**MATHEMATICS APPLICATIONS**

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

**Examination 2016**

**Calculator-Assumed**

# Marking Key

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

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

**Question 7 (a)**

|  |  |
| --- | --- |
| Solution  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 * determines another 2 correct values | 1  1 |

**Question 7 (c)**

|  |  |
| --- | --- |
| Solution    *n* = 8, *P*8 = 62 510 people | |
| Marking key/mathematical behaviours | Marks |
| * identifies required term (8th) * determines correct population | 1  1 |

**Question 7 (d)**

|  |  |
| --- | --- |
| Solution  *=* 29 500 | |
| Marking key/mathematical behaviours | Marks |
| * Substitutes correct value for r * States rest of formula correct, even if r is incorrect | 1  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 * determines other 3 correct values | 1  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 * determines correct capacity for 2 paths * determines correct capacity for another 2 paths * determines correct capacity for remaining paths | 1  1  1  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 * justifies decision | 1  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 * calculates seasonal index | 1  1 |

**Question 10 (d)**

|  |  |
| --- | --- |
| Solution  An increase of 175 per quarter | |
| Marking key/mathematical behaviours | Marks |
| * specifies increase * determines number of dwellings per quarter as a rate | 1  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 * makes seasonal adjustment | 1  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 * compares prediction with raw data | 1  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 * marks edges to show routes used | 1  1 |

**Question 11 (b)**

|  |  |
| --- | --- |
| Solution    Cost = $140 000 | |
| Marking key/mathematical behaviours | Marks |
| * identifies 4 correct edges without circuits * identifies 2 more edges and no circuits * determines cost | 1  1  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 * only links odd nodes with shortest route | 1  1 |

**Question 11 (c)**

|  |  |
| --- | --- |
| Solution  (iii)  CFUPKUKZPWSPCS | |
| Marking key/mathematical behaviours | Marks |
| * draws new route(s) identified in part (ii) * list stations in correct order | 1  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 * labels and scales vertical axis * selects month as explanatory variable * plots 12 points accurately * plots further 6 points accurately * plots final 6 points accurately | 1  1  1  1  1  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 * indicates non-acceptable features | 1  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  0.01160 000 = $660 | |
| Marking key/mathematical behaviours | Marks |
| * writes correct product * calculates correct amount of money | 1  1 |

**Question 13 (b)**

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

**Question 13 (c)**

|  |  |
| --- | --- |
| Solution  = 1.011 – 2000 , = 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. * (ii) determines correct value. | 1  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 36 + $1203.22 = $73 203.22 | |
| Marking key/mathematical behaviours | Marks |
| * calculates total regular repayments$2000 36 * includes final repayment in total | 1  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 * interprets the value correctly | 1  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 * identifies significance of 1 | 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 * identifies 2 paths R to K and 2 other paths * identifies other 3 paths | 1  1  1 |

**Question 15 (a)**

|  |  |
| --- | --- |
| Solution  Weight = 0.9465 x height – 89.635 | |
| Marking key/mathematical behaviours | Marks |
| * determines “gradient” * expresses relationship in linear format with correct intercept | 1  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 * justifies decision | 1  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 * determines remaining 4 correct residuals | 1  1 |

**Question 15 (f)**

|  |  |
| --- | --- |
| Solution | |
| Marking key/mathematical behaviours | Marks |
| * labels and scales horizontal axis * labels and scales vertical axis * plots 6 residuals points * plots remaining 4 residual points | 1  1  1  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 * justifies choice of linear model | 1  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 * determines correct LST for 5 tasks * determines correct LST for remaining tasks | 1  1  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 * calculates required value correctly | 1  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 * indicates correct reason | 1  1 |

**NEEDS MAWA ACKNOWLEDGEMENT**