

Mathematics Applications Year 12
Test 3 2016

Section 1 Calculator Free
Shortest Path, Periodic Time Series

STUDENT'S NAME SOLUTIONS

DATE: Thursday 19th May

TIME: 20 minutes

MARKS: 20

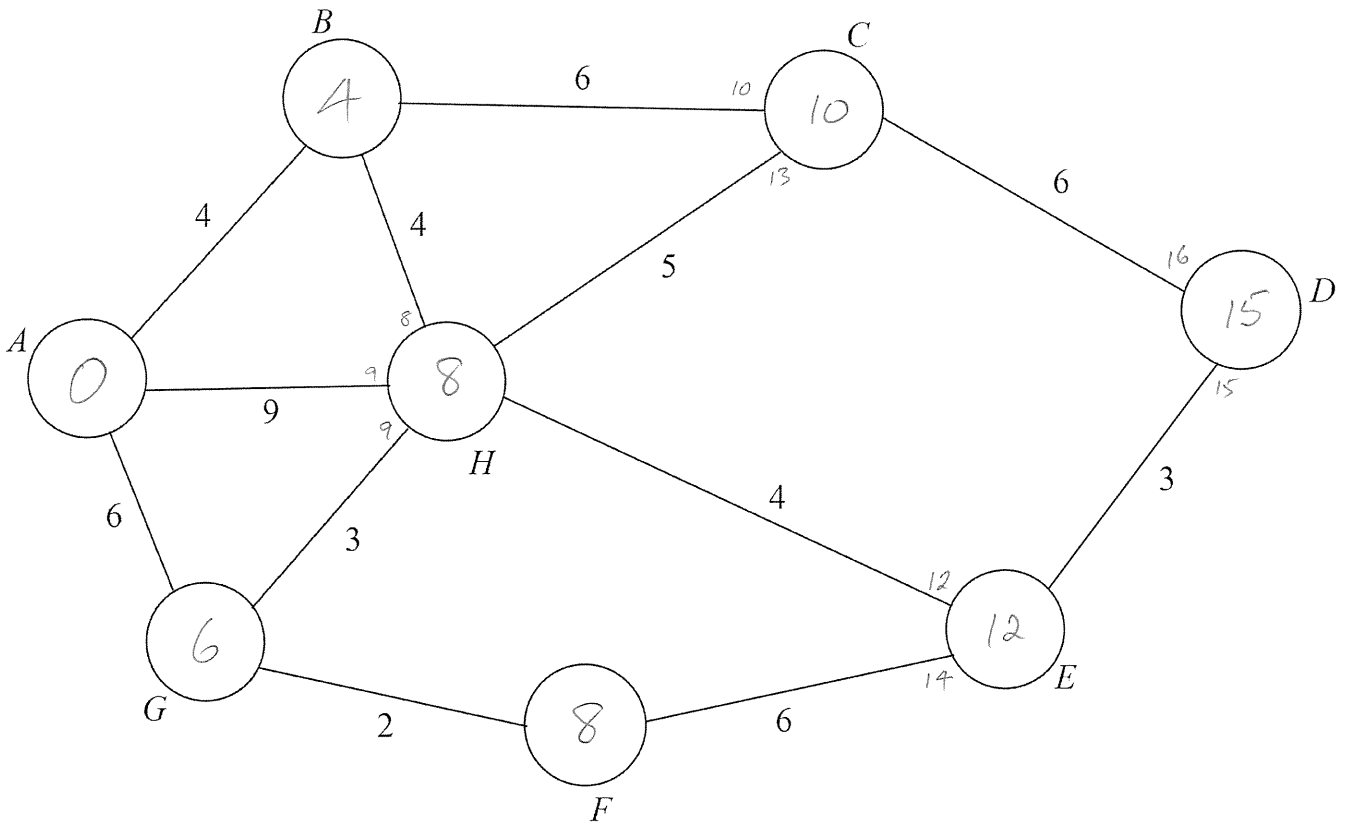
INSTRUCTIONS:

