MATHEMATICS APPLICATIONS

MAWA Semester 2 (Units 3 & 4) Examination 2017

Calculator-Assumed

Marking Key

Section Two: Calculator-assumed (100 Marks)

Question 7 (a)

Solution

Suburb	Houses	Units	Blocks
EB	54	14	8
WB	121	15	43
Totals	175	29	51

Marking key/mathematical behaviours	Marks
• enters given data into correct cells of the table	1

Question 7 (b)

Solution

Suburb	Houses	Units	Blocks
EB	31%	48%	16%
WB	69%	52%	84%
Totals	100%	100%	100%

Marking key/mathematical behaviours	Marks
• provides total percentages for each column	1
• determines percentages for two types of properties	1
• determines percentages for a third type of property	1

Question 7 (c)

Solution

There does not appear to be any association between the suburb and the units sold.
The proportions of houses and blocks appear to be linked to the suburb and much higher in West Busselton than in East Bunbury

Marking key/mathematical behaviours	Marks
• identifies association of suburb with each type of property	1
• describes associations clearly	1
• describes association in terms of proportions	1

Question 8 (a)

Solution

n	0	1	2
Value after n months ($)	$2400	$2304	$2211.84

Marking key/mathematical behaviours	Marks
• enters value for 0 and 1 month	1
• enters value after 2 months	1

Question 8 (b)

Solution

4% per month

Marking key/mathematical behaviours	Marks
• identifies rate	1

Question 8 (c)

Solution

$V_n = 2400(0.96)^n$

Marking key/mathematical behaviours	Marks
• identifies starting term and rate	1
• uses correct format for the rule	1

Question 8 (d)

Solution

$2400 \times 0.96^{12} = \$1470.50$

Marking key/mathematical behaviours	Marks
• identifies rate	1

Question 8 (e)

Solution

% decrease = (2400-1470.50)/2400 x 100 = 38.73%

Marking key/mathematical behaviours	Marks
• identifies value of decrease	1
• determines percentage decrease	1

Question 8 (f)

Solution

After 39 months. At the end of September 2020

Marking key/mathematical behaviours	Marks
• determines duration	1
• determines end of time interval	1

Question 9 (a)

Solution	
CEGH 50 CEJGH 20 CJGH 10 CJH 90 CLJH 20 CLNH 40 Total number of trains is 230	
Marking key/mathematical behaviours	Marks
• Determines 2 paths and their respective number of trains	1
• Determines a further 2 paths and their respective number of trains	1
• Determines a further 2 paths and their respective number of trains	1
• Determines maximum number of trains	1

Question 9 (b)

Solution	
190 trains	
Marking key/mathematical behaviours	Marks
• determines maximum number possible through J	1

Question 9 (c)

Solution LN by 10, EJ by 10 and GH by 70 EG by 10 and GH by 60 [Other solutions possible]	
Marking key/mathematical behaviours	Marks
• identifies edges with greater capacity	1
• determines size of extra capacity	1

Question 10 (a)

Solution	
Increasing (or positive) trend	
Marking key/mathematical behaviours	Marks
• identifies trend from graph	1

Question 10 (b)

Solution	
Every fourth value is the highest of the four in that year.	
Marking key/mathematical behaviours	Marks
• describes seasonality	1

Question 10 (c)

Solution Circles the point at (20, 45)	
Marking key/mathematical behaviours	Marks
• identifies the outlier	1

Question 10 (d)

Solution (22 + 21 + 16 + 45) ÷ 4 = 26	
Marking key/mathematical behaviours	Marks
• determines mean	1

Question 10 (e)

Solution 170% which indicates the number is well above the average for the 4 seasons in that year	
Marking key/mathematical behaviours	Marks
• determines percentage of seasonal mean	1
• describes significance of seasonal mean	1

Question 10 (f)

Solution (59% + 103% + 52% + 81% + 72%) ÷ 5 = 73.4%	
Marking key/mathematical behaviours	Marks
• calculates seasonal index	1

Question 10 (g)

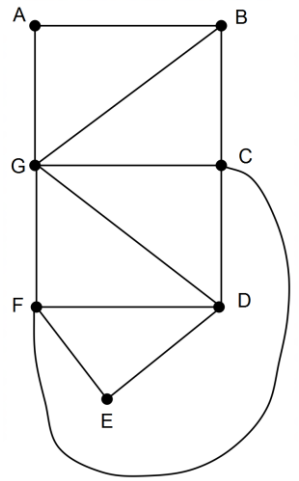
Solution 11 ÷ 52% = 21	
Marking key/mathematical behaviours	Marks
• applies rule to deseasonalise	1
• uses appropriate rounding	1

Question 10 (h)

Solution Car thefts will continue to rise. Need to know that the number of cars parked at the airport will not decrease significantly	
Marking key/mathematical behaviours	Marks
• describes prediction based on data provided	1
• identifies further information needed to support the prediction	1

