Mathematics Department

Course: ATMAA

Topic Title: Time Series Analysis

Test 4

JOHN TONKIN COLLEGE

Student Name:_____ Date: _____

Special Instructions: Calculator Allowed

1 page of A4 notes and Formula Sheet Allowed

Time Allowed: 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

B a negative secular trend.

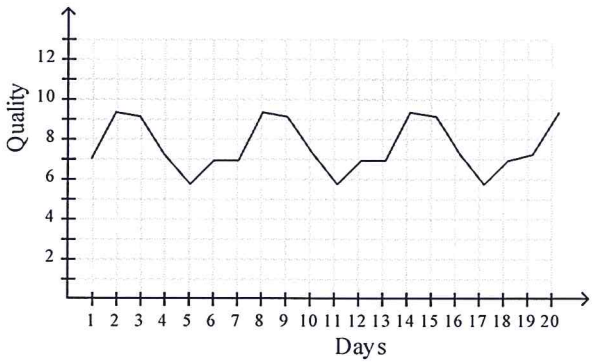
C a positive secular trend

D a cyclic pattern

E a random pattern

Question 2. **(1 mark)**

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



A a positive secular trend

B a negative secular trend

C a cyclic pattern

D a random pattern

E a seasonal variation

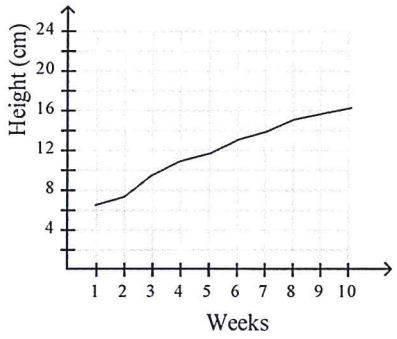
Question 3. **(1 mark)**

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

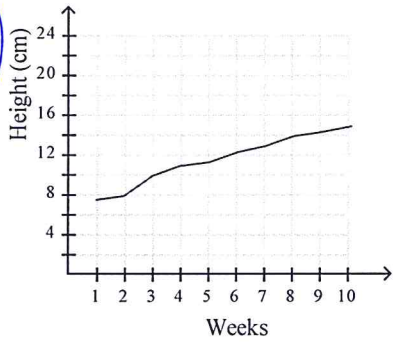
Week	1	2	3	4	5	6	7	8	9	10
Height	7.4	7.8	9.8	10.8	11.2	12.1	12.7	13.7	14.2	14.7

Choose the correct time series plot using the data listed.

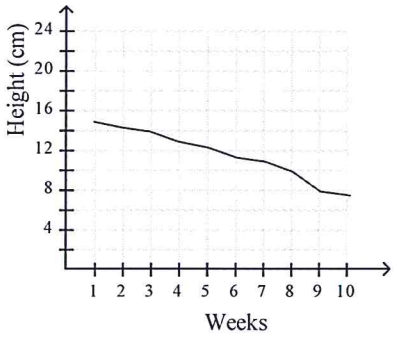
A



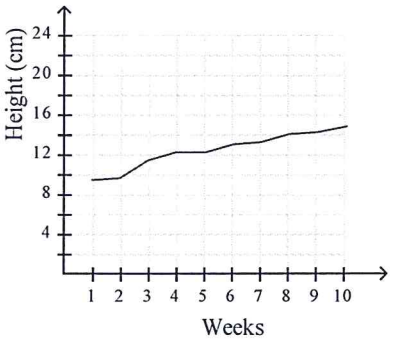
D



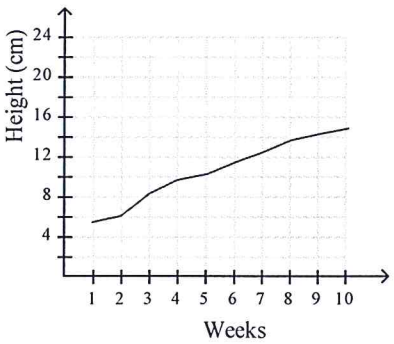
B



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

Smoothed 361 381 394 414

✓ ✓ ✓ ✓

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

Moulded 291.75 319 351.5 390.25 570

Centred

2003	2004	2005	2006
305	335	371	480

✓ ✓ ✓ ✓

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	50.75
2012	67	67	32	54	55
2013	60	61	37	51	52.25
2014	58	62	32	49	50.25

Year	Q_1	Q_2	Q_3	Q_4
2011	1.2611	1.1429	0.5123	1.0837
2012	1.2182	1.2182	1.5818	0.9818
2013	1.1483	1.1675	0.7081	0.9761
2014	1.1542	1.2338	0.6368	0.9751
Totals	4.7818	4.7624	3.4390	4.0167
SI	1.1955	1.1906	0.8598	1.0042

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	49.25 ✓
2012	64	27	29	77	49.25
2013	67	35	29	87	54.50 ✓
2014	65	30	35	87	54.25