Standard Items: Pens, pencils, drawing templates, eraser

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

1. (3 marks)

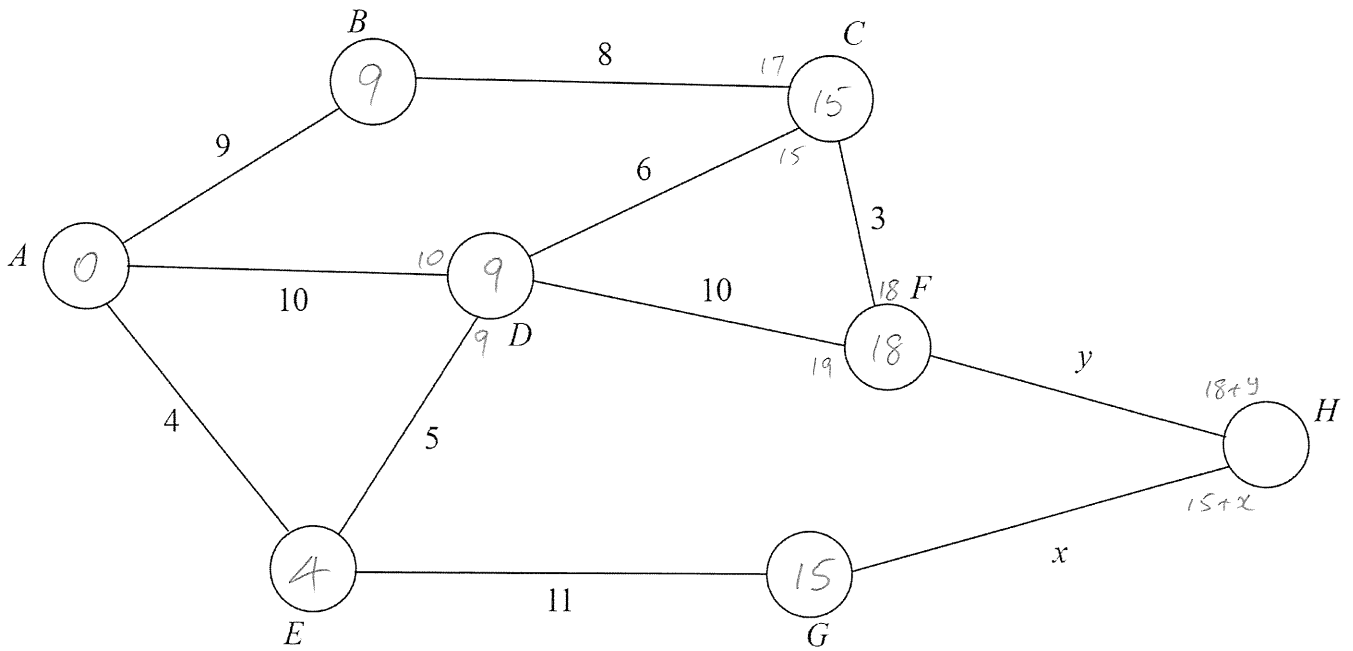
The weighted graph below shows the distance, in metres, between offices in a building. Determine the shortest path between A and D and its length.



15, ABHED

2. (4 marks)

