MATHEMATICS APPLICATIONS

MAWA Semester 2 (Units 3 & 4) Examination 2016

Calculator-Assumed

Marking Key

The release date for this exam and marking scheme is

- **the end of week 1 of term 4, 2016**

Section Two: Calculator-assumed **(109 Marks)**

Question 7 (a)

Solution $\frac{3500}{23\ 500} \times 100 = 15\%$	
Marking key/mathematical behaviours	Marks
• shows correct ratio of populations in calculation of %	1

Question 7 (b)

Solution

Number of years after Dec 31,2012	1	2	3	4	5
Population of Baldivis	23 500	27 025	31 078	35 740	41 101

Marking key/mathematical behaviours	Marks
• determines 2 correct values	1
• determines another 2 correct values	1

Question 7 (c)

Solution $n = 8$, $P_8 = 62\ 510$ people	
Marking key/mathematical behaviours	Marks
• identifies required term (8^{th})	1
• determines correct population	1

Question 7 (d)

Solution $T_n = 29\ 500(1.08)^{n-1}$	
Marking key/mathematical behaviours	Marks
• Substitutes correct value for r	1
• States rest of formula correct, even if r is incorrect	1

Question 7 (e)

Solution

Number of years after Dec 31,2012	1	2	3	4	5
Population of Ellenbrook	29 500	31 860	34 408	37 161	40 134

Marking key/mathematical behaviours	Marks
• determines first and second terms	1
• determines other 3 correct values	1

Question 7 (f)

Solution

The year 2017

Marking key/mathematical behaviours	Marks
• Determines correct value.	1

Question 8 (a)

Solution

Q

Marking key/mathematical behaviours	Marks
• determines correct node	1

Question 8 (b)

Solution

40 kilolitres per hour

Marking key/mathematical behaviours	Marks
• determines correct value	1

Question 8 (c)

Solution

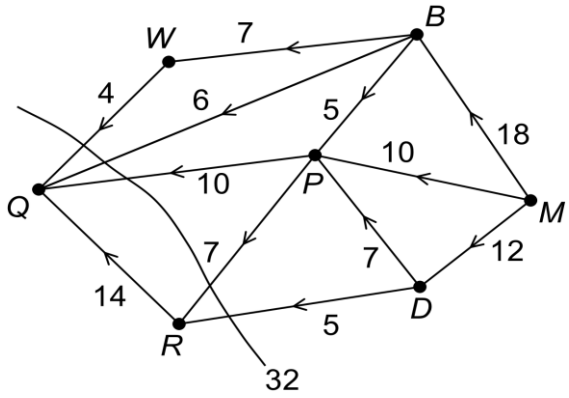
32 kilolitres per hour
System of paths for maximum flow is not unique. One possible system

MBWQ = 4 kL/h	MPRQ = 5 kL/h
MBQ = 6 kL/h	MDPRQ = 2 kL/h
MBPQ = 5 kL/h	MDRQ = 5 kL/h
MPQ = 5 kL/h	

Marking key/mathematical behaviours	Marks
• determines correct value for maximum flow	1
• determines correct capacity for 2 paths	1
• determines correct capacity for another 2 paths	1
• determines correct capacity for remaining paths	1

Question 8 (d)

Solution



Marking key/mathematical behaviours	Marks
• shows “cut” on network	1

Question 8 (e)

Solution

The total capacity along the edges of the minimum cut is equal to the maximum flow through the network

Marking key/mathematical behaviours	Marks
• describes equal values of edges and maximum capacity	1

Question 8 (f)

Solution

The maximum flow increases by 5 kL per hour
Paths MPQ (up by 5), MPRQ (down by 4) and MDPRQ (up by 4) are affected

Marking key/mathematical behaviours	Marks
• determines correct decision	1
• justifies decision	1

Question 9 (a)

Solution

0.9920

Marking key/mathematical behaviours	Marks
• determines correct correlation coefficient	1

Question 9 (b)

Solution

temperature

Marking key/mathematical behaviours	Marks
• identifies correct response variable	1

Question 9 (c)

Solution 97.4%	
Marking key/mathematical behaviours	Marks
• interprets coefficient of determination	1

Question 9 (d)

Solution No. A strong association may be due to another associated variable.	
Marking key/mathematical behaviours	Marks
• explains correlation not implying causality	1

Question 9 (e)

Solution Graph A Points are closer to the line AND greater coefficient of determination (or correlation coefficient)	
Marking key/mathematical behaviours	Marks
• identifies graph with stronger linear relationship • links strength to closeness of points to the line • links strength to relevant statistic	1 1 1

