**MATHEMATICS APPLICATIONS**

**MAWA Semester 2 (Units 3 & 4)**

**Examination 2016**

**Calculator-free**

# Marking Key

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The release date for this exam and marking scheme is

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

**Section One: Calculator-free (51 Marks)**

**Question 1 (a)**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Solution   |  |  |  |  |  | | --- | --- | --- | --- | --- | | **Time** | Start  9 am | 10 am | 11 am | noon | | **Luca** | 20 | 31 | 42 | 53 | | **Mila** | 30 | 38 | 46 | 54 | | |
| Marking key/mathematical behaviours | Marks |
| * accurately completes pattern for Luca * accurately completes pattern for Mila | 1  1 |

**Question 1 (b)**

|  |  |
| --- | --- |
| Solution  *L0 = 20, Ln+1 = Ln + 11* | |
| Marking key/mathematical behaviours | Marks |
| * identifies initial term * identifies recurrence relation | 1  1 |

**Question 1 (c)**

|  |  |
| --- | --- |
| Solution  *Mn= 22 + 8n* | |
| Marking key/mathematical behaviours | Marks |
| * identifies correct “gradient” * expresses rules correctly in linear format | 1  1 |

**Question 1 (d)**

|  |  |
| --- | --- |
| Solution  *Mn= 22 + 8n = 22 + 8 x 12 = 118* | |
| Marking key/mathematical behaviours | Marks |
| * determines correct expression using rule identified | 1 |

**Question 2 (a)**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Solution   |  |  |  |  | | --- | --- | --- | --- | |  | Monday | Tuesday | Wednesday | | Jean | 3 | 5 | 2 | | Ray | 2 | 4 | 3 | | Mario | 4 | 5 | 1 | |  |  |  |  | | |
| Marking key/mathematical behaviours | Marks |
| * creates table to represent assignment data | 1 |

**Question 2 (b)**

|  |  |
| --- | --- |
| Solution | |
| Marking key/mathematical behaviours | Marks |
| * creates labelled matrix to represent assignment data | 1 |

**Question 2 (c)**

|  |  |
| --- | --- |
| Solution  Jean for Tuesday, Ray for Wednesday and Mario for Monday [12 hours] | |
| Marking key/mathematical behaviours | Marks |
| * determines optimum assignment by inspection | 1 |

**Question 2 (d)**

|  |  |
| --- | --- |
| Solution  Every number was subtracted from 7 | |
| Marking key/mathematical behaviours | Marks |
| * identifies calculation used | 1 |

**Question 2 (e)**

|  |  |
| --- | --- |
| Solution  In each row the smallest number was subtracted from each number in the row | |
| Marking key/mathematical behaviours | Marks |
| * identifies calculation used | 1 |

**Question 2 (f)**

|  |  |
| --- | --- |
| Solution  Where the optimum allocation is to be located. The intersection of the person and the day represents the solution | |
| Marking key/mathematical behaviours | Marks |
| * interprets process in use of Hungarian algorithm | 1 |

**Question 2 (g)**

|  |  |
| --- | --- |
| Solution  Ned on Friday, Mary on Monday, Sue on Tuesday, Eva on Wednesday, Jon on Thursday OR  Ned on Friday, Mary on Monday, Sue on Tuesday, Eva on Thursday, Jon on Wednesday  31 hours | |
| Marking key/mathematical behaviours | Marks |
| * determines optimum assignment * describes first solution * describes second solution | 1  1  1 |

**Question 3 (a)**

|  |  |
| --- | --- |
| Solution  Edges in minimum spanning tree: AB = 11m BD = 12m DC = 10m CE = 8m  41 metres needed | |
| Marking key/mathematical behaviours | Marks |
| * determines 2 correct sections * determines 2 more correct connections * determines total minimum | 1  1  1 |

**Question 3 (b)**

|  |  |
| --- | --- |
| Solution | |
| Marking key/mathematical behaviours | Marks |
| * draws 2 correct edges * draws other 2 correct edges | 1  1 |

