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Faculty of Engineering, Environment and Computing 7099MAA Module Title Optimisation and Simulation



Assignment Brief 2020/21

Module Title Optimisation and Simulation	Ind	Cohort (Sept/Jan/May)	Module Code 7099MAA
Coursework Title: Manufacturing Problem			Hand out date: 19-05-21
Lecturer Ammar Al Al-Bazi			Due date: 05-07-21
Estimated Time (hrs): 50	Coursework type: Report		Credit 5
Word Limit*: 1500 words			
Submission arrangement online via CU Moodle: File types and method of recording: MS Word or Pdf + 1 Output Excel File Mark and Feedback date: TBC Mark and Feedback method: Online			

Module Learning Outcomes Assessed:

1. Appraise the principles and techniques associated with operations management and other related production engineering modelling techniques.
2. Understand and analyse logic/ flow of production operations and be able to identify deficiencies/ bottlenecks in any engineering production facility.
3. Utilise both mathematical and simulation problem-solving techniques and methodologies to understand, solve then optimise problems in the area of production engineering and operations management.
4. Predict and proactively resolve any operational engineering disruptions using mathematical and simulation tools to support the decision-making process for a future state design.

Task and Mark distribution:

Please see Page 3 and onwards

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Notes:

1. You are expected to use the [CUHarvard](#) referencing format. For support and advice on how these students can contact [Centre for Academic Writing \(CAW\)](#).
2. Please notify your registry course support team and module leader for disability support.
3. Any student requiring an extension or deferral should follow the university process as outlined [here](#).
4. The University cannot take responsibility for any coursework lost or corrupted on disks, laptops or personal computer. Students should therefore regularly back-up any work and are advised to save it on the University system.
5. If there are technical or performance issues that prevent students from submitting coursework through the online coursework submission system on the day of a coursework deadline, an appropriate extension to the coursework submission deadline will be agreed. This extension will normally be 24 hours or the next working day if the deadline falls on a Friday or over the weekend. This will be communicated via email and as a CUMoodle announcement.
- 6.

Mark allocation guidelines to students (to be edited by staff per assessment)

0-39	40-49	50-59	60-69	70+	80+
Work mainly incomplete and /or weaknesses in most areas	Most elements completed; weaknesses outweigh strengths	Most elements are strong, minor weaknesses	Strengths in all elements	Most work exceeds the standard expected	All work substantially exceeds the standard expected

Coursework Title: Manufacturing Problem

Module Code: 7099MAA

Coursework Type: Assignment

Proportion of Module Credit: 5 credits out of 15 credits

Module Title: Optimisation and Simulation

Module Leader: Ivan Arokiam, Co-Lecturer: Ammar Al-Bazi

Submission Date: By 05th July 21 6 pm

Feedback and Support Method: Individual written feedback to be provided on Moodle:

A slot of time will be allocated to provide students with a brief on all the assignment elements. Students are welcome to contact the lecturer during his contact hours/ THETA hours for any further assistance. However, there is a clear marking scheme/ directions on the bottom of this coursework directing students on how to prepare and manage their outputs for best achievement.

FeedForward Method: Classroom discussion:

Upon marks have been released a FeedForward discussion session will be allocated to provide ideas/ directions on how the conducted work could be developed further/ taken forward in the future.

The Scenario Description

ABC Manufacturer located in West Midlands seeks to maximise its production profits. This manufacturer produces two types of goods, X and Y. Goods X and Y are manufactured by a 2-stages process. All initial operations are performed by machine centre I. All final operations may be performed by either machine centre A or machine centre B. Machine centres A and B are different from each other because, in general, they yield different unit rates and different unit profits for any given good.

Assume that a certain amount of overtime has been made available in machine centre A for the manufacture of goods X and Y. Since the use of overtime results in changes (decreases) in unit profits denote separately, by machine centre AA, any overtime use of machine centre A. The unit times required to manufacturing goods X and Y are given in Table 1

Table 1: information of producing goods X and Y

Operation	Machine Centre	Good X			Good Y		
		X1	X2	X3	Y1	Y2	Y3
1	I	0.01	0.01	0.01	0.03	0.03	0.03
2	A	0.02		0.01	0.05		
	AA		0.02			0.05	
	B			0.03	0.64		0.08

In this table, X1, X2, and X3 are introduced to denote the three possible combinations for producing goods X, and similarly, Y1, Y2 and Y3 are defined for good Y. The available hours in each machine centre are given in Table 2.