Question 11 (a)

Solution



Marking key/mathematical behaviours	Marks
• identifies graph in planar form	1

Question11 (b)

Solution

B and G

Marking key/mathematical behaviours	Marks
• identifies odd vertices	1

Question 11 (c)

Solution

BCFEDFGDCGABG

Marking key/mathematical behaviours	Marks
• starts and finishes at the odd vertices	1
• all sequence correct with no more than one leg missing	1
• all legs represented	1

Question 11 (d)

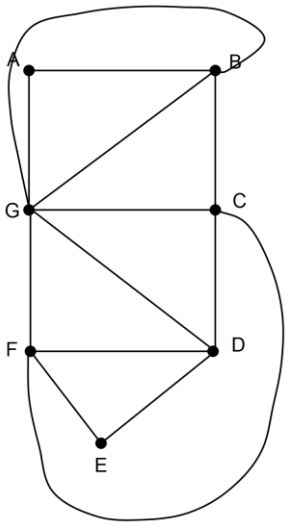
Solution

Graph is connected
Starts and ends at different nodes
All edges crossed once only

Marking key/mathematical behaviours	Marks
• describes two features of semi-eulerian graphs	2

Question 11 (e)

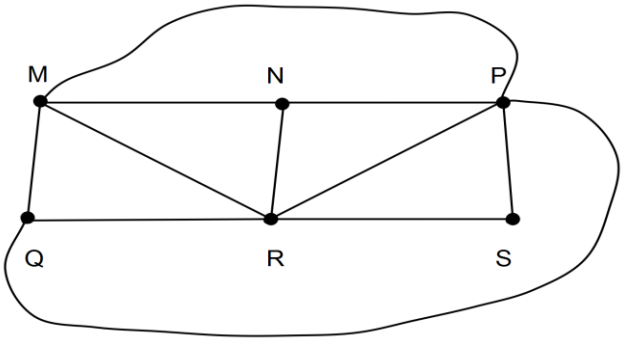
Solution



Marking key/mathematical behaviours	Marks
• identifies an Eulerian graphs	1

Question 11 (f)

Solution



Marking key/mathematical behaviours	Marks
• graph has 11 edges and 6 nodes (two of which are odd)	1
• graph has 7 faces	1
• graph is semi-eulerian	1

Question 12 (a)

Solution 0.75% or 0.0075	
Marking key/mathematical behaviours	Marks
• calculates monthly interest rate	1

Question 12 (b)

Solution $B_{n+1} = 1.0075B_n + 200, B_0 = 1000$	
Marking key/mathematical behaviours	Marks
• uses equation to determine deseasonal value	1
• makes seasonal adjustment	1

Question 12 (c)

Solution $1627.18, $12.20, $200.00, $1839.38	
Marking key/mathematical behaviours	Marks
• enters values given in question	1
• calculates interest	1
• determines account balance at end of month	1
• Rounds all values to nearest cent	1

Question 12 (d)

Solution After 18 months. / By the end of the 19th month.	
Marking key/mathematical behaviours	Marks
• Indicates time total reached	1

Question 12 (e)

Solution $5220.38 – (1000 + 19 x 200)= $420.38	
Marking key/mathematical behaviours	Marks
• determines total deposit	1
• calculates total interest	1

Question 12 (f)

Solution Yes, No, Yes, Yes	
Marking key/mathematical behaviours	Marks
• identifies influence of each of 4 factors on the investment growth	4

Question 13 (a)

Solution ZQRE 31 hours	
Marking key/mathematical behaviours	Marks
• identifies critical path • determines minim time	1 1

Question 13 (b)

Solution After 21 hours	
Marking key/mathematical behaviours	Marks
• identifies earliest start time	1

Question 13 (c)

Solution 8 hours from commencement	
Marking key/mathematical behaviours	Marks
• identifies latest start time	1

Question 13 (d)

Solution 9 hours	
Marking key/mathematical behaviours	Marks
• determines float time	1

Question 13 (e)

Solution Critical path in unchanged and minimum completion time reaches 34 hours	
Marking key/mathematical behaviours	Marks
• determines effect of change on critical path • determines effect of change on minimum completion time	1 1

Question 14 (a)

Solution $10 956.90	
Marking key/mathematical behaviours	Marks
• calculates future value	1

Question 14 (b)

Solution $i_{effective} = \left(1+\frac{i}{n}\right)^{n} - 1$ = (1+0.0305/12)^{12} – 1 = 0.03093 So 3.09%	
Marking key/mathematical behaviours	Marks
• substitutes into formula	1
• calculates effective rate of interest	1
• gives interest as a percentage correct to 2 decimal places	1

Question 14 (c)

Solution Yes – the interest rate is higher than the 3.09% effective rate of interest	
Marking key/mathematical behaviours	Marks
• concludes in the affirmative	1
• compares 3.10% to the effective rate of interest	1

Question 14 (d)