Year	Q_1	Q_2	Q_3	Q_4
2011	1.1371	0.5482	0.6904	1.6244 ✓
2012	1.2995	0.5482	0.5888	1.5635 ✓
2013	1.2294	0.6422	0.5321	1.5963 ✓
2014	1.1982	0.5530	0.6452	1.6037 ✓
Totals	4.8642	2.2916	2.4565	6.3879 ✓
SI	1.2161	0.5729	0.6141	1.5969
	✓	✓	✓	✓

Deseasonalised data

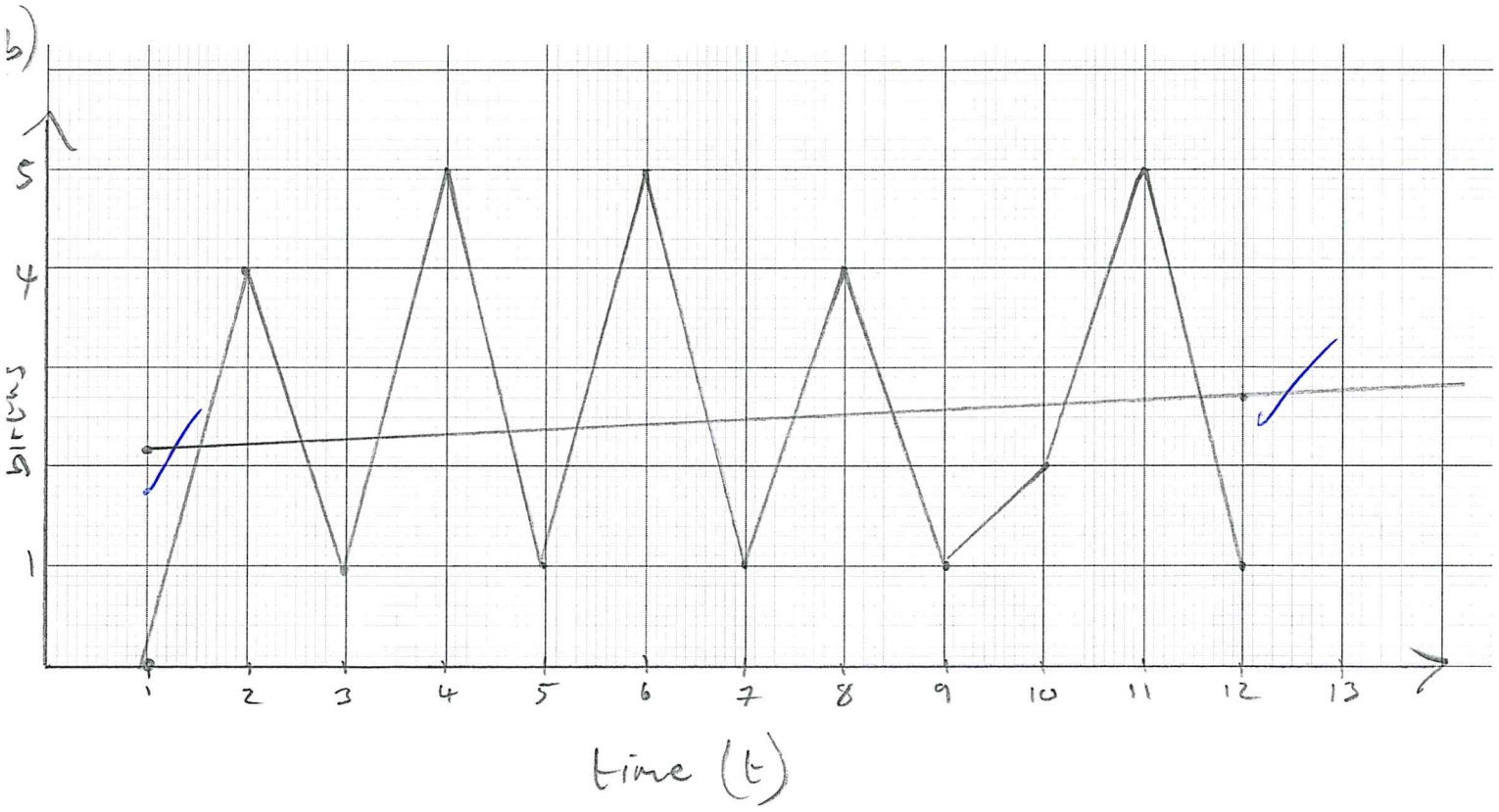
Year	Q_1	Q_2	Q_3	Q_4
2011	46.05	47.13	55.37	50.10
2012	52.63	47.13	47.22	48.22
2013	55.09	61.09	47.22	54.48
2014	53.45	52.37	56.99	54.48
	✓	✓	✓	✓

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. (2 marks) ✓✓



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.

$y = 0.04x + 2.23$ ✓

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

$x = 13$

$y = 0.04(13) + 2.23$

$y = 2.75$ ✓ ∴ 3 births in the first quarter of 2014. ✓