Question 9 (f)

Solution Graph B because it is based on more data	
Marking key/mathematical behaviours	Marks
• identifies more reliable indicator	1

Question 9 (g)

Solution Collect data from different parts of the world, at different heights or at different times of the year	
Marking key/mathematical behaviours	Marks
• identifies the need for variety in the data collected.	1

Question 10 (a)

Solution The two seasonal indices provided are moderately below 100%, or in each year except 2012, the number of dwellings in lowest in the March quarter	
Marking key/mathematical behaviours	Marks
• describes one aspect of the seasonal nature of data provided	1

Question 10 (b)

Solution 5153 ÷ 94% = 5482 dwellings	
Marking key/mathematical behaviours	Marks
• calculates deseasonalised value	1

Question 10 (c)

Solution (105% + 104% + 109% + 106%) ÷ 4 = 106%	
Marking key/mathematical behaviours	Marks
• adds correct % to determine average	1
• calculates seasonal index	1

Question 10 (d)

Solution An increase of 175 per quarter	
Marking key/mathematical behaviours	Marks
• specifies increase	1
• determines number of dwellings per quarter as a rate	1

Question 10 (e)

Solution 175 x 18 + 3453 = 6603 6603 x 0.95 = 6273	
Marking key/mathematical behaviours	Marks
• uses equation to determine deseasonal value	1
• makes seasonal adjustment	1

Question 10 (f)

Solution The prediction is very inaccurate. It is about 600 more than occurred	
Marking key/mathematical behaviours	Marks
• concludes correctly about the accuracy of the prediction	1
• compares prediction with raw data	1

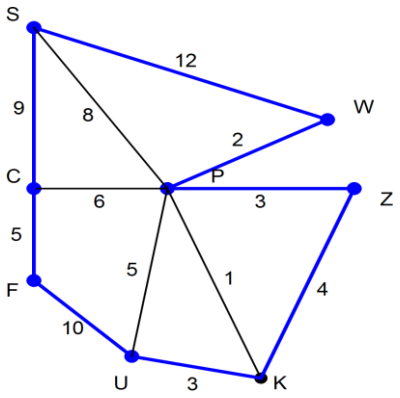
Question 10 (g)

Solution The number of dwellings approved in 2015 has fallen compared to both 2013 and 2014	
Marking key/mathematical behaviours	Marks
• provides evidence of changing trend	1

Question 11 (a)

Solution

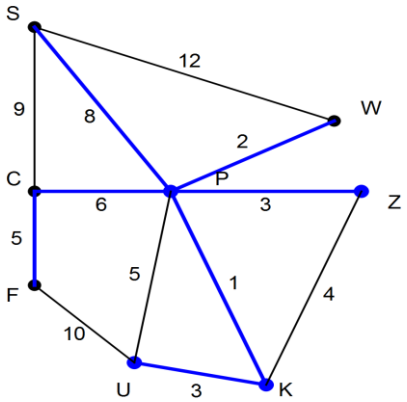
48 km



Marking key/mathematical behaviours	Marks
• determines distance	1
• marks edges to show routes used	1

Question 11 (b)

Solution



Cost = $140 000

Marking key/mathematical behaviours	Marks
• identifies 4 correct edges without circuits	1
• identifies 2 more edges and no circuits	1
• determines cost	1

Question 11 (c)

Solution

(i) Too many odd nodes

Marking key/mathematical behaviours	Marks
• explains inability to travel network without repeating routes	1

Question 11 (c) (cont'd)

Solution

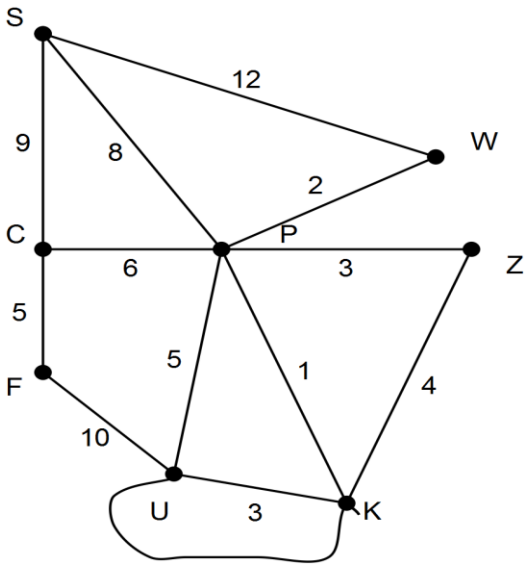
(ii) Create extra route from U to K

Marking key/mathematical behaviours	Marks
• links two odd nodes	1
• only links odd nodes with shortest route	1

