

MATHEMATICS APPLICATIONS

MAWA Semester 1 (Unit 3) Examination 2016

Calculator-free

Marking Key

Section One: Calculator-free

(50 Marks)

Question 1 (a)

Solution	
The worker determined the degree of each vertex and concluded that the network had no odd vertices.	
Marking key/mathematical behaviours	Marks
<ul style="list-style-type: none"> determines degree of each vertex 	1
<ul style="list-style-type: none"> identifies there are no odd vertices 	1

Question 1 (b)

Solution	
Eulerian.	
Marking key/mathematical behaviours	Marks
<ul style="list-style-type: none"> identifies type of trail 	1

Question 1 (c)

Solution	
T A B E F B C D B H G F H T (or reverse order)	
T A B C D B H G F B E F H T (or reverse order)	
Marking key/mathematical behaviours	Marks
<ul style="list-style-type: none"> lists first seven vertices in correct order 	1
<ul style="list-style-type: none"> lists remaining seven vertices in correct order 	1

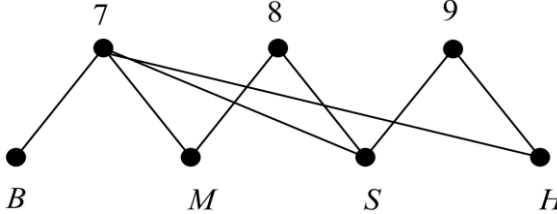
Question 2 (a)

Solution	
The relationship is weak. The correlation coefficient is about 0.45 OR the data points do not form a close linear pattern.	
Marking key/mathematical behaviours	Marks
<ul style="list-style-type: none"> describes the strength of the linear relationship 	1
<ul style="list-style-type: none"> justifies conclusion 	1

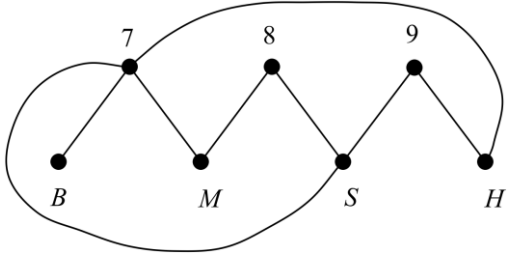
Question 2 (b)

Solution	
(i) There would be about 10 burglaries	
(ii) As the number of assaults increases by 1 the number of burglaries decreases by 1.	
Marking key/mathematical behaviours	Marks
<ul style="list-style-type: none"> interprets the y-intercept 	1
<ul style="list-style-type: none"> describes the change as negative 	1
<ul style="list-style-type: none"> identifies the rate of change as 1 for 1 [1 mark for each value] 	2

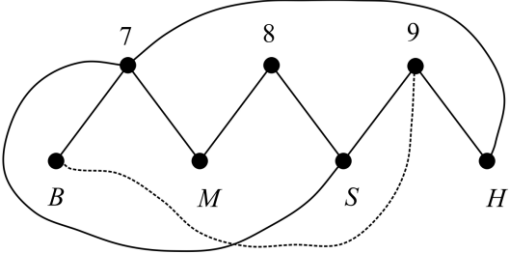
Question 3 (a)

Solution	
	
Marking key/mathematical behaviours	Marks
<ul style="list-style-type: none"> identifies correct edges for Town 7 identifies correct edges for Town 8 identifies correct edges for Town 9 	<p>1</p> <p>1</p> <p>1</p>

Question 3 (b)

Solution	
(i) when it can be drawn on a sheet of paper without any edges crossing	
	
(ii)	
Marking key/mathematical behaviours	Marks
<ul style="list-style-type: none"> describes planarity connects all towns with their respective services draws network without any edges crossing 	<p>1</p> <p>1</p> <p>1</p>

Question 3(c)

Solution	
(i) Bank	
(ii) Graph showing direct edge from Town 9 to the bank.	
	