Table 2: Hours availability at each machine centre for each operation

Operation	Machine Centre	Hours Available
1	I	850
2	A	700
	AA	100
	B	900

Table 2 defines the maximum number of hours spent by each operation at each machine centre. Such definition introduces the hours' availability constraint. The unit profit achieved per X1, X2, and X3 as referred to the three possible combinations for producing X and Y1, Y2 and Y3 as similarly defined for good Y. See Table 3 for the profit profile.

Table 3: Profit per part (in pounds)

Good X			Good Y		
X1	X2	X3	Y1	Y2	Y3
0.40	0.28	0.32	0.72	0.64	0.60

The problem is to determine how much of each good should be made through the use of possible combinations of machine centres to maximise the total profits, considering the prescribed limitations on the capacities of the machine centres.

The Coursework Tasks

For this piece of individual coursework, you are required to apply optimisation modelling to deliver the tasks below:

Task 1- Analyse the problem stating its elements, including decision variables, constraint types and definitions, objective function and how it has been formulated, and other related coefficients. *Do not include any numerical values in your analysis.*

Task 2- Develop a linear programming model (after combining elements defined in Task 1). This encapsulates all related variables, constraints, coefficients and objective function. *Do include here numerical values.*

Task 3- Develop a spreadsheet model to solve the developed linear programming model in Task 2 using Solver.

Task 4- Analyse and discuss the results/ outputs by making relevant comparisons via Excel diagrams. A sensitivity analysis should be conducted to show how available resources could be exhausted.

Notes:

- This assignment has to be completed as an individual project.
- You will need to adopt the report structure provided below, use examples and cases from textbooks, journals, papers and reports to support your arguments and reference properly, using CU Harvard Reference Style (www.coventry.ac.uk/caw CU Harvard Reference Style)
- The structure of the report (the outlines below have to be linked with the coursework tasks above):
 - Title page (To include report title)
 - Table of contents
 - Introduction
 - The main body of the Report including
 - Problem Definition
 - Problem Analysis
 - Mathematical Modelling
 - The LP standard form
 - The spreadsheet models
 - Analysis and discussion
 - Bibliography/References
 - Appendices (if found)

Online Submission Requirements

- ✓ The Handout Date: Wednesday **19th May 2021**
- ✓ Online Submission – By 6 pm, Monday **05^h July 2021** **online submission on Resit AULA 7099MAA module web.** The mandatory submission components are:

- A detailed report including all the required tasks 1-4,
 - A copy of the developed spreadsheet model (.xlsx extension)
 - A copy of Excel file including all outputs, diagrams plus overall comparison diagrams if found.
- ✓ Report Word limitation: 1500 words as an individual report (for the body of the report, excluding Bibliography, References, and Appendices)

Report Structure (including learning outcomes, marking scheme and criteria):

The report must cover the learning outcomes (LO1-LO4):

- LO1: Appraise the principles and techniques associated with operations management and other related production engineering modelling techniques. [SM1], [E3LS2], [EP2]
- LO2: Understand and analyse logic/ flow of production operations and be able to identify deficiencies/ bottlenecks in any engineering production facility. [SM1], [SM2]
- LO3: Utilise both mathematical and simulation problem-solving techniques and methodologies to understand, solve then optimise problems in the area of production engineering and operations management. [SM2], [EA1], [EA3], [E3LS3]
- LO4: Predict and proactively resolve any operational engineering disruptions using mathematical and simulation tools to support the decision-making process for a future state design. [EA3], [SM3], [E3LS3], [E3LS4], [EP3], [AGS1]

Assessment Criteria

The following criteria will be interpreted appropriately according to the nature of the assessment and the general framework set by the module aim and learning outcomes.

For a Bare Pass Mark (40%)

- Work lacks any academic merit as adjudged by the foregoing.

For an Excellent Mark (>69%)

- Show a thorough understanding of the purpose of the activity.
- Display knowledge of all the relevant principles, theories, and practices and an ability to apply them effectively.
- Provide evidence of extensive reading beyond that listed, including academic journals.
- Demonstrate an ability to select critical points, evaluate them and communicate the conclusions effectively.
- Develop and run models that reflect as realistically and sensibly as possible given situations.

- Develop and run LP models that are based on sensible and useful options that go beyond given situations.
- Provide analysis, discussion, and comment critically on the results produced by models.
- Provide solutions to business problems that are creative and practicable.
- Provide sound, supported, discussions of further research that may be needed.

Re-assessment

This assignment represents 50% of the Module Assessment.

Contact information:

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