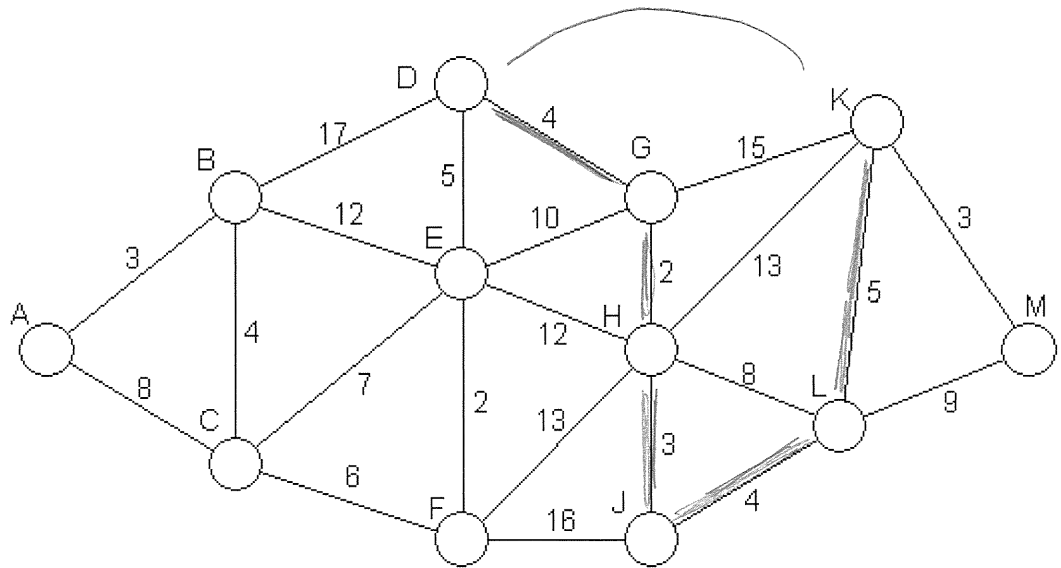
For the weighted network shown below, determine the relationship between x and y if the shortest path between A and H passes through G .



$$15 + x < 18 + y$$

$$x < 3 + y$$

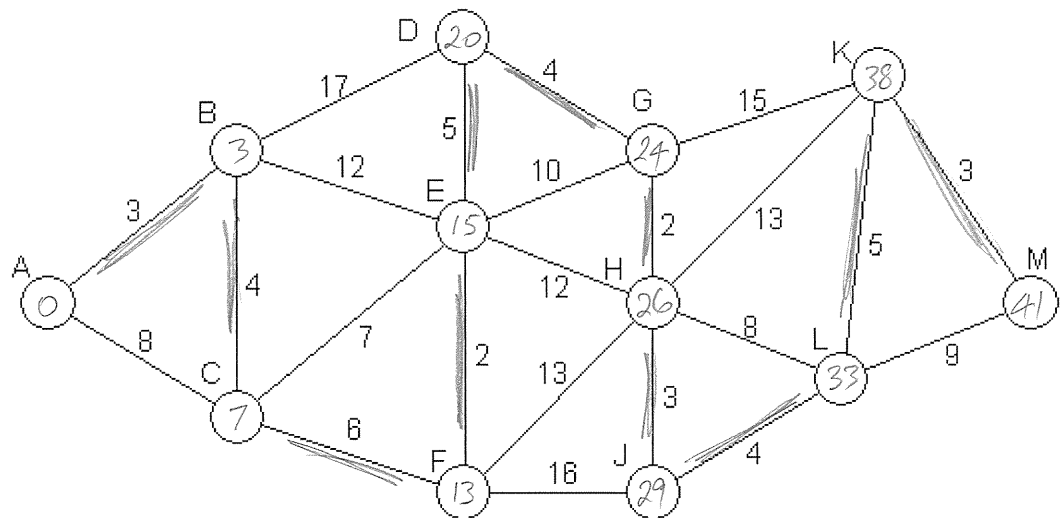
- (c) The local council is considering constructing a path directly from D to K. What possible walking times would this path have in order to change the quickest route found in (a)? [2]



