ASSESSMENT DETAILS
SIT718 Real World Analytics

Assessment Task 4: Problem solving task 3

This document supplies detailed information on an assessment task for this unit.

Key information

- Due: 12th February 2019 11.30pm AEST
- Weighting: 25%
- Reference style: Harvard

Learning Outcomes

This assessment assesses the following Unit Learning Outcomes (ULO) and related Graduate Learning Outcomes (GLO):

Unit Learning Outcome (ULO)	Graduate Learning Outcome (GLO)
ULO3 – assessed through student ability to apply game theory, and linear programming skills and models, to make optimal decisions. **ULO4** - assessed through student ability to develop software codes to solve computational problems for real world analytics.	**GLO1 -** Discipline knowledge and capabilities **GLO4 –** Critical thinking **GLO5 –** Problem solving

Purpose

Assignment 3 assesses your abilities to build linear programming models and solving them. You will demonstrate your skills in using linear programming to model real life case studies. You will consider cases with two variables and solve them using the graphical method. For problems with more than two variables, you will solve the linear programming models that you built using linear programming solvers in appropriate software, such as R. You will consider game theory – two players zero sum game – to build appropriate models that describe different game scenarios. You will demonstrate your knowledge in investigating the existence of equilibrium (stable solution). You will use mixed models to find appropriate solutions and solve the models you constructed with appropriate software such as R.

Instructions

The work is individual. Solutions and answers to the assignment must be explained carefully in a concise manner and presented carefully. Use of books, articles and/or online resources on share price related to SIT718 Real World Analytics is allowed. Students are expected to refer to the suitable literature where appropriate.

The assessment consists of **THREE question sets**. Students must attempt all tasks and provide an individual written report in appropriate word processor.

The detailed problem description and data set will be released to students on Wednesday 9th January 2019.

Submission details

Provide your solutions, including graphs and tables (if appropriate) in one pdf file. Label the file with *yourname.pdf*, where `*youname*' is replaced with your name - you can use your surname or first name - just to help me distinguish them!)

Your final submission should consist of:

1. A pdf fille (created in any word processor), containing the solutions of the questions, labelled with your name;

2. two codes combined in one with your R file, labelled with *yourname.R*, with lp models for questions 2 and 3. You can also copy and paste the R codes in your solution document (pdf file).

Assignment (a report in pdf format, software code and/or data) must be submitted via the assignment dropbox in the unit site (accessed in DeakinSync)

No e-mail or hardcopy submissions are accepted.

Extension requests

Requests for extensions should be made to Unit/Campus Chairs well in advance of the assessment due date. If you wish to seek an extension for an assignment, you will need to apply by email directly to **Prof. Maia Angelova** (maia.a@deakin.edu.au), as soon as you become aware that you will have difficulty in meeting the scheduled deadline, but at least 3 days before the due date. When you make your request, you must include appropriate documentation (medical certificate, death notice) and a copy of your draft assignment.

Conditions under which an extension will normally be approved include:

Medical To cover medical conditions of a serious nature, e.g. hospitalisation, serious injury or chronic illness. Note: Temporary minor ailments such as headaches, colds and minor gastric upsets are not serious medical conditions and are unlikely to be accepted. However, serious cases of these may be considered.

Compassionate e.g. death of close family member, significant family and relationship problems.

Hardship/Trauma e.g. sudden loss or gain of employment, severe disruption to domestic arrangements, victim of crime. Note: Misreading the timetable, exam anxiety or returning home will not be accepted as grounds for consideration.

Special consideration

You may be eligible for special consideration if circumstances beyond your control prevent you from undertaking or completing an assessment task at the scheduled time.
See the following link for advice on the application process:
http://www.deakin.edu.au/students/studying/assessment-and-results/special-consideration

Assessment feedback

Students will receive written feedback and model solutions to aid reflection and analysis of problem strategies and solutions for consideration in the upcoming problem-solving task.

Referencing

You must correctly use the Harvard method in this assessment. See the Deakin referencing guide.

Academic integrity, plagiarism and collusion

Plagiarism and collusion constitute extremely serious breaches of academic integrity. They are forms of cheating, and severe penalties are associated with them, including cancellation of marks for a specific assignment, for a specific unit or even exclusion from the course. If you are ever in doubt about how to properly use and cite a source of information refer to the referencing site above.

Plagiarism occurs when a student passes off as the student's own work, or copies without acknowledgement as to its authorship, the work of any other person or resubmits their own work from a previous assessment task.

Collusion occurs when a student obtains the agreement of another person for a fraudulent purpose, with the intent of obtaining an advantage in submitting an assignment or other work.