Solution With a higher annual interest rate With interest compounded more frequently	
Marking key/mathematical behaviours	Marks
• identifies two different ways to increase the value of the investment	2

Question 15 (a)

Solution

$$\begin{bmatrix} 0 & 0 & 1 & 0 & 0 & 0 \\ 1 & 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 \\ 1 & 0 & 0 & 1 & 1 & 0 \end{bmatrix}$$

Marking key/mathematical behaviours	Marks
• all diagonal entries are 0	1
• all 0s correct	1
• all 1s correct	1

Question 15 (b)

Solution

Person A
The total of the numbers in their column is the highest

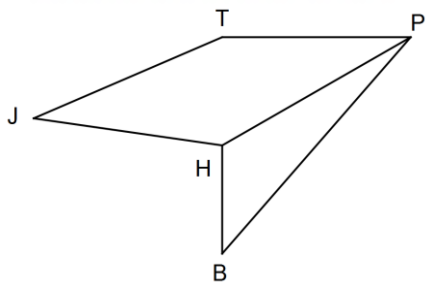
Marking key/mathematical behaviours	Marks
• interprets adjacency matrix	1
• describes values in adjacency matrix	1

Question 15 (c)

Solution

(i)

$$\begin{bmatrix} 0 & 4 & 1 & 5 & 2 \\ 4 & 0 & 5 & 1 & 2 \\ 1 & 5 & 2 & 6 & 4 \\ 5 & 1 & 6 & 2 & 4 \\ 2 & 2 & 4 & 4 & 2 \end{bmatrix}$$



(ii) There are 2. JHPB and JTPB

Marking key/mathematical behaviours	Marks
• determines cube of matrix	1
• determines number of three-stage communications	1
• names each three-stage communication	1

Question 16 (a)

Solution	
DADEC = -0.142 X 25 + 13.4 = 9.85 103% of 9.85 = 10.1	
Marking key/mathematical behaviours	Marks
• substitutes into equation	1
• determines deseasonalised value	1
• adjusts using seasonal index	1

Question 16 (b)

Solution	
Not very reliable as the numbers used are averages / the June 2014 figure could be atypical of the June average and this could make the seasonal average lower than the long term trend for that seasonal average.	
Marking key/mathematical behaviours	Marks
• identifies prediction not very reliable	1
• explains lack of reliability	1

Question 16 (c)

Solution	
Deseasonalised data (DADEC) = $-0.219t + 14.8$	
Marking key/mathematical behaviours	Marks
• determines gradient and y-intercept	1
• expresses relationship in linear form with correct variables	1

Question 16 (d)

Solution	
The rate for the last two years shows an increasing downward trend (-0.219 compared to -0.142). This indicates that the trend for the first two years was less negative and maybe even positive. The gradient of the line for that period would have been greater than -0.142.	
Marking key/mathematical behaviours	Marks
• describes the trend for the first two years	1
• justifies the description of the change	1

Question 17 (a)

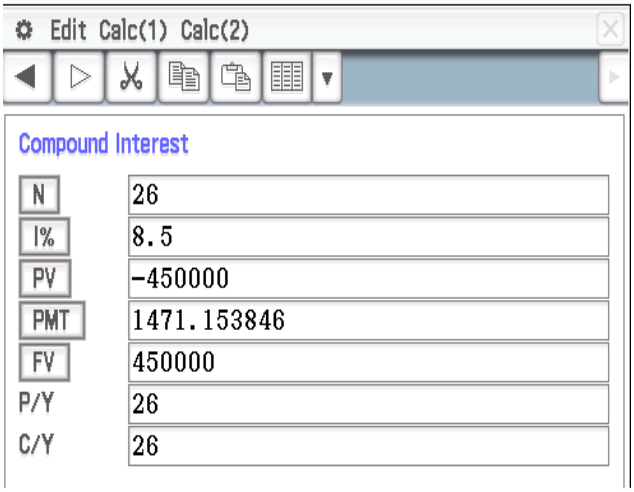
Solution

450 000 x 0.95 x 1.085 = $463 837. 50

Marking key/mathematical behaviours	Marks
• states an expression to calculate value using percentage decrease	1
• determines value of investment	1

Question 17 (b)

Solution
$1471.15



Marking key/mathematical behaviours	Marks
• identifies all correct variables	1
• determines withdrawal amount	1

Question 17 (c)

Solution

After the first 5 years, the superannuation is worth $331 856.95
[N=5, I% = 6.5, PV= 450000, PMT=50000,FV=?]
After the next 5 years, the superannuation is worth $198 458.94
[N=5, I% = 6.5, PV= =$331 856.95400000, PMT=$45 000,FV=?]
He can only take a salary of $40000 for the next 6 years after that (16 years all together)
[N=?, I%=6.5, PV = 198 458.94, FV=0]

Marking key/mathematical behaviours	Marks
• determines value after 5 years	1
• determines value after 10 years	1
• determines duration of the investment	1