



**YEAR 12
MATHEMATICS
APPLICATIONS**

**Test 4, 2023
Section One: Calculator Free
Networks and Assignment**

STUDENT'S NAME: _____

DATE: Monday 28th August

TIME: 20 minutes

MARKS: 18

ASSESSMENT %: 10

INSTRUCTIONS:

Standard Items: Pens, pencils, drawing templates, eraser

Special Items:

Questions or parts of questions worth more than 2 marks require working to be shown to receive full marks.

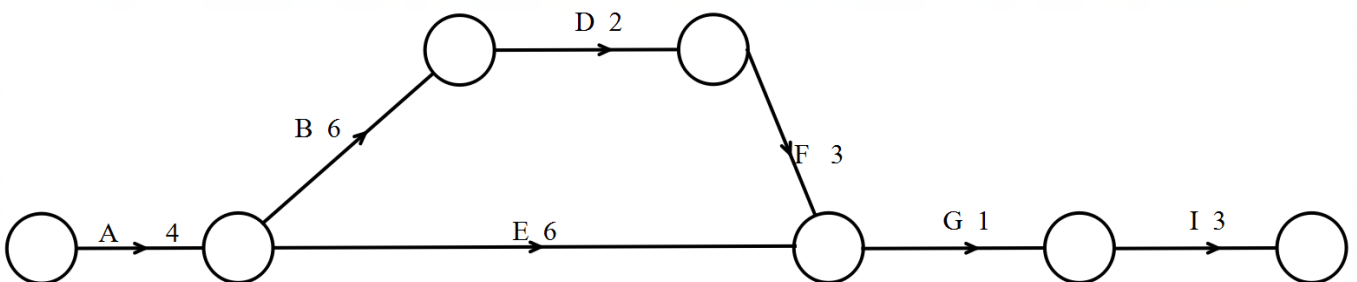
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Question 1

(11 marks)

To prepare an aircraft for a new flight there are several tasks which need to take place prior to passengers boarding. Each task and the time need to complete the task and predecessors are given in the table and diagram below.

Task	Duration (hours)	Immediate Predecessor(s)
A	4	---
B	6	A
C	7	A
D	2	B
E	6	A
F	3	C, D
G	1	
H	6	E, F
I	3	G



- (a) In the network above there are two activities missing from the schedule. Draw and label these activities on the network. (2 marks)

- (b) The immediate predecessors for activity G must be included, complete the table to include these activities. (2 marks)

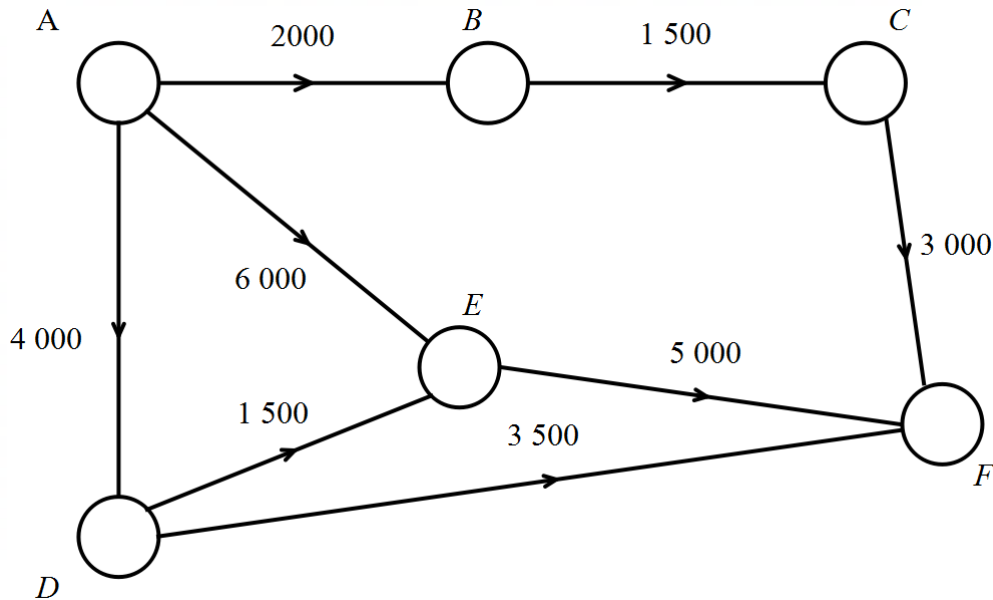
- (c) State the critical pathway and the minimum completion time for the aircraft to be prepared.
(2 marks)
- (d) State the earliest starting time for activity G. (1 mark)
- (e) State the float time for activity E. (1 mark)
- (f) If the time to complete activity I is increased by 3 hours, then explain the effective this would have on the minimum completion time and the critical path. (2 marks)
- (g) The passengers are due to board the flight at 11pm, when should the preparation begin?
(1 mark)

Question 2

(7 marks)

The network below displays the maximum tonnage that can be trucked through a system of roads designed specifically for the movement of large hauls.

