**Overview of Time Series Report Writing**

***Key components of the statistical enquiry cycle for investigating time series data:***

* using existing data sets
* selecting a variable to investigate
* selecting and using appropriate display(s)
* identifying features in the data and relating this to the context
* finding an appropriate model
* using the model to make a forecast
* communicating findings in a conclusion

***Aiming for Excellence***

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| **Achievement** | **Merit** | **Excellence** |
| http://www.pamhook.com/plug-ins/soloSymbolgen/soloImage.php?color=a90a34Investigate time series data involves showing evidence of using each component of the statistical enquiry cycle. | http://www.pamhook.com/plug-ins/soloSymbolgen/soloImage.php?color=a90a34Investigate time series data, *with justification* involves linking components of the statistical enquiry cycle to the context, and referring to evidence such as statistics, data values, trends, or features of visual displays in support of statements made.  | http://www.pamhook.com/plug-ins/soloSymbolgen/soloImage.php?color=a90a34Investigate time series data, *with statistical insight* involves integrating statistical and contextual knowledge throughout the statistical enquiry cycle, and may include reflecting about the process; considering other relevant variables; evaluating the adequacy of any models; or showing a deeper understanding of models.  |

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| **Time Series** | ☹ | 😐 | ☺ |
| * Time series is essentially an investigation into ‘what has already happened and what then is likely to happen’ with consideration of how valid it all is.
 |  |  |  |
| * In this assessment you will be given some raw data that you will be required to analyse by drawing graphs (using iNZight) and writing a report.
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| **Overview of Time Series Report (Use headings 1-7 to organise your report)** | ☹ | 😐 | ☺ |
| I notice / I wonder (**do not** include these notes in your final report) |  |  |  |
| 1. Introduction / Background |  |  |  |
| 2. Discussion of the Trend component |  |  |  |
| 3. Discussion of the Seasonal component |  |  |  |
| 4. Overview of model, variation and residuals |  |  |  |
| 5. Forecast  |  |  |  |
| 6. Further considerations |  |  |  |
| 7. Conclusion |  |  |  |

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| 1. **Writing Introductions for Time Series investigations**
 | ☹ | 😐 | ☺ |
| **Description and Investigative Question*** Description of topic (one sentence)
* Investigative Question
* Aim / Interest (Why worth investigating? Questions?)
 |  |  |  |
| **Data / Survey*** Source
* Definition and description of variables
* Important aspects of survey details / validity
 |  |  |  |
| **Research*** The most important factors that might affect xxx
* Research such as … suggests that xxx will be increasing / decreasing over time because…
 |  |  |  |

**Useful words:**

* XXX data is a useful measure of…
* In this report xxx is investigated and predicted for …
* An understanding of xxx over time might be useful in order to…
* This data was collected by… This might affect the findings of this study because…
* This survey data is likely to be valid for predicting xxx because…
* Factors that research suggests may influence xxx include…

**Writing Introduction: Self / Peer Review:**

|  |  |  |
| --- | --- | --- |
| **Description and Investigative Question*** Description of topic
* Investigative question
* Aim / Interest (Why worth investigating? Questions?)
 | **Data / Survey*** Source
* Definition and description of variables
* Important aspects of survey details / validity
 | **Research*** Most important factors that might affect xxx
* Research such as … suggests that xxx will be increasing / decreasing over time because…
 |
| I need to work on… |

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| --- | --- | --- | --- |
| 1. **Discussion of the trend component**
 | ☹ | 😐 | ☺ |
| *Inzight Graph: Time Series Plot* |  |  |  |
| One paragraph per section (increasing, stable, decreasing) |  |  |  |
| Describe trend from left to right |  |  |  |
| * **Statement** – identify

*>Can be done in same sentence(s)* |  |  |  |
| * **Numbers** – quantify
 |  |  |  |
| * **Context** – what does this mean? (rate of change)
 |  |  |  |
| * **Statistics** – what assumptions are we making? Why is this a ‘sensible’ trend?
 |  |  |  |
| * **Research** – why might we see this trend?
 |  |  |  |