Question 11 (c)

Solution

(iii)



CFUPKUKZPWSPCS

Marking key/mathematical behaviours	Marks
• draws new route(s) identified in part (ii)	1
• list stations in correct order	1

Question 11 (d)

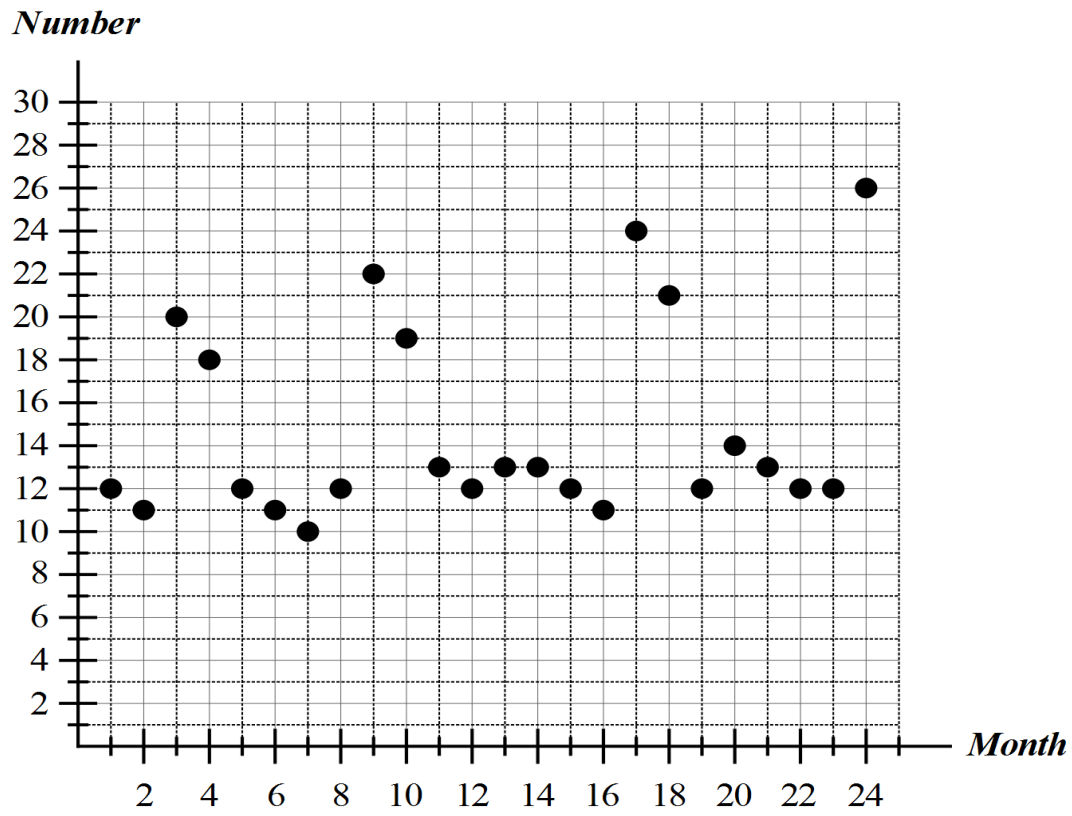
Solution

A: Hamiltonian circuit
B: minimum spanning tree
C: Eulerian trail

Marking key/mathematical behaviours	Marks
• identifies each of the projects correctly	3

Question 12 (a)

Solution



Marking key/mathematical behaviours	Marks
• labels and scales horizontal axis	1
• labels and scales vertical axis	1
• selects month as explanatory variable	1
• plots 12 points accurately	1
• plots further 6 points accurately	1
• plots final 6 points accurately	1

Question 12(b)

Solution

Number of volunteers is increasing

Marking key/mathematical behaviours	Marks
• describes trend	1

Question 12 (c)

Solution

Each peak is higher than the one before

Marking key/mathematical behaviours	Marks
• justifies choice in part (b)	1

Question 12 (d)

Solution Cyclic, systematic	
Marking key/mathematical behaviours	Marks
• selects two features	1
• indicates non-acceptable features	1

Question 12 (e)

Solution There are four major peaks – possibly associated with the new campaigns After each peak there is a slight drop After the slight drop numbers go down and stay down The peaks do not occur at regular intervals	
Marking key/mathematical behaviours	Marks
• for each feature described 1 mark	3