$$D - K \text{ ORIGINAL} = 4 + 2 + 3 + 4 + 5 = 18$$

∴ REQUIRE LESS THAN 18

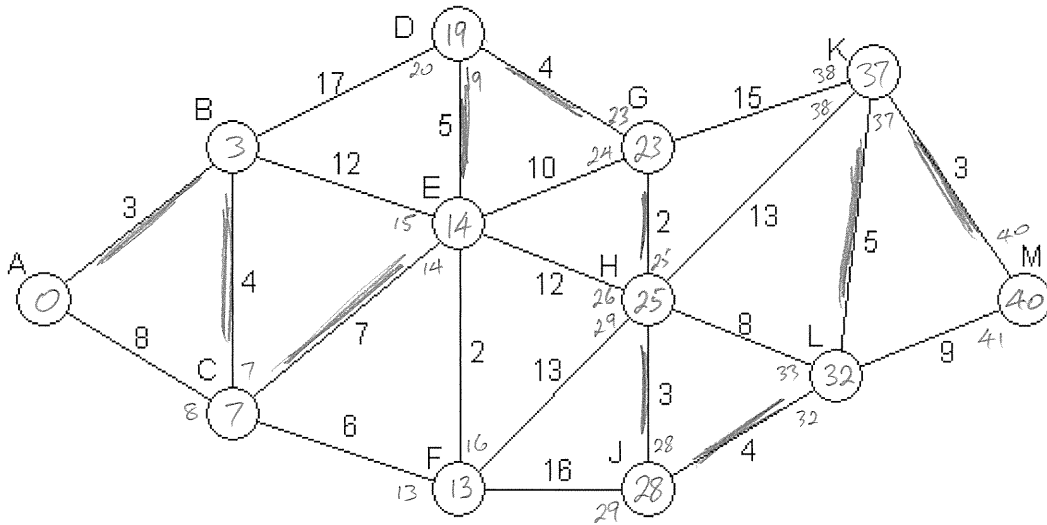
- (d) A semi-Hamiltonian path passes through all vertices of a network without travelling along any edge twice. It can also pass through a vertex more than once. Determine the shortest semi-Hamiltonian path, and its length, for the network beginning at A. [4]



ABC F E D G H J L K M 41

3. (13 marks)

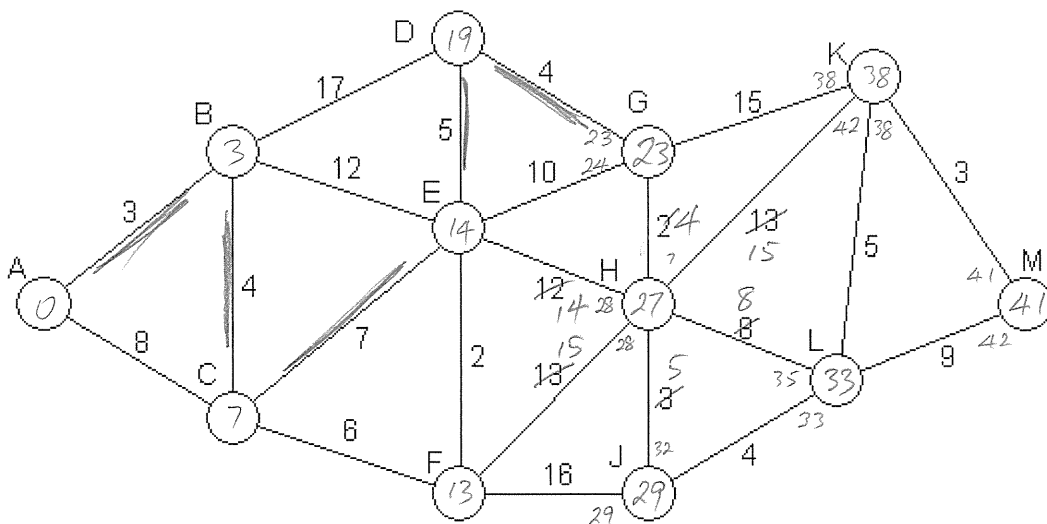
The diagram below shows the walking time, in minutes, of pathways between various points of interest in a recreation park.