* As seen in the graph
* According to the graph
* Rapid/steady/gradual/plateau/sudden/generally/ relatively
* Peak / dip / spike
* Increase/decrease/stable
* Fallen/risen
* Weekly/monthly/quarterly/annual
* This means xxx is increasing / decreasing xxx per xxx
* This trend assumes that …

**Discussion of the trend: Self / Peer Review:**

|  |  |  |  |
| --- | --- | --- | --- |
| **Statement and Numbers*** “Identify and Quantify
 | **Context*** What does this mean?
 | **Statistics*** What assumptions are we making?
 | **Research*** Why might we see this trend?
 |
| I need to work on… |

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| --- | --- | --- | --- |
| 1. **Discussion of the seasonal component**
 | ☹ | 😐 | ☺ |
| *Inzight Graph: Seasonal Effect* |  |  |  |
| There is clear / limited evidence / no evidence of seasonality in this series as seen in the following graphs. |  |  |  |
| * **Statement** – identify high and low seasons and any unusual seasons (outliers)
 |  |  |  |
| * **Numbers** – quantify amount above or below trend
 |  |  |  |
| * **Context** – what does this mean? Link back to investigative question.
 |  |  |  |
| * **Statistics** – what assumptions are we making?
 |  |  |  |
| * **Research** – why might we see this seasonal pattern?
 |  |  |  |

* As seen in the estimated seasonal effects plot…
* This means that…
* Seasonality / seasonal effect
* The estimated seasonal effect shows that
* Considerably, significantly, slightly, normally
* Higher / Lower / Peak / Low / Trough / Outlier
* Above / below the trend
* This is possibly due to… This may be because… This may be caused by…
* This supports… This is justified by…
* One would expect this because…
* This explanation is supported by …

**Discussion of the Seasonal Effect: Self / Peer Review:**

|  |  |  |  |
| --- | --- | --- | --- |
| **Statement and Numbers*** “Identify and Quantify”
 | **Context*** What does this mean?
 | **Statistics*** What assumptions are we making?
 | **Research*** Why might we see this seasonal pattern?
 |
| I need to work on… |

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| 1. **Overview of model, variation and residuals**
 | ☹ | 😐 | ☺ |
| *Inzight Graph: Decompose* |  |  |  |
| * Residuals - Size, Pattern, Any unusual residuals with possible cause.
 |  |  |  |
| **Discuss Variation*** + Summary Of Variation Table
	+ Trend – what % of the variation in the data is from the trend?
	+ Seasonal – what % of the variation in the data is from the trend?
	+ Residual– what % of the variation in the data is from the trend?
 |  |  |  |
| **Discuss usefulness of model*** + Discussion of main source of variation in the model and link to its usefulness for predictions / forecasting / extrapolating beyond the data.
 |  |  |  |

**Summary of Variation Table**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Min (000)** | **Max (000)** | **Range (000)** | **Approx. % of Contribution** |
| **Raw Data** | From raw data plot | From raw data plot | Max - Min |  |
| **Trend** | From trend line | From trend line | Max - Min | $$=\frac{trend range}{raw data range}×100$$ |
| **Seasonal** | From Seasonal effect plot | From Seasonal effect plot | Max - Min | $$=\frac{seasonal range}{raw data range}×100$$ |
| **Residual** | From residual plot | From residual plot | Max - Min | $$=\frac{residual range}{raw data range}×100$$ |

* The residual is relatively small (percentage)
* There is an unusual residual …
* This may have been caused by…
* Xx% of the variation in the data is the trend
* Xx% of the variation in the data is seasonal
* Xx% of the variation in the data is residual
* This model is likely to be useful for forecasting because…
* The large proportion of variation in the residuals means this is not a particularly useful model for…