Question 13 (a)

Solution $0.011 \times 60\,000 = \$660$	
Marking key/mathematical behaviours	Marks
• writes correct product	1
• calculates correct amount of money	1

Question 13 (b)

Solution $60660 - 2000 = \$58660$	
Marking key/mathematical behaviours	Marks
• adds interest and subtracts repayment	1
• calculates correct amount of money.	1

Question 13 (c)

Solution $A_{n+1} = 1.011\,A_n - 2000$, $A_0 = 60000$	
Marking key/mathematical behaviours	Marks
• substitutes correct value for k	1

Question 13 (d)

Solution (i) \$57 305.26 (ii) \$23 423.77	
Marking key/mathematical behaviours	Marks
• (i) determines correct value.	1
• (ii) determines correct value.	1

Question 13 (e)

Solution 3 years and 1 month	
Marking key/mathematical behaviours	Marks
• determines correct value	1

Question 13 (f)

Solution Total repayments = $\$2000 \times 36 + \$1203.22 = \$73\,203.22$	
Marking key/mathematical behaviours	Marks
• calculates total regular repayments$\$2000 \times 36$	1
• includes final repayment in total	1

Question 13 (g)

Solution Total repayments – \$60000 = \$73203.22 – \$60000 = \$13203.22	
Marking key/mathematical behaviours	Marks
• subtracts amount borrowed from total repayments	1

Question 14 (a)

Solution Total number of paths that lead from the gate to other features	
Marking key/mathematical behaviours	Marks
• identifies total links	1

Question 14 (b)

Solution 2 The number of paths between the rose garden and the kiosk	
Marking key/mathematical behaviours	Marks
• identifies correct value	1
• interprets the value correctly	1

Question 14 (c)

Solution Each 0 indicates that there is no path from that feature back to itself. The value of 1 indicates that there is a loop at the canoe hiring facility	
Marking key/mathematical behaviours	Marks
• identifies significance of 0	1
• identifies significance of 1	1

Question 14 (d)

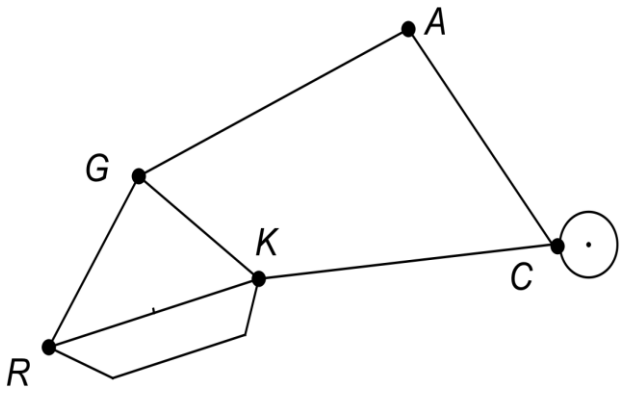
Solution Symmetry about the leading diagonal indicates that the graph is a non-directed graph. (All paths can be travelled in both directions.)	
Marking key/mathematical behaviours	Marks
• identifies correct significance	1

Question 14 (e)

Solution No. There is a 0 in R4 of C1, so there is not a path from the gate to the canoe hire facility.	
Marking key/mathematical behaviours	Marks
• determines correct answer with correct .reason.	1

Question 14 (f)

Solution



Marking key/mathematical behaviours	Marks
• identifies loop at C	1
• identifies 2 paths R to K and 2 other paths	1
• identifies other 3 paths	1

Question 15 (a)

Solution

Weight = 0.9465 x height – 89.635

Marking key/mathematical behaviours	Marks
• determines “gradient”	1
• expresses relationship in linear format with correct intercept	1

Question 15 (b)

Solution

0.8143

Marking key/mathematical behaviours	Marks
• calculates coefficient of determination	1

Question 15 (c)

Solution

Weight = 0.9465 x 211 – 89.635 = 110 kg

Marking key/mathematical behaviours	Marks
• determine prediction	1

Question 15 (d)

Solution

Prediction not very reliable as it is extrapolated beyond the data

Marking key/mathematical behaviours	Marks
• describes reliability of prediction	1
• justifies decision	1

Question 15 (e)