- (a) List the quickest route for a person to walk from the park entrance at A to the maze located at M and state the time taken. To obtain full marks, numbers must be added to the above diagram showing that an appropriate method has been used. [4]

40 A B C E D G H J L K M

- (b) After a period of heavy rain, all six pathways through H take an extra 2 minutes. What effect does this have on the quickest time to walk through the park from A to M? Show working to justify your answer. [3]



41 2 SOLNS
 A B C E D G K M
 A B C E D G H J L K M



**Mathematics Applications Year 12
Test 3 2016**

**Section 2 Calculator Assumed
Shortest Path, Periodic Time Series**

STUDENT'S NAME _____

DATE: Thursday 19th May

TIME: 30 minutes

MARKS: 29

INSTRUCTIONS:

Standard Items: Pens, pencils, drawing templates, eraser

Special Items: Three calculators, notes on one side of a single A4 page (these notes to be handed in with this assessment)

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

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4. (20 marks)

The sales of reverse cycle air conditioners by a company are shown below.

Year	Period of time	t	Air conditioner sales	Season mean of sales	4PCMA	Sales as % of the season mean	Deseasonalised sales (seasonally adjusted)
2013	Summer	1	1250	889	-	140.6%	909
	Autumn	2	A		-	64.8%	886
	Winter	3	1110		904	124.9%	892
	Spring	4	620		925	69.7%	849
2014	Summer	5	1370	F	B	C	D
	Autumn	6	E		973.3	63.4%	959
	Winter	7	1234		991.5	125.3%	991
	Spring	8	710		1010.5	G	972
2015	Summer	9	1426	1075.5	1034	132.6%	H
	Autumn	10	720		1060.5	66.9%	1107
	Winter	11	1326		1076.7	123.3%	1065
	Spring	12	830		-	77.2%	1137

	Summer	Autumn	Winter	Spring
1st year	140.6	64.8	124.9	69.7
2nd year	139.2	J	125.3	72.1
3rd year	132.6	66.9	123.3	77.2
Seasonal Index	K	65.0	124.5	73.0

- (a) Determine the value of A, B, C, D, E, F, G, H, J and K as shown in the table above. [10]

A	576	E	624	J	63.4
B	946.5	F	984.5	K	137.4
C	139.2	G	72.1		
D	997	H	1038		

- (b) What does the Winter Seasonal Index indicate about the Winter season. [1]

WINTER SEASON SALES GREATER THAN GENERAL TREND (BY 24.5%)

- (c) Determine the least squares regression line of Deseasonalised data against time. [3]

$$D = 835.2 + 22.81t$$

- (d) Predict the sales for Spring 2017. [4]

$$t = 20$$

$$\begin{aligned} \text{TREND VALUE} &= 835.2 + 22.81(20) \\ &= 1291 \end{aligned}$$

$$\begin{aligned} \text{PREDICTED VALUE} &= 1291 \times 0.73 \\ &= 943 \end{aligned}$$

- (e) Determine the actual sales for Summer 2016. [2]

$$\frac{\frac{1426}{2} + 720 + 1326 + 830 + \frac{x}{2}}{4} = 1076.7$$

$$x = 1436$$

5. (9 marks)

