S32-test Time Series: Test Pack

EDEXCEL 1ST0 · Calculator allowed · about 15 minutes

Total Marks

Name: _______________________________ Date: ____ / ____ / ______

Answer ALL questions. Show all your working.

1 Statisticians use particular words to describe patterns in data recorded over time. For each statement, write down whether it is True or False.

(i) A time series is a set of data values recorded at successive points in time, usually at equal intervals such as every month or every quarter. **(1)**

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(ii) In a time series, the trend describes the short pattern that repeats within each year, while seasonal variation describes the long-term direction of the data. **(1)**

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(iii) A time series graph is drawn by plotting each value in time order along the horizontal axis and joining consecutive points with straight lines. **(1)**

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(Total for Question 1 is 3 marks)

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2 A different branch of the same company, Elm Grove Bike Hire, produces five successive 4-point moving averages, in order: 58, 61, 60, 64, 67.

(a) State whether the trend is increasing, decreasing, or roughly constant. **(1)**

(b) Give a reason for your answer, using values from the list. **(1)**

(c) A customer claims that, because the trend is increasing, Quarter 3 rentals must always be the highest quarter of the year at every branch. Is the customer correct? Write Yes or No, and give a brief reason. **(2)**

(Total for Question 2 is 4 marks)

3 Elmwood Community Library wants to investigate whether the number of books borrowed each quarter shows both a repeating seasonal pattern and a long-term trend, to help decide how many staff to schedule on the enquiries desk each quarter.

(a) Plan: state an appropriate time interval over which to collect loan data, and explain why at least two full years of data should be collected before drawing any conclusion about seasonality. **(2)**

(b) Collect: state one advantage of using the library's own computerised loan-return records (a secondary data source) rather than carrying out a new survey of members. **(1)**

(c) Process: the table shows quarterly book loans, in hundreds, for two years. **(3)**

Quarter	**Y1 Q1**	**Y1 Q2**	**Y1 Q3**	**Y1 Q4**	**Y2 Q1**	**Y2 Q2**
Books borrowed (hundreds)	42	30	26	50	46	34

Calculate the first two 4-point moving averages for this data.

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(d) Interpret: three further moving averages, continuing from part (c), are 39.5, 41 and 42.5. Using all five values, describe the trend, and suggest one staffing decision the library could make based on it, linking back to the original purpose of the investigation. **(3)**

(Total for Question 3 is 9 marks)

Mark scheme · S32-test Time Series: Test Pack

Question 1

- (i) **B1** True cao
- **(i) Answer: True**
- (ii) **B1** False cao
- **(ii) Answer: False**
- (iii) **B1** True cao
- **(iii) Answer: True**

Question 2

- (a) **B1** Increasing cao
- **(a) Answer: Increasing**
- (b) **B1** compares the first and last values (e.g. 67 is greater than 58), or notes the values generally rise overall, oe
- **(b) Answer: The final moving average (67) is higher than the first (58), and the values generally rise across the list.**
- (c) **B1** No
- (c) **B1** moving averages smooth out/remove the seasonal variation between quarters, so the trend on its own cannot show which individual quarter is highest within a year, oe
- **(c) Answer: No - the moving average removes the seasonal variation between quarters, so it cannot show which individual quarter has the highest raw rentals within a year.**

Question 3

- (a) **B1** states a suitable interval, e.g. quarterly (or monthly)
- (a) **B1** explains that at least two full cycles/years are needed to check that a pattern genuinely repeats, rather than being a one-off event in a single year, oe
- **(a) Answer: Record the number of books borrowed each quarter, for at least two full years, so any pattern can be checked for repeating rather than being a one-off.**
- (b) **B1** e.g. the data already exists / records every loan exactly / is quicker and cheaper than running a new survey, oe
- **(b) Answer: Loan-return records already exist and count every loan exactly, so they are quicker and cheaper to use than collecting new survey data.**
- (c) **M1** correct method shown, e.g. (42+30+26+50)/4
- (c) **A1** 37 cao
- (c) **A1** 38 cao
- **(c) Answer: 37, 38**
- (d) **B1** trend is increasing (book loans are rising from one year to the next), since 37, 38, 39.5, 41, 42.5 rises steadily
- (d) **B1** identifies from the raw data that Quarter 4 (and Quarter 1) tend to be busier within the year than Quarter 2 or Quarter 3 (e.g. Y1 Q4 = 50, Y1 Q1 = 42, compared with Q2 = 30 and Q3 = 26)
- (d) **B1** gives a sensible staffing recommendation linked to the purpose, e.g. schedule extra enquiries-desk staff every Quarter 4 and Quarter 1, and gradually increase baseline staffing over time as the underlying trend rises, oe
- **(d) Answer: The trend is increasing; Quarter 4 and Quarter 1 are the busier quarters each year, so the library should schedule extra enquiries-desk staff in those quarters and gradually increase overall staffing as the rising trend continues.**