It is impossible to draw an edge from Town 9 to the bank without crossing another edge	
Marking key/mathematical behaviours	Marks
<ul style="list-style-type: none"> (i) designates that a bank is the additional service (ii) draws a graph showing edge from Town 9 to bank draws with correct edges crossing 	<p>1</p> <p>1</p> <p>1</p>

Question 4 (a)

Solution	
Letters A, C and D should be circled	
Marking key/mathematical behaviours	Marks
<ul style="list-style-type: none"> selects one correct feature 	1
<ul style="list-style-type: none"> selects second correct feature 	1
<ul style="list-style-type: none"> selects third correct feature (only selecting 3) 	1

Question 4 (b)

Solution	
Cannot travel every edge only once AND start and finish at same vertex	
Marking key/mathematical behaviours	Marks
<ul style="list-style-type: none"> describes first condition 	1
<ul style="list-style-type: none"> describes second condition 	1

Question 4 (c)

Solution	
Euler's Rule : $n(\text{vertices}) + n(\text{faces}) - n(\text{edges}) = 2$	
$5 + 3 - 6 = 2$	
Marking key/mathematical behaviours	Marks
<ul style="list-style-type: none"> states Euler's Rule 	1
<ul style="list-style-type: none"> substitutes correct number of vertices, faces and edges 	1

Question 4 (d)

Solution	
Graph is still connected when edge PQ is removed	
Marking key/mathematical behaviours	Marks
<ul style="list-style-type: none"> explains graph remains connected 	1
<ul style="list-style-type: none"> when edge PQ removed 	1

Question 4 (e)

Solution	
The degree of vertex R is <u>3</u> because <u>exactly 3 edges meet at R</u> .	
Marking key/mathematical behaviours	Marks
<ul style="list-style-type: none"> identifies degree of node 	1
<ul style="list-style-type: none"> justifies choice of value 	1

Question 5 (a)

Solution					
Number of hours pump was working	1	2	3	5	6
Volume of water in the tank (in litres)	360	560	760	1160	1360
Marking key/mathematical behaviours					Marks
<ul style="list-style-type: none"> determines starting value and third term 					1
<ul style="list-style-type: none"> determines 5th term 					1
<ul style="list-style-type: none"> identifies term number 					1

Question 5 (b)

Solution	
760 litres	
Marking key/mathematical behaviours	Marks
<ul style="list-style-type: none"> relates sequence to context of problem 	1

Question 5 (c)

Solution	
$T_{n+1} = T_n + 200 \quad T_1 = 360$	
Marking key/mathematical behaviours	Marks
<ul style="list-style-type: none"> describes recursive relation 	1
<ul style="list-style-type: none"> identifies starting term (or any particular term) 	1

Question 5 (d)

Solution	
Linear. The increase is a constant number	
Marking key/mathematical behaviours	Marks
<ul style="list-style-type: none"> identifies correct relationship 	1
<ul style="list-style-type: none"> justifies choice of type 	1

Question 5 (e)

Solution	
1960	
Marking key/mathematical behaviours	Marks
<ul style="list-style-type: none"> identifies correct term ($n = 9$) 	1
<ul style="list-style-type: none"> determines correct value 	1

Question 5 (f)

Solution	
18 hours	
Marking key/mathematical behaviours	Marks
<ul style="list-style-type: none"> identifies correct term 	1

Question 6 (a)

Solution	
6	
Marking key/mathematical behaviours	Marks
<ul style="list-style-type: none"> identifies Hamiltonian circuits 	1

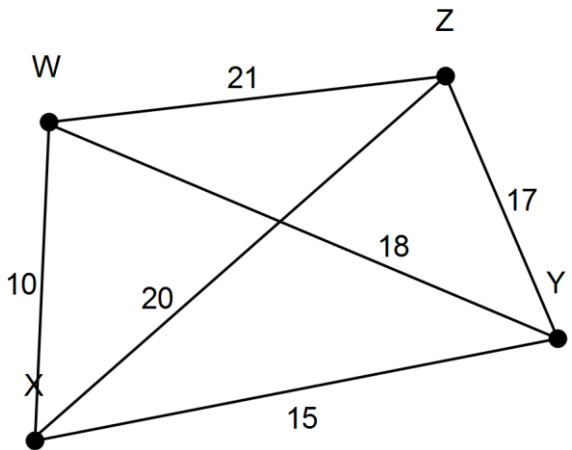
Question 6 (b)

Solution	
WXYZW or WZYXW 63 km	
Marking key/mathematical behaviours	Marks
<ul style="list-style-type: none"> identifies shortest circuit 	1
<ul style="list-style-type: none"> determines length of shortest circuit 	1

Question 6 (c)

Solution	
It goes through each vertex only once It starts and ends at the same vertex	
Marking key/mathematical behaviours	Marks
<ul style="list-style-type: none"> identifies cyclic nature 	1
<ul style="list-style-type: none"> describes path through vertices 	1

Question 6 (d)

Solution	
	
Marking key/mathematical behaviours	Marks
<ul style="list-style-type: none"> uses and labels correct number of nodes 	1
<ul style="list-style-type: none"> completes all edges 	1
<ul style="list-style-type: none"> places correct weights on all edges 	1