Faculty of Business and Law

Assignment Brief Mode E and R Regulations

Module Title:	Operations Analytics
Module Code:	7036SSL
Module Leader:	

Assignment Number	**Coursework 2**
Assignment Title	Forecasting and Capacity Planning
Assignment Credits	**10 Credits**

Release Date:	**27/01/2022**
Submission Date/Time:	**08/04/2022 18:00:00**
Submission Time and Place:	**Submission through Turnitin ONLY**

Assessment Information

This assignment is designed to assess the following learning outcomes:

LO1: Demonstrate a critical understanding of the use of analytical methodologies in Operations Management and Logistics, with a particular emphasis on the Forecasting function.

LO2: Demonstrate a comprehensive understanding and application of the methods, tools and techniques of analytics modeling and simulation used to solve real business problems.

LO3: Critically apply various analytics methodologies and techniques to solve operational problems.

LO4: Using available data and a critical understanding of available analytic techniques and tools, make decisions on the suitability of a variety of analytics models in responding to specific Operations Management and Forecasting problems.

This assignment is an **individual** assignment.

This assignment requires you to:

You will be given one real (empirical) stationary time series representing demand or production for a real product or set of products, of varying frequency e.g. daily, monthly or quarterly. Using this time series data carry out the following exercises.

Important: All solutions should be submitted in a single Excel file. All solutions should make use of Excel formulae, so that all calculations can be verified and marked. Do not simply include solutions values.

PART A: FORECASTING

A.1 – Time Series Exploration

For **the selected** time series:

a) Create a time series plot.
b) Calculate measures of location, mean and median.
c) Calculate measures of variation, range, standard deviation and coefficient of variation.
d) Using the classical decomposition method as discussed in class, decompose the time series into its main components (trend, seasonality and/or noise) using additive decomposition.

A.2 – Time Series Model Building

a) Divide the series into test set (the last 7 observations of the time series) and training set (the remaining observations of the time series).
b) Using the training set, build exactly three contender forecasting models of sensible relevance for time series. For example, if the time series does not contain a seasonal component, then it makes no sense considering a seasonal model.

A.3 – Time Series Forecasting

a) For each of the candidate models estimated, produce a forecast equal to the length of the test set, that is, for h=7 steps ahead. You should have three forecasts in total.
b) Calculate the in-sample and out-of-sample forecasting performance using the following metrics:
    a. Mean error (ME)
    b. Mean absolute error (MAE)
    c. Mean squared error (MSE)

A.4 – Safety Stock

Using the final "best" forecast:

a) Calculate the expected value of lead-time demand based on lead-time of seven also equal to the forecast horizon, h=7.
b) Calculate the standard deviation of lead-time demand based on lead-time of seven also equal to the forecast horizon, h=7.
c) Calculate the reorder point based on the assumption of a normal distribution of forecast errors, and a stock-out risk of 5%.

PART B – SIMULATION

B.1 – Expected Lead Time Demand for a company

Assume that a share of the expected lead-time demand or production belongs to the company. However, there is some uncertainty associated with this share. This can be summarized using the following table:

Share	0.5	0.6	0.7	0.8	0.9	1.0
Probability	0.05	0.10	0.25	0.25	0.20	0.15

Using simulation and a total of 120 trials, calculate the expected lead-time demand or production achieved by the company.

B.2 – Expected Profit for the company

The forecasted units are assumed to have a selling price of £5.00 and a variable cost of production per unit £2.50. Estimate the expected profit obtained by the company.

PART C – THE REPORT

You are required to write a report outlining your forecasting approach and simulation model, and presenting your results. Your report should contain the following, compulsory sections:

C.1 Introduction

State briefly what is contained in the report, that is, the work you have done, and your most important findings.

C.2 Forecasting Approach and Findings

In this section, you will document the work done in each of the subsections below as per the detailed instructions in Part A, and discuss your findings.

Time series exploration: Include your time series plot and briefly discuss the features of the time series. Briefly comment on each of the measures of location, and each of the measure of variation. Describe the process of classical decomposition applied, and briefly comment on each of the main components (trend, seasonality and/or noise) using additive decomposition.

Time series model building: Describe the process of splitting the time series into training and test sets, explaining the reasons why. Discuss the three models built, justifying your choice. Briefly discuss the specification of each model. For example, if exponential smoothing is used, then briefly comment on the various parameters. If a moving average is used, then briefly comment on the chosen length of the moving average. Remember to also discuss the pros and cons of each method.

Time series forecasting: For each contender model, briefly discuss and interpret the findings of each of the error metrics obtained in Part A.3 based on in-sample performance. With appropriate reference to forecasting performance, discuss which method, out of the three contenders, you think is "best" and why.

Safety stock:

Describe your approach to the safety stock calculations and discuss the results obtained in Part A.4.