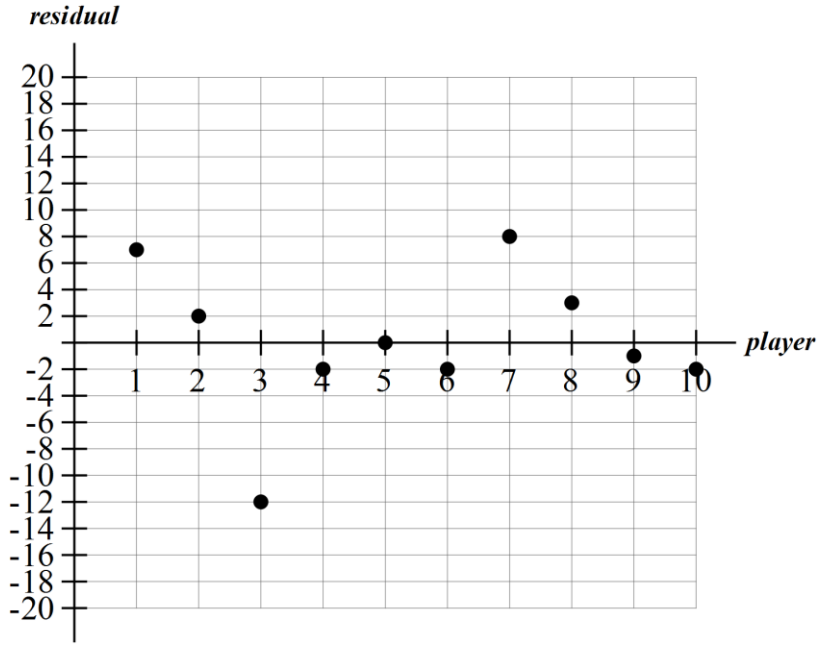
Solution

Residuals	7	2	-12	-2	0	-2	8	3	-1	-2

Marking key/mathematical behaviours	Marks
• determines first 6 correct answer residuals	1
• determines remaining 4 correct residuals	1

Question 15 (f)

Solution



Marking key/mathematical behaviours	Marks
• labels and scales horizontal axis	1
• labels and scales vertical axis	1
• plots 6 residuals points	1
• plots remaining 4 residual points	1

Question 15 (g)

Solution

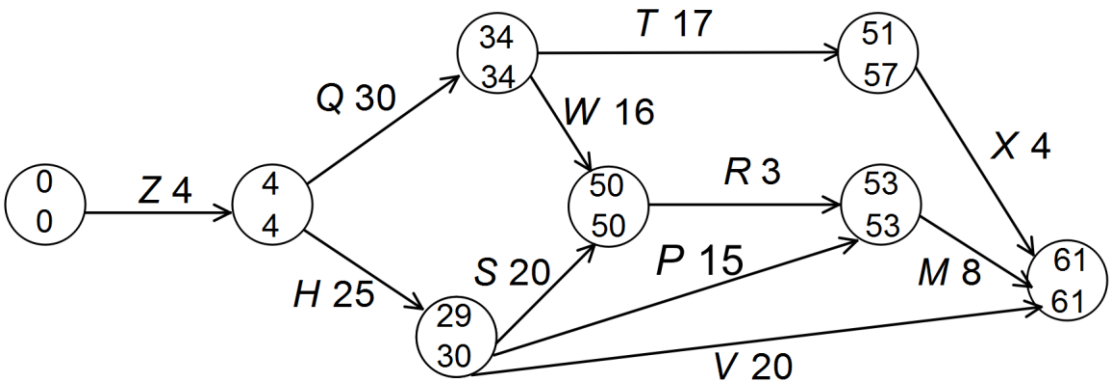
A linear model seems suitable for this relationship
Note the position of the residuals - they are scattered above and below the horixontal axis

Marking key/mathematical behaviours	Marks
• describes suitability of using linear model	1
• justifies choice of linear model	1

Question 16 (a)

Solution

Project network showing EST and LST for each task.



Marking key/mathematical behaviours for **Question 6 (a)**	Marks
• determines correct EST for all tasks	1
• determines correct LST for 5 tasks	1
• determines correct LST for remaining tasks	1

Question 16 (b)

Solution

Z – Q – W – R – M

Marking key/mathematical behaviours	Marks
• identifies all correct tasks in correct order	1

Question 16 (c)

Solution

Float time for P = LSD – EST
= 38 – 29 minutes (53 – 15 = 38)
= 9 minutes

Marking key/mathematical behaviours	Marks
• indicates correct method	1
• calculates required value correctly	1

Question 16 (d)

Solution

The minimum completion time remains unchanged because task P has a float time of 9 minutes which covers the 8 extra minutes taken on the task.

Marking key/mathematical behaviours	Marks
• determines correct conclusion	1
• indicates correct reason	1

NEEDS MAWA ACKNOWLEDGEMENT