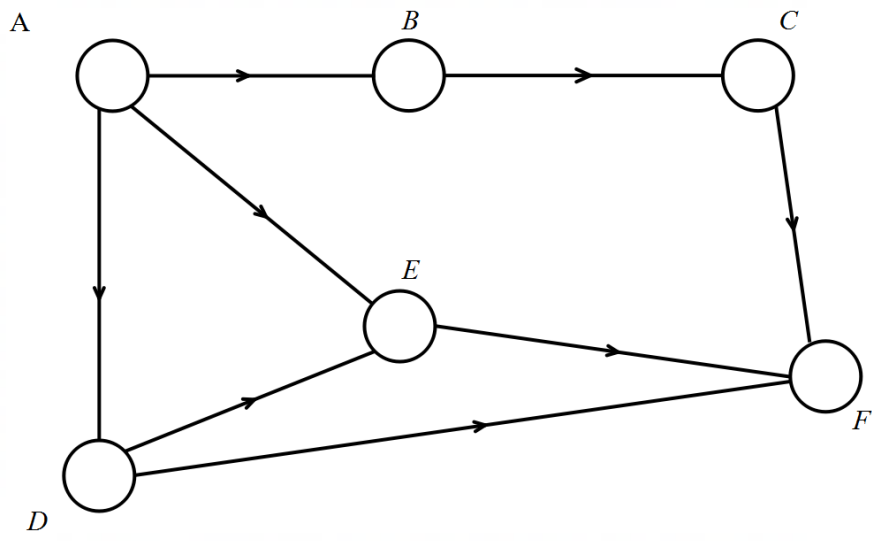
The numbers on the paths represent the capacity of the road in units of tonnes per minute. The arrows indicate direction and flow.



(a) What is the maximum amount of tonnage that can be moved from A to F? Show systematic working to allow your solution to be check. (2 marks)

(b) Create a minimum of four cuts and hence verify your solution to part (a). (3 marks)

- (c) Use the diagram below to draw the flow on each path that will result in this maximum flow. (2 marks)



END OF QUESTIONS



**YEAR 12
MATHEMATICS
APPLICATIONS**

**Test 4, 2023
Section Two: Calculator Allowed**

Networks and Assignment

STUDENT'S NAME: _____

DATE: Monday 28th August

TIME: 25 minutes

MARKS: 28

ASSESSMENT %: 10

INSTRUCTIONS:

Standard Items: Pens, pencils, drawing templates, eraser

Special Items: 1 A4 page notes, Classpad, Scientific Calculator

Questions or parts of questions worth more than 2 marks require working to be shown to receive full marks.

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Question 3

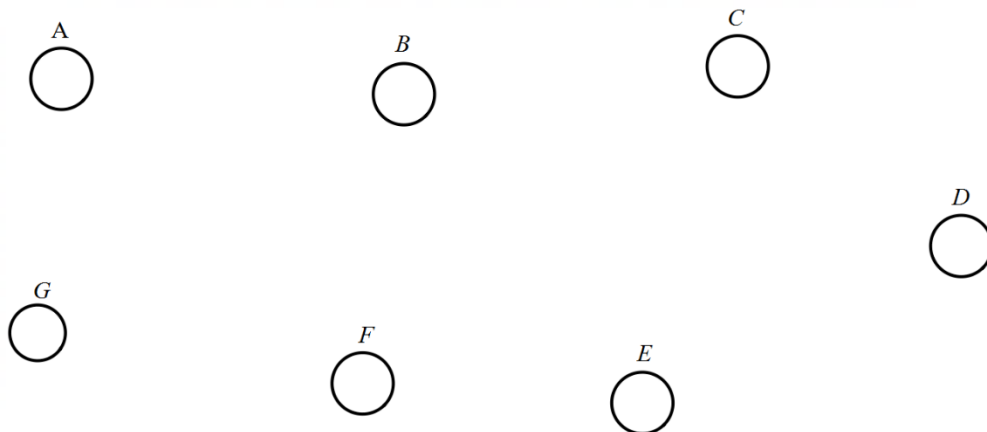
(7 marks)

The table below shows the cost of building direct ‘light rail’ links between seven different locations in Perth, in millions of dollars.

	A	B	C	D	E	F	G
A	-	50	58	-	-	54	35
B	50	-	44	65	32	33	58
C	58	44	-	42	43	-	-
D	-	65	42	-	45	68	-
E	-	32	43	45	-	32	61
F	54	33	-	68	32	-	49
G	35	58	-	-	61	49	-

- (a) Use Prim’s Algorithm to determine the minimum spanning tree for this network, draw this minimal spanning tree on the graph below, and clearly state the cost of building light rail.

