**Topic: Time Series Skills and Applications**

Time: 45 mins Marks: /45 marks

**Calculator Assumed**



**Question One: [3, 2, 2, 2, 2, 2: 13 marks]**

Use the information in the partially completed table below to calculate the values of **A, B, C, D, E** and **F**.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Year/Quarter | Company Earnings ($ 000’s) | 4 Point Centred Moving Average | Average for the Year | Company Earnings as a percentage of Yearly average |
| 2012 – 1 | 38 |  | **B** |  |
| 2012 – 2 | 45 |  | **C** |
| 2012 – 3 | 20 | **A** |  |
| 2012 – 4 | 78 | 44.25 |  |
| 2013 – 1 |  | 43.75 | 43 | 80% |
| 2013 – 2 | 43 |  | 100% |
| 2013 – 3 | 18 |  | 41.86% |
| 2013 – 4 | **D** | 41.625 | 176.74% |
| 2014 – 1 | **E** |  | 40.25 |  |
| 2014 – 2 | 40 | 40.375 |  |
| 2014 – 3 |  | 40.125 |  |
| 2014 – 4 |  | 39.75 |  |
| 2015 – 1 | 30 | 39.625 | 38.5 |  |
| 2015 – 2 | 38 | 39.125 |  |
| 2015 – 3 | 16 |  |  |
| 2015 – 4 | **F** |  |  |

**Working space for question one.**

**Question Two: [2, 2, 3, 3, 4, 2, 3, 3: 22 marks]**

A street market has recently opened. It is open 3 days a week. Attendance is recorded and tracked for the first three weeks of the market opening.

|  |  |  |  |
| --- | --- | --- | --- |
| **Week/Day** | **Attendance (000’s)** | **Weekly Mean** | **Attendance Percentage of Mean** |
| **Week 1 / 1** | 12 |  | 144% |
| **Week 1 / 2** | 8 | 96% |
| **Week 1 / 3** | 5 | 60% |
| **Week 2 / 1** | 9 |  | 117.39% |
| **Week 2 / 2** | 8 | 104.35% |
| **Week 2 / 3** | 6 | 78.26% |
| **Week 3 / 1** | 9 |  | 108% |
| **Week 3 / 2** | 9 | 108% |
| **Week 3 / 3** | 7 | 84% |

The seasonal index for Day 2’s is 102.78%. The seasonal index for Day 3’s is 74.09%.

a) Explain what these figures mean.

b) Calculate the seasonal index for Day 1’s.

c) Complete the following table of the deseasonalised data for attendance at the street market.

|  |  |
| --- | --- |
| **Week/Day** | **Deasonalised Attendance (000’s)** |
| **1 /1** |  |
| **1 / 2** | 7.78 |
| **1 / 3** | 6.75 |
| **2 / 1** | 7.31 |
| **2 / 2** |  |
| **2/ 3** | 8.10 |
| **3 / 1** | 7.31 |
| **3 / 2** | 8.76 |
| **3 / 3** |  |

d) Complete the following graph for the deseasonalised data.

e) State the rule for the least squares regression line for the deseasonalised data and add this line to the scatterplot of the deseasonalised attendance.

f) Compare the scatterplot for the deseasonalised data to that of the actual data shown below and comment on the effect of deasonalising the data.



g) Calculate the deseasonalised attendance figure for each day in the fourth week.

f) Using deseasonalised attendance prediction, estimate the actual attendance for the fourth week.

**Question Three: [2, 2, 3: 7 marks]**

The following table shows the seasonal indices for the weekly sales figures for a particular company.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Day** | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday | Sunday |
| **Seasonal Index** | 98% | 80% | 79% |  | 102% | 141% | 70% |

a) Calculate the seasonal index for Thursday.

The actual sales figure for Friday is $25 300.

b) Calculate the deasonalised sale figure for Friday.

The least squares regression line for predicting the deseasonalised sale figure for this week of sales is given by , where day 1 is Monday, day 2 is Tuesday etc and sales are in thousands of dollars.

c) Calculate the actual sales figure for Sunday.

**Question Four [3 marks]**

The following table shows the seasonal indices for the weekday sales figures for a particular company.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Day** | Monday | Tuesday | Wednesday | Thursday | Friday |
| **Seasonal Index** | 70% |  | 48% |  | 110% |

Tuesday’s seasonal index figure is 0.7 of Thursday’s.

Calculate the seasonal index for Tuesday and Thursday.

