Mathematics Applications Units 3 & 4
Test 3   2017
Section 1   Calculator Free

Time Series Analysis

STUDENT'S NAME: _____

DATE: Monday 15th May   **TIME:** 15 minutes   **MARKS**: 18

INSTRUCTIONS:

Standard Items: Pens, pencils, pencil sharper, eraser, correction fluid/tape, ruler, highlighters, Formula Sheet.

Questions or parts of questions worth more than 2 marks require working to be shown to receive full marks.
_____

1.   (3 marks)

Consider the following media report on the likely improvement in employment.

8 MAY 2017 - 12:26PM

April job ads lift suggests strength: ANZ

Job ads in April grew at a stronger rate than they did in March, suggesting that employment could strengthen further in coming months, says the ANZ Bank.

Source: AAP

🐦 Tweet

f Recommend 0

8 MAY 2017 - 12:26 PM UPDATED YESTERDAY 12:26 PM

A solid rise in the number of jobs advertised in April, following a more modest lift in March, suggests that employment is likely to strengthen over the coming months, the ANZ Bank says.

Jobs advertisements rose 1.4 per cent in April, in seasonally adjusted terms, surpassing a rise of 0.8 per cent in March, according to the latest job ads survey by the bank.

Annual growth in job ads jumped to 10.1 per cent, from 7.1 per cent in March.

(a)   State the:

(i)   explanatory (independent) variable: [1]

(ii)   response (dependent) variable: [1]

(b)   Circle the phrase in the report which suggests the response variable contains a cyclic component.   [1]

2.   (6 marks)

Consider the following *Time Series* graph showing Forest Timber Production.
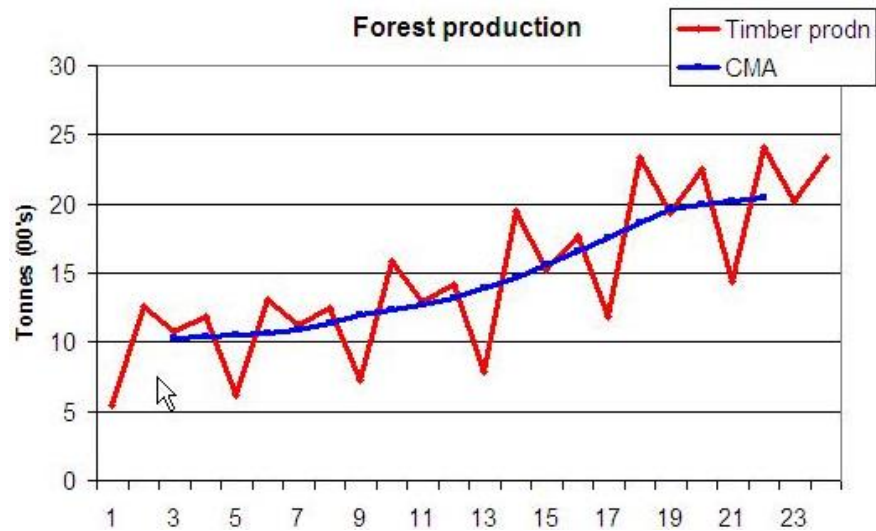
(a)   Is the underlying production trend on the increase, stable or decreasing?   [1]

(b)   One graph shows a cyclic component in the data. State the length of the cycle.   [1]

(c)   State the actual timber production when $t = 13$.   [1]

(d)   In the ledger key, what does CMA stand for?   [1]

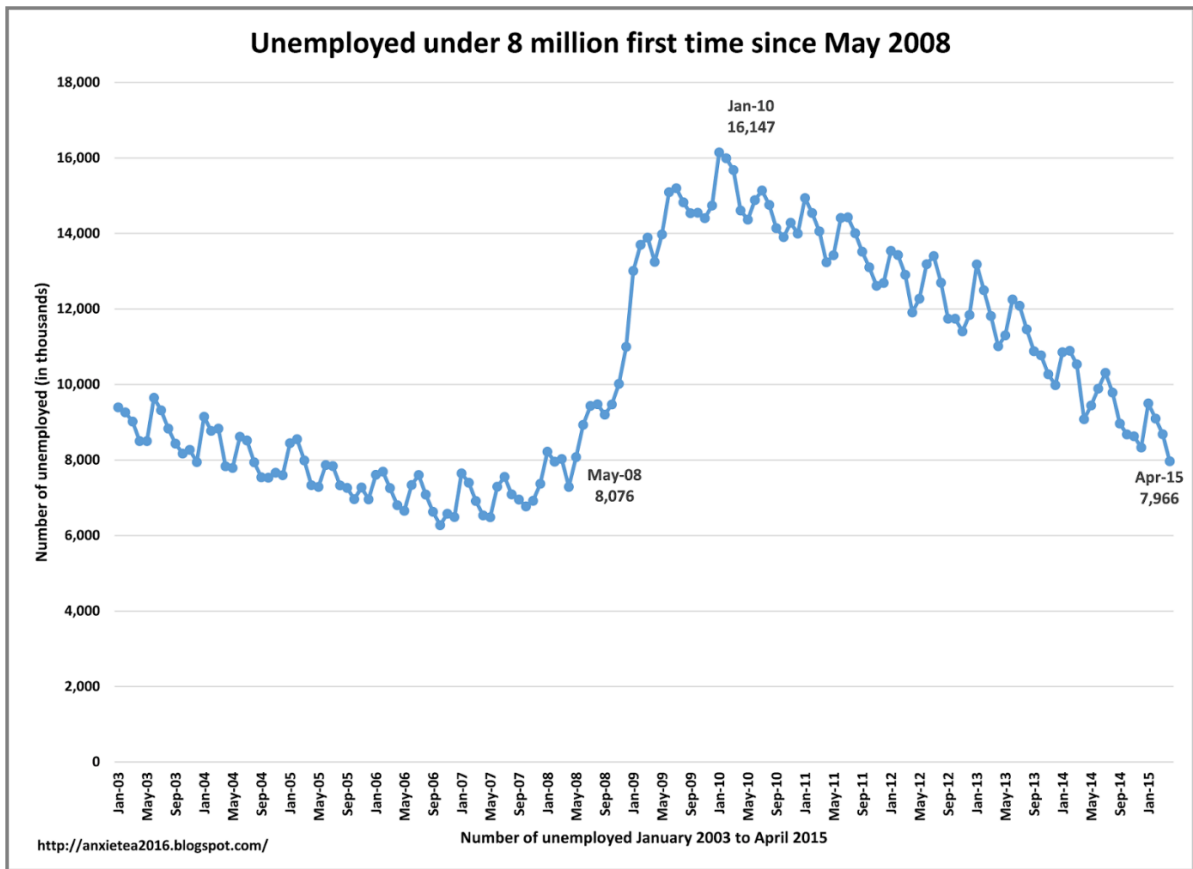(e)   Two graphs are shown. How do the two graphs relate?   [2]