Work submitted may be reproduced and/or communicated by the university for the purpose of assuring academic integrity of submissions: https://www.deakin.edu.au/students/study-support/referencing/academic-integrity

1. A factory produces dresses and coats for a chain of departmental stores in Victoria. The stores will accept all the production supplied by the factory. The production process includes Cutting, Sewing and Packaging, in this order. You can assume that each worker participates in one operation only (Cutting, Sewing, or Packaging). The factory employs 25 workers in the cutting department, 52 workers in the sewing department and 14 work-ers in the packaging department. The factory works 8 hours a day (these are productive hours). There is a daily demand for at least 120 dresses, and no specific demand for the coats. The table below gives the time requirements (in minutes) and profit per unit for the two garments to be produced.

	minutes per unit			
	Cutting	Sewing	Packaging	Unit profit ($)
Dresses	25	25	15	8
Coats	12	55	15	15

a) Explain why a linear programming model would be suitable for this case study.
[5 marks]

b) Formulate a Linear Programming model to help the management of the factory determine the optimal daily production schedule, that is, find the number of dresses and coats to be produced that would maximize the profit.
[10 marks]

c) Use the graphical method to find the optimum solution. Show the feasible region and the optimal solution on the graph. Annotate your graph. What is the optimum profit?
[10 marks]

Note: you can use graphical solvers available online but make sure that your graph is clear, all variables involved are clearly represented and annotated, and each line is clearly marked and related to the corresponding equation.

d) Find a range for the profit ($) of a dress that can be changed without affecting the optimum solution obtained above.
[10 marks]

2. A food producer makes three types of cereals A, B, and C from a mix of several ingredients Oates, Raisins, Apricots and Hazelnuts. The cereals are produced in 2kg boxes. The following table provides details of the sales price per box of cereals and the production cost per ton (1000 kg) of cereals respectively.

	Sales price per box	Production cost per ton
Cereal A	$2.60	$4.20
Cereal B	$2.30	$2.60
Cereal C	$3.20	$3.00

The following table provides the purchase price per ton of ingredients and the maximum availability of the ingredients in tons respectively.

Ingredients	Purchase price per ton	Maximum availability in tons
Oates	$100	10
Raisins	$90	5
Apricots	$110	2
Hazelnuts	$200	2

The minimum daily demand (in boxes) for each cereal and the proportion of the Oates, Raisins, Apricots and Hazelnuts in each cereal is detailed in the following table.

		proportion of			
	Minimum demand (boxes)	Oates	Raisins	Apricots	Hazelnuts
Cereal A	1000	0.80	0.10	0.05	0.05
Cereal B	800	0.60	0.25	0.05	0.10
Cereal C	750	0.45	0.15	0.10	0.30

a) Choose appropriate decision variables. Formulate a linear programming (LP) mod-el to determine the optimal production mix of cereals that maximises the profit, while satisfying the constraints. Then compute the associated amounts of ingredients for each cereal.

[15 Marks]

b) Find the optimal solution using R/R studio.

[15 Marks]

3. John and Alice are playing a game by putting chips in two piles (each player has two piles P1 and P2), respectively. Alice has 4 chips and John has 5 chips. Each player place his/her chips in his/her two piles, then compare the number of chips in his/her two piles with that of the other player's two piles. Note that once a chip is placed in one pile it cannot be moved to another pile. There are four comparisons including John's P1 vs Alice's P1, John's P1 vs Alice's P2, John's P2 vs Alice's P1, and John's P2 vs Alice's P2. For each comparison, the player with more chips in the pile will score 1 point (the opponent will loose 1 point). If the number of chips are the same in the two piles, then nobody will score any points from this comparison. The final score of the game is the sum score over the four comparisons. For example, if Alice puts 4 and 0 chips in her P1 and P2, John puts 1 and 4 chips in his P1 and P2, respectively. Then Alice will get 1 (4 vs 1) + 0 (4 vs 4) - 1 (0 vs 1) - 1 (0 vs 4) = -1 as her final score, and John will get his final score of 1.

   (a) Give reasons why/how this game can be described as two-players-zero-sum game. [5 Marks]

   (b) Formulate the payoff matrix for the game. [8 Marks]

   (c) Explain what is a saddle point. Verify: does the game have a saddle point? [5 Marks]

   (d) Construct a linear programming model for this game; [6 Marks]

   (e) Produce an appropriate code to solve the linear programming model in part (c). [6 Marks]

   (f) Solve the game for Alice using the linear programming model you constructed in part (c). Interpret your solution. [5 Marks]

[Hint: To record the number of chips in each pile for each player you may use the notation (i, j), where i is the number of chips in P1 and j is the number of chips in P2, for example (2,1) means two chips in P1 and one chip in P2.]