**Question 3 (c)**

|  |  |
| --- | --- |
| Solution  Network drawn is a connected graph with all edges different, each vertex visited only once | |
| Marking key/mathematical behaviours | Marks |
| * identifies 2 conditions * identifies 3rd condition | 1  1 |

**Question 4 (a)**

|  |  |
| --- | --- |
| Solution  $6000 | |
| Marking key/mathematical behaviours | Marks |
| * reads investment graph | 1 |

**Question 4 (b)**

|  |  |
| --- | --- |
| Solution  $6850 | |
| Marking key/mathematical behaviours | Marks |
| * reads investment graph | 1 |

**Question 4 (c)**

|  |  |
| --- | --- |
| Solution  monthly | |
| Marking key/mathematical behaviours | Marks |
| * reads investment graph | 1 |

**Question 4 (d)**

|  |  |
| --- | --- |
| Solution  *P1=6000, Pn+1 = Pn* x (1 + 0.045 ÷ 12) | |
| Marking key/mathematical behaviours | Marks |
| * identifies first term (or any other) * determines correct interest rate * identifies recurrence relation | 1  1  1 |

**Question 4 (e)**

|  |  |
| --- | --- |
| Solution  (i) exponential  (ii) The growth is a rate not a fixed amount  (iii) The increasing growth is too small to be noticed on a graph with a very small scale. | |
| Marking key/mathematical behaviours | Marks |
| * identifies type of relationship * explains lack of constant growth * identifies small amount of growth | 1  1  1 |

**Question 5 (a)**

|  |  |
| --- | --- |
| Solution  4 | |
| Marking key/mathematical behaviours | Marks |
| * reads time series graph | 1 |

**Question 5 (b)**

|  |  |
| --- | --- |
| Solution  700 | |
| Marking key/mathematical behaviours | Marks |
| * reads time series graph | 1 |

**Question 5 (c)**

|  |  |
| --- | --- |
| Solution  (i) 900  (ii) July 2011 to October 2011 | |
| Marking key/mathematical behaviours | Marks |
| * reads pattern in time series graph * interprets scale on horizontal axis | 1  1 |

**Question 5 (d)**

|  |  |
| --- | --- |
| Solution  July 2009 | |
| Marking key/mathematical behaviours | Marks |
| * interprets data point on time series graph | 1 |

**Question 5 (e)**

|  |  |
| --- | --- |
| Solution  Removing the outlier allows the calculation to be more typical of what normally occurs | |
| Marking key/mathematical behaviours | Marks |
| * explains outlier’s effect on calculations | 1 |

**Question 5 (f)**

|  |  |
| --- | --- |
| Solution  The owners may have been away in January of that particular year | |
| Marking key/mathematical behaviours | Marks |
| * links percentage to drop in consumption | 1 |

**Question 5 (g)**

|  |  |
| --- | --- |
| Solution  Divide the consumption for the January by the average for each season of that year | |
| Marking key/mathematical behaviours | Marks |
| * describes method of calculation | 1 |

**Question 5 (h)**

|  |  |
| --- | --- |
| Solution  April  Has the lowest seasonal index AND it is the lowest point on the graph in each cycle | |
| Marking key/mathematical behaviours | Marks |
| * identifies period for minimum consumption * gives reason to justify choice * gives second reason to justify choice | 1  1  1 |

**Question 6 (a)**

|  |  |
| --- | --- |
| Solution  The repayments are less than the interest charged | |
| Marking key/mathematical behaviours | Marks |
| * explains increasing loan value | 1 |

**Question 6 (b)**

|  |  |
| --- | --- |
| Solution  $2000 | |
| Marking key/mathematical behaviours | Marks |
| * reads investment graph | 1 |

**Question 6 (c)**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Solution   |  |  | | --- | --- | | **Change to feature of the loan** | **Letter** | | An increased amount is borrowed | D | | An increase in the rate at which interest is charged on the loan | B | | An increase in the size of the repayments | A | | An increase in the frequency of compounding | C | | An increase in the time taken to pay off the loan | D, B | | An increase in the overall amount paid back | D, B | | |
| Marking key/mathematical behaviours | Marks |
| * selects graphs showing each of the 6 features described | 6 |