**Discussion of the Model, Variation and Residuals: Self / Peer Review:**

|  |  |  |
| --- | --- | --- |
| **Residuals*** Relative size
* Pattern
* Any unusual
 | **Variation*** Summary of Variation chart
* Percentage of variation from trend, from seasonal effect and from residuals
 | **Usefulness of model*** Link to amount of variation from residuals
* Link to ability to forecast beyond the end of the data
 |
| I need to work on… |

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| 1. **Forecast**
 | ☹ | 😐 | ☺ |
| *Inzight Graph: Predict* |  |  |  |
| A visual inspection of the plot shows that the model provides a good fit of the data as the fitted line and raw data are very similar. |  |  |  |
| *Inzight: Rounded Data* |  |  |  |
| **Make a prediction*** From this model xxx is predicted to be between xxx and xxx in (time).
 |  |  |  |
| **Check robustness of prediction*** Take out last 3 data points, re-analyse and check against predictions.
 |  |  |  |

**Robustness of Prediction Table**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Date** | **Actual** | **Prediction** | **Lower Limit** | **Upper Limit** |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

* This model predicts xxx to be xxx in xxx
* In the near future it is predicted that xxx
* Prediction Interval (95% Confidence Interval)
* The actual values are close to those predicted which suggests…
* Actual value / Predicted Value / Interpolate / Extrapolate
* Factors that might affect the accuracy of this prediction include…

**Make a forecast: Self / Peer Review:**

|  |  |  |
| --- | --- | --- |
| **Predicted model*** Match fitted line with raw data
* Not too many gaps / significant gaps
 | **Make a prediction*** From this model xxx is predicted to be between xxx and xxx in (time).
 | **Check robustness of prediction*** Compare actual and predicted for last three points
 |
| I need to work on… |

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| --- | --- | --- | --- |
| 1. **Further Considerations**
 | ☹ | 😐 | ☺ |
| **Evaluate the adequacy of the model**Limitations of forecasting* What might change in the future that would make your forecast invalid?

Limitations of data to answer investigative question* What does the data not tell you in relation to the investigative question?
 |  |  |  |
| **Consider other relevant variables*** Repeat investigation for a related variable
* Compare and contrast different components
 |  |  |  |

* This forecast is dependent on…
* If xxx changed then…
* The data covers…
* One variable that is likely to be related to xxx is xxx
* It is likely that as xxx increases xxx increases / decreases

**Further Considerations: Self / Peer Review:**

|  |  |
| --- | --- |
| **Evaluate the adequacy of the model*** How useful is your forecast?
* How valid is the model?
* What circumstances might affect your forecast (research)
 | **Consider other relevant variables*** Linking paragraph about why second variable is relevant
* Trend / Seasonal Effect / Forecast
* What this model means relative to your investigation
 |
| I need to work on… |

|  |  |  |  |
| --- | --- | --- | --- |
| 1. **Conclusion**
 | ☹ | 😐 | ☺ |
| **Concise summary linked to original purpose of the investigation*** Purpose of report
* Brief description of model
 |  |  |  |
| * What the model predicted
* Summary of usefulness or limitations of model / how the model might be improved
 |  |  |  |
| * Summary of investigation into other relevant variable
* Summary of what this means in context / research / future investigations
 |  |  |  |

* This report investigated… and used this analysis to predict…
* Analysis of the data showed a trend of … and seasonal effect…
* This model was used to forecast…
* These forecasts are likely to be robust because…
* Possible uses of this data are…
* A further variable that was considered was…
* Possible limitations of this model include…
* These findings are useful because…

**Conclusion: Self / Peer Review:**

|  |  |  |
| --- | --- | --- |
| **Purpose and model*** Purpose of this investigation
* Description of model: Trend, Seasonal Effect
 | **What model predicted*** Forecast
* Usefulness / Limitations / Improvements
 | **Summary*** Of relevant variable – why investigated and key findings
* Links to context, research, future investigation.
 |
| I need to work on… |