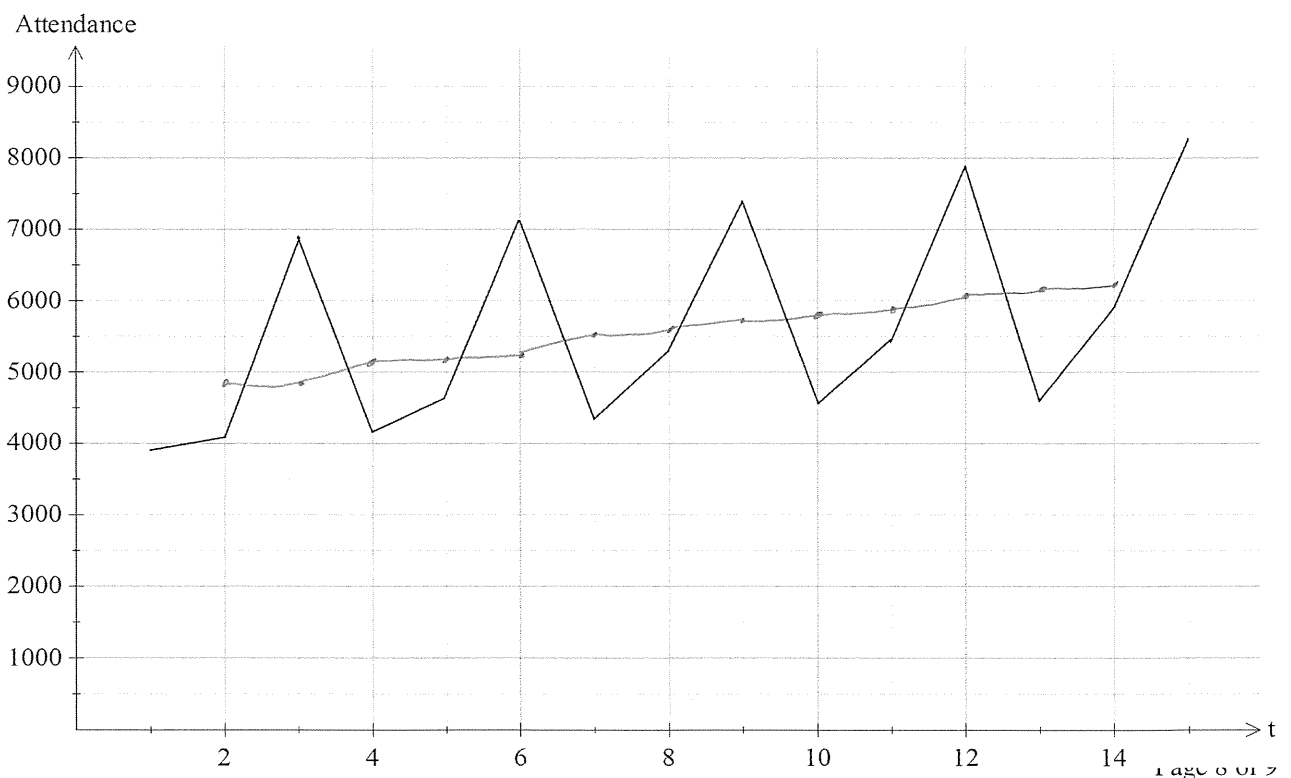
A Camping and Caravan Show occurs annually on Friday, Saturday and Sunday of the same weekend each year. The attendances for 2011 to 2015 are shown in the table below.

Year	Day	Time Period (t)	Attendance	Moving Average (M)
2011	Friday	1	3987	-
	Saturday	2	4013	4991.7
	Sunday	3	6973	5066
2012	Friday	4	4212	5269.7
	Saturday	5	4624	5318.7
	Sunday	6	7120	5344.3
2013	Friday	7	4289	5549
	Saturday	8	5238	5648
	Sunday	9	7417	5722.7
2014	Friday	10	4513	5809.7
	Saturday	11	5499	5974.7
	Sunday	12	7912	6019.7
2015	Friday	13	4648	6183
	Saturday	14	5989	6300.3
	Sunday	15	8264	-

(a) What type of moving average has been used in the table? [1]

3 POINT

(b) Plot the moving average data on the graph below which has original data already drawn. [3]



(c) What is the effect of the moving average?

[1]

SMOOTH DATA

(d) The local council has informed the event organisers that once the attendance on any one day exceeds 10 000, a permit to conduct the event the following year at the current venue will no longer be approved due to overcrowding. On the basis of the data in the table, predict the day and year when the attendance will first exceed 10 000.

The trend line for moving average against time is $M = 107.2t + 4772.8$.

The seasonal indices for Friday, Saturday and Sunday are 76.9%, 89.4% and 133.7% respectively.

[4]

$$10\ 000 = (107.2t + 4772.8) \times 1.337$$

$$t = 25.2$$

REQUIRE SUNDAY $\therefore t = 27$

ie 9 YEARS

\therefore 2019