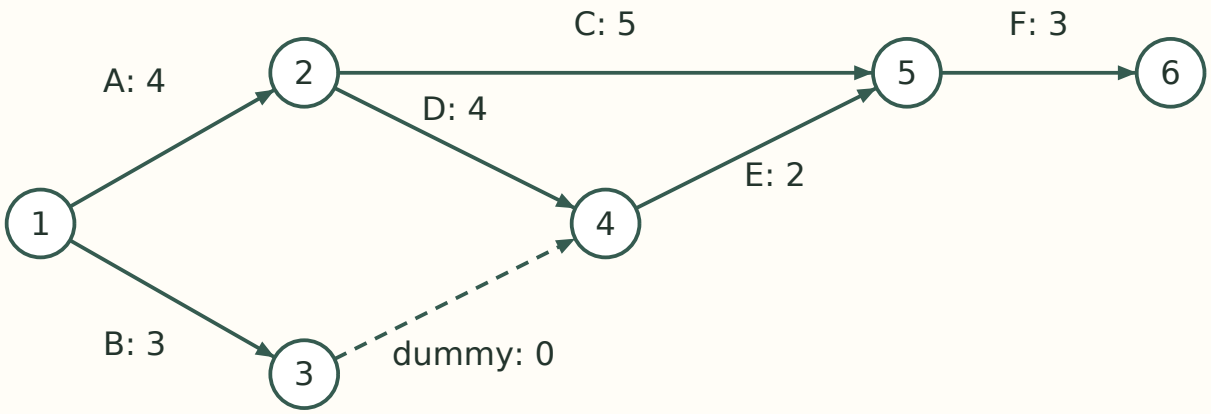
Activity	Duration	Immediate predecessors
A	4	None
B	3	None
C	5	A
D	4	A
E	2	B and D
F	3	C and E

(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]

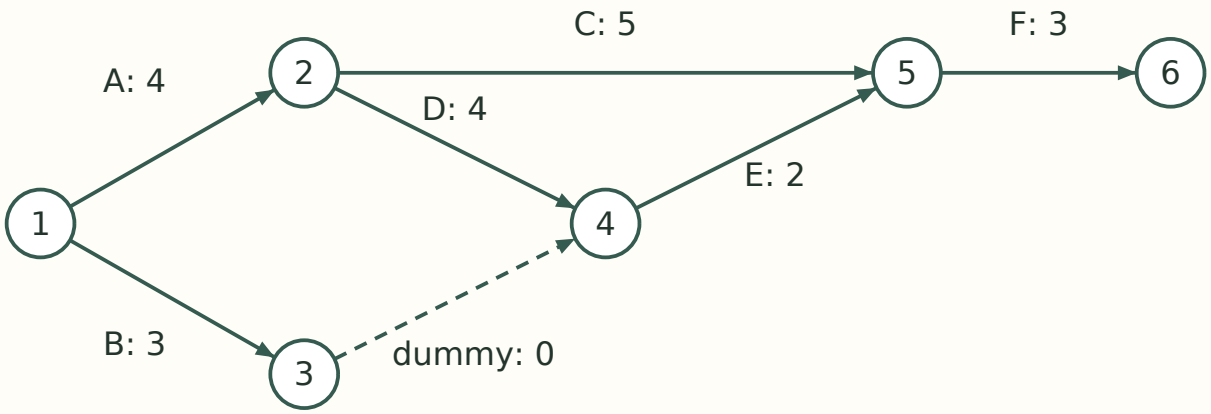


Activity-on-arrow network; durations are in days.

(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]