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| --- | --- | --- |
| Mathematics Department | |  |
| Course: ATMAA | |
| Topic Title: Time Series Analysis  Test 4 | |
| Student Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | Date: \_\_\_\_\_\_\_\_\_\_\_\_ | | |
| Special Instructions: Calculator Allowed  **1 page of A4 notes and Formula Sheet Allowed** | Time Allowed: 60 mins | | |
|  | Marks: / 45 | | |

**Multiple Choice**

Identify the choice that best completes the statement or answers the question.

**Question 1.** **(1 mark)**

A time series for the mass of a decomposing pile of leaves is most likely to have ...

A a seasonal variation D a cyclic pattern

B a negative secular trend. E a random pattern

C a positive secular trend

**Question 2. (1 mark)**

Which of the following is most likely to apply to the time series plot below?



|  |  |  |  |
| --- | --- | --- | --- |
| A | a positive secular trend | D | a random pattern |
| B | a negative secular trend | E | a seasonal variation |
| C | a cyclic pattern |

**Question 3. (1 mark)**

The height of a plant, in cm, is observed every week and the results recorded in the table below.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Week | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Height | 7.4 | 7.8 | 9.8 | 10.8 | 11.2 | 12.1 | 12.7 | 13.7 | 14.2 | 14.7 |

Choose the correct time series plot using the data listed.

|  |  |  |  |
| --- | --- | --- | --- |
| A |  | D |  |
| B |  | E |  |
| C |  |

**End of multiple choice questions**

**Question 4. (4 marks)**

If a three-point moving average is used to smooth the data in the table below, calculate the smoothed

values. If necessary, round to the nearest whole number of births.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Year | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 |
| Births | 334 | 365 | 384 | 394 | 405 | 443 |

**Question 5. (4 marks)**

If a four-point moving average is used to smooth the data in the table below, calculate the smoothed

values. If necessary, round to the nearest whole number of births.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Year | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
| Births | 253 | 280 | 299 | 335 | 362 | 410 | 454 | 484 |

**Question 6. (11 marks)**

Calculate the seasonal index for the four quarters, correct to three decimal places.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Year | Sales for quarter 1 | Sales for quarter 2 | Sales for quarter 3 | Sales for quarter 4 | Yearly average (for your use) |
| 2011 | 64 | 58 | 26 | 55 |  |
| 2012 | 67 | 67 | 32 | 54 |  |
| 2013 | 60 | 61 | 37 | 51 |  |
| 2014 | 58 | 62 | 32 | 49 |  |

**Question 7. (15 marks)**

Find the deseasonalised values for the four quarters, correct to two decimal places.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Year | Sales for quarter 1 | Sales for quarter 2 | Sales for quarter 3 | Sales for quarter 4 | Yearly average (for your use) |
| 2011 | 56 | 27 | 34 | 80 |  |
| 2012 | 64 | 27 | 29 | 77 |  |
| 2013 | 67 | 35 | 29 | 87 |  |
| 2014 | 65 | 30 | 35 | 87 |  |

**Question 8. (8 marks)**

Staff in a small country hospital tabulated the number of births recorded over a period of 3 years as

shown in the table below.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Year** | **Q1** | **Q2** | **Q3** | **Q4** |
| 2011 | 0 | 4 | 1 | 5 |
| 2012 | 1 | 5 | 1 | 4 |
| 2013 | 1 | 2 | 5 | 1 |

**a**  Create a time series plot using the data given.



**b**  Using technology, find the least squares regression line and add it to your time series plot.

**c**  State the equation of the least squares regression line.

**d**  Use the equation to predict the number of births in the small country hospital in the first quarter of 2014.