3. (5 marks)

Complete the following statements:

- A seasonal index is a measure of how a season compares with the

  _____

  [1]

- Seasonal indices are calculated so that their average is _____

  [1]

- If a seasonal index is 1.15, this means that this season is 15% _____
  than the average.

  [1]

- *Deseasonalising* is the process that is used to remove the seasonal effects from a set of

  data. This allows any _____to be made clearer.

  [1]

- To calculate deseasonalised data, each actual figure is _____by its
  appropriate seasonal index.

  [1]

4.   (4 marks)

Consider the following unemployment figures for an unknown country.

Unemployed under 8 million first time since May 2008

Jan-10
16,147

May-08
8,076

Apr-15
7,966

Number of unemployed (in thousands)

http://anxietea2016.blogspot.com/

Number of unemployed January 2003 to April 2015

(a)   Provide numerical evidence to support the graph's title.   [2]

(b)   Draw on the graph two trend lines that indicate, except for a brief period, that
       unemployment was generally reducing over time.   [1]

(c)   During which two years did unemployment rise sharply?   [1]

End of Section I Questions

TRINITY COLLEGE

Mathematics Applications Units 3 & 4
Test 3   2017

Section 2   Calculator Assumed

Time Series Analysis

STUDENT'S NAME: _____

DATE: Monday 15th May   **TIME:** 35 minutes   **MARKS**: 37

INSTRUCTIONS:

Standard Items: Pens, pencils, pencil sharper, eraser, correction fluid/tape, ruler, highlighters,
Formula Sheet retained from Section 1.

Special Items: Drawing instruments, templates, three calculators, notes on one side of a single A4 page
(these notes to be handed in with this assessment).

Questions or parts of questions worth more than 2 marks require working to be shown to receive full marks.
_____

5.   (5 mark)

The *Seasonal Indices* for the first 3 quarters of a company's sales figures are:

Q1:   127%
Q2:   71%
Q3:   114%

(a)   Determine the seasonal index for Q4   [1]

(b)   If the Q2 actual sales figures are 1240, calculate the deseasonalised value.   [2]

(c)   A fitted trend line to the smoothed data, indicates that the seasonally adjusted figure for
Q2 of the following year, is 1820. Determine a prediction for the <u>actual</u> sales figures. [2]

6. (19 mark)

The school canteen records icecream sales quarterly. The data is detailed below:

Year	Quarter	t	Sales	CMA	Seasonally Adjusted Sales
2014	1	1	300		265
	2	2	250		252
	3	3	200	286.25	288
	4	4	320	**B**	272
2015	1	5	450	342.88	397
	2	6	390	360.50	393
	3	7	223	384.88	329
	4	8	438	407.00	372
2016	1	9	527	436.88	465
	2	10	490	470.63	493
	3	11	362		521
	4	12	**A**		483

(a) State the moving average used in the table above and explain the reason. [2]

(b) Comment on the trend of the data. [1]

(c)   Calculate the missing values A and B in the table   [4]

The table below shows the seasonal indices for the above data:

Year	Q1	Q2	Q3	Q4	Average
2014	300	250	200	320	
2015	450	390	223	438	
2016	527	490	362		
Seasonal Indices	1.1342	0.9933			

(d)   Calculate the missing seasonal indices in the table above.   [4]

The least squares line of regression, <u>using the CMA</u>, is $y = 24.754t + 215.542$

(e)   Using the CMA line of regression, and the seasonal indices, predict the sales for Q2,
        2017.   [2]

(f)   Determine the least squares line of regression $y = at + b$ <u>using the Deseasonalised Data</u>.
                                                                             [3]

(g)   Using the Deseasonalised line of regression, predict the sales for Q2, 2017 and explain
        why your prediction is different from that of part (e).   [3]

7. (13 mark)

The data in the table below shows Year 12 mean daily attendance for the term over three years:

Year	Terms	t	Mean Daily Attendance	Yearly Average	Attendance as a % of the Yearly Average	Adjusted Attendance
2013	1	1	178			
	2	2	150			
	3	3	179			
2014	1	4	175			
	2	5	145			
	3	6	175			
2015	1	7	168			
	2	8	141			
	3	9	171			

(a) Complete the tables above and below to deseasonalise the attendance figures. [11]

	T1	T2	T3
2013			
2014			
2015			
Seasonal Index			

(b) Comment on the reliability of using this time series data to predict Term 2 attendance in 2017.

[2]

End of Questions