(5 marks)



- (b) An option exists to use an existing rail line between locations A and F, making it possible to halve the costs of this link. If this option is taken then describe the effect, if any, on the cost of building the light rail.

(2 marks)

Question 4

(7 marks)

A store specialising in cars and parts employs staff who have been trained within specific areas of the store. The average daily sales for each of the four employees in each specific area is shown in the table below.

The four employees have demonstrated they perform better in different areas.

Table 1

	Tyres	Tools	4x4	Electrical
Aaron	580	550	360	440
Brian	340	590	420	530
Carl	550	480	380	410
Dane	510	550	540	290

- (a) Management would like to maximise the total daily sales and some of the results from the first step are shown in the Table 2 below. Complete the table for the first step of the algorithm.

(1 mark)

Table 2

	Tyres	Tools	4x4	Electrical
Aaron	10		230	150
Brian	250		170	60
Carl	40		210	180
Dane	80		50	300

- (b) Table 3 shows the result of all steps of the Hungarian algorithm. (3 marks)
 Allocate the four areas to maximise output display your working in Table 3.

Table 3

	Tyres	Tools	4x4	Electrical
Aaron	0	30	210	0
Brian	250	0	160	220
Carl	0	70	160	0
Dane	40	0	0	220

Aaron	Brian	Carl	Dane

- (c) Determine the maximum daily sales. (1 mark)
- (d) Aaron phones in saying he is not well and will not be coming into work for the day. How does this affect the allocation of jobs and the maximum profit. (2 marks)

Question 5**(8 marks)**

An East Perth IGA provides a delivery service to its elderly customers. Each morning there are four deliveries to be made. Each of the four drivers, Erin, Frank, George, and Helen, is available to do one of the deliveries.

The table below shows the time, in minutes, that each driver would take to complete each of the four deliveries.

Delivery number	Erin	Frank	George	Helen
1	35	31	41	36
2	25	26	33	36
3	32	28	25	24
4	27	30	31	28

The store manager will allocate the deliveries so that the total delivery time is at a minimum. He decides to use the Hungarian algorithm to determine the allocation of deliveries to the drivers.

- (a) Determine the optimum allocation of the delivery drivers so that their travel time is minimised. (5 marks)

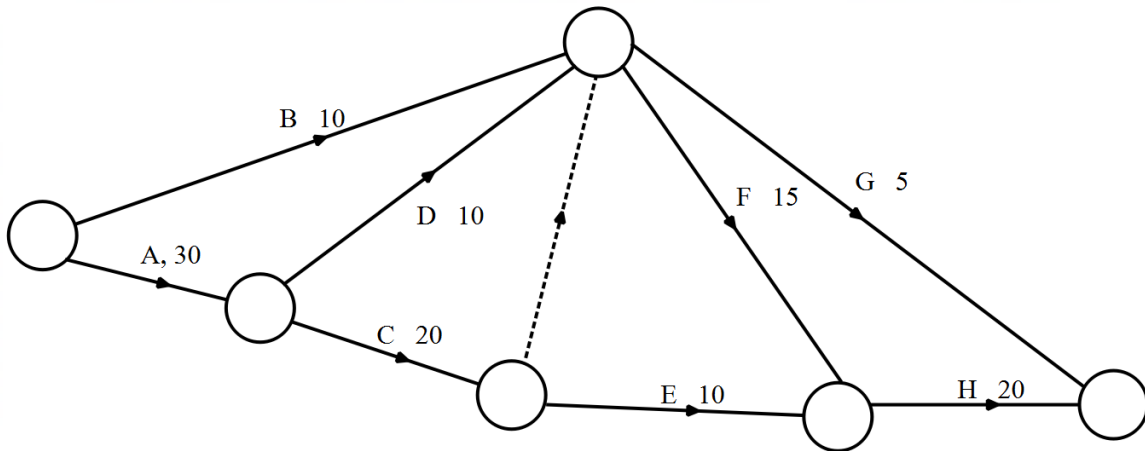
(b) State the minimum delivery time and the allocation of drivers.

(3 marks)

Question 6

(7 marks)

The network shown below is a schedule for the construction of a new Theatre room. The duration of each activity is in hours.



(a) Complete the precedence table. (3 marks)

Task	Duration	Immediate Predecessor(s)
A		
B		
C		
D		
E		
F		
G		
H		

(b) The network shows a dummy activity. What is the purpose of the dummy activity? (2 marks)

(c) Assuming that no activities are delayed, determine how long each of the following activities could be delayed without affecting the minimum completion time of the Theatre room. (2 marks)

(i) Activity D

(ii) Activity G

END OF QUESTIONS