PART C.3 Simulation Approach and Findings

In this section, you will document the work done in each of the subsections below as per the detailed instructions in Part B, and discuss your findings.

Expected Lead Time Demand for the company:

Describe your approach to simulating and calculating the expected lead time demand for the company, and discuss the results obtained in Part B.1.

Expected Profit for the company:
Describe your approach to simulating and calculating the expected profit for the company, and discuss the results obtained in Part B.2.

PART C.4 Conclusion and recommendation
Summarize here the work done and comment on your main findings.

Criteria for Assessment

The assessment will be marked out of a total of 100 marks.

- **50 marks** for the Excel Spreadsheet Models and Calculations as required in Part A and B, and as detailed in each Part A and B question.

Assignment Part	**Mark**
A.1 – Time Series Exploration	15
A.2 – Time Series Model Building	10
A.3 – Time Series Forecasting	10
A.4 – Safety Stock	5
B.1 – Expected Lead Time Demand for a company	5
B.2 – Expected Profit for the company	5
Total	**50**

- **50 marks** for the word report as detailed below:

Assignment Part	**Mark**
Introduction	5
Forecasting Approach and Findings	30
Simulation Approach and Findings	10
Conclusion and recommendations	5
Total	**50**

Total Marks (100) = Forecasting and Simulation (50) + Report (50)
You must submit your Excel spreadsheet showing your calculations as well as your report.

Word Count
The word count is 2500 words

There will be a penalty of a deduction of 10% of the mark (after internal moderation) for work exceeding the word limit by 10% or more. The word limit includes quotations and citations, but excludes the references list.

How to submit your assessment

The assessment must be submitted by **18:00:00 on 08.04.2022**. No paper copies are required. You can access the submission link through the module web.

- Your coursework will be given a zero mark if you do not submit a copy through Turnitin. Please take care to ensure that you have fully submitted your work.
- Please ensure that you have submitted your work using the correct file format, unreadable files will receive a mark of zero. The Faculty accepts Microsoft Office and PDF documents, unless otherwise advised by the module leader.
- All work submitted after the submission deadline without a valid and approved reason (see below) will be given a mark of zero.
- The University wants you to do your best. However we know that sometimes events happen which mean that you can't submit your coursework by the deadline – these events should be beyond your control and not easy to predict. If this happens, you can apply for an extension to your deadline for up to two weeks, or if you need longer, you can apply for a deferral, which takes you to the next assessment period (for example, to the resit period following the main Assessment Boards). You must apply before the deadline. You will find information about the process and what is or is not considered to be an event beyond your control at https://share.coventry.ac.uk/students/Registry/Pages/Deferrals-and-Extension.aspx
- Students MUST keep a copy and/or an electronic file of their assignment.
- Checks will be made on your work using anti-plagiarism software and approved plagiarism checking websites.

GUIDELINES AND BACKGROUND TO THIS ASSIGNMENT

Plagiarism
As part of your study you will be involved in carrying out research and using this when writing up your coursework. It is important that you correctly acknowledge someone else's writing, thoughts or ideas and that you do not attempt to pass this off as your own work. Doing so is known as plagiarism. It is not acceptable to copy from another source without acknowledging that it is someone else's writing or thinking. This includes using paraphrasing as well as direct quotations. You are expected to correctly cite and reference the works of others. The Centre for Academic Writing provides documents to help you get this right. If you are unsure, please visit www.coventry.ac.uk/caw. You can also check your understanding of academic conduct by completing the Good Academic Practice quiz.

Self-plagiarism or reuse of work previously submitted
You must not submit work for assessment that you have already submitted (partially or in full), either for your current course or for another qualification of this and any other university, unless this is specifically provided for in your assignment brief or specific course or module information. Where earlier work by you is citable, ie. it has already been published/submitted, you must reference it clearly. Identical pieces of work submitted concurrently will also be considered to be self-plagiarism**.** Self-plagiarism is unacceptable because you cannot gain credit for the same work twice.

The University VLE includes a plagiarism detection system and assessors are experienced enough to recognise plagiarism when it occurs. Copying another student's work, using previous work of your own or copying large sections from a book or the internet are examples of plagiarism and carry serious consequences. If you are a business student and joined Coventry University in September 2020 or later please use APA 7th edition referencing, if you joined prior to this date you may use APA or the existing Harvard Reference Style (Coventry version) that you are familiar with. Law students should use OSCOLA. Please be consistent in the referencing style that you use and use it correctly to avoid a case of plagiarism or cheating being brought. If you are unsure, please contact the Centre for Academic Writing, your Progress Coach or a member of the course team.

Return of Marked Work
You can expect to have marked work returned to you 10 working days after the submission date. If for any reason there is a delay you will be kept informed. Marks and feedback will be provided online. As always,

marks will have been internally moderated only, and will therefore be provisional; your mark will be formally agreed later in the year once the external examiner has completed their review.