**Topic: SOLUTIONS**

Time: 45 mins Marks: /45 marks

**Calculator Assumed**



**Question One: [3, 2, 2, 2, 2, 2: 13 marks]**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Year/Quarter | Company Earnings ($ 000’s) | 4 Point Centred Moving Average | Average for the Year | Company Earnings as a percentage of Yearly average |
| 2012 – 1 | 38 |  | **B 45.25** |  |
| 2012 – 2 | 45 |  | **C 99.45%** |
| 2012 – 3 | 20 | **A 44.8** |  |
| 2012 – 4 | 78 | 44.25 |  |
| 2013 – 1 | 34.4 | 43.75 | 43 | 80% |
| 2013 – 2 | 43 |  | 100% |
| 2013 – 3 | 18 |  | 41.86% |
| 2013 – 4 | **D** 76 | 41.625 | 176.74% |
| 2014 – 1 | 31 **E** |  | 40.25 |  |
| 2014 – 2 | 40 | 40.375 |  |
| 2014 – 3 |  | 40.125 |  |
| 2014 – 4 |  | 39.75 |  |
| 2015 – 1 | 30 | 39.625 | 38.5 |  |
| 2015 – 2 | 38 | 39.125 |  |
| 2015 – 3 | 16 |  |  |
| 2015 – 4 | 70 **F** |  |  |

**Question Two: [2, 2, 3, 3, 4, 2, 3, 3: 22 marks]**

A street market has recently opened. It is open 3 days a week. Attendance is recorded and tracked for the first three weeks of the market opening.

|  |  |  |  |
| --- | --- | --- | --- |
| **Week/Day** | **Attendance (000’s)** | **Weekly Mean** | **Attendance Percentage of Mean** |
| **Week 1 / 1** | 12 |  | 144% |
| **Week 1 / 2** | 8 | 96% |
| **Week 1 / 3** | 5 | 60% |
| **2 / 1** | 9 |  | 117.39% |
| **2 / 2** | 8 | 104.35% |
| **2 / 3** | 6 | 78.26% |
| **3 / 1** | 9 |  | 108% |
| **3 / 2** | 9 | 108% |
| **3 / 3** | 7 | 84% |

The seasonal index for Day 2’s is 102.78%. The seasonal index for Day 3’s is 74.09%.

a) Explain what these figures mean.

For this street market the attendance on day 2’s is 2.78% above the average and the day 3’s tend to see their attendance dropped by 25.91% of the average.

b) Calculate the seasonal index for Day 1’s.



c) Complete the following table of the deseasonalised data for attendance at the street market.

|  |  |
| --- | --- |
| **Week/Day** | **Deasonalised Attendance (000’s)** |
| **1 /1** | 9.75 |
| **1 / 2** | 7.78 |
| **1 / 3** | 6.75 |
| **2 / 1** | 7.31 |
| **2 / 2** | 7.78 |
| **2/ 3** | 8.10 |
| **3 / 1** | 7.31 |
| **3 / 2** | 8.76 |
| **3 / 3** | 9.45 |

d) Complete the following graph for the deseasonalised data.









e) State the rule for the least squares regression line for the deseasonalised data and add this line to the scatterplot of the deseasonalised attendance.





Line

f) Compare the scatterplot for the deseasonalised data to that of the actual data shown below and comment on the effect of deasonalising the data.

Deasonalising the data smooths out the peaks and bumps and allows us to see certain key features of this data such as the fact that day 1 week 1 appears to be high even once deasonalised. Perhaps this was because it was opening night of the street market and they had a special event for the opening.



g) Calculate the deseasonalised attendance figure for each day in the fourth week.

|  |  |
| --- | --- |
| **Week/Day** | **Deasonalised Attendance (000’s)** |
| 4/1 | 8.4138 |
| 4/2 | 8.4746 |
| 4/3 | 8.5354 |

f) Using deseasonalised attendance prediction, estimate the actual attendance for the fourth week.

**Question Three: [2, 2, 3: 7 marks]**

The following table shows the seasonal indices for the weekly sales figures for a particular company.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Day** | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday | Sunday |
| **Seasonal Index** | 98% | 80% | 79% |  | 102% | 141% | 70% |

a) Calculate the seasonal index for Thursday.



The actual sales figure for Friday is $25 300.

b) Calculate the deasonalised sale figure for Friday.



The least squares regression line for predicting the deseasonalised sale figure for this week of sales is given by, where day 1 is Monday, day 2 is Tuesday etc and sales are in thousands of dollars.

c) Calculate the actual sales figure for Sunday.



**Question Four [3 marks]**

The following table shows the seasonal indices for the weekday sales figures for a particular company.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Day** | Monday | Tuesday | Wednesday | Thursday | Friday |
| **Seasonal Index** | 70% |  | 48% |  | 110% |

Tuesday’s figure is 0.7 of Thursday’s.

Calculate the seasonal index for Tuesday and Thursday.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Day** | Monday | Tuesday | Wednesday | Thursday | Friday |
| **Seasonal Index** | 0.7 | 1.12 | 0.48 | 1.60 | 1.1 |