

Module Code:	MA4001NP
Module Title:	Logic and Problem Solving
Module Leader:	Mr. Prabin Banstola (Informatics College Pokhara)

Coursework Type:	Group
Coursework Weight:	This coursework accounts for 50% of the overall module grades.
Submission Date:	Thursday, 16 May 2024, before 01:00 PM
Coursework given out:	Week 25
Submission Instructions:	<p>Submit the following to the Informatics College Pokhara MST platform before the due date (before 1PM on the due date):</p> <ul style="list-style-type: none"> • A single report (document) in .pdf format in the MST portal by the group leader only (single file is to be submitted for the entire group).
Warning:	<p>London Metropolitan University and Informatics College Pokhara takes plagiarism very seriously. Offenders will be dealt with sternly.</p>

Plagiarism:

You are reminded that there exist regulations concerning plagiarism. Extracts from these regulations are printed overleaf. Please sign below to say that you have read and understand these extracts:

Extracts from University Regulations on Cheating, Plagiarism and Collusion

Section 2.3: *"The following broad types of offence can be identified and are provided as indicative examples ...*

- (i) *Cheating: including taking unauthorised material into an examination; consulting unauthorised material outside the examination hall during the examination; obtaining an unseen examination paper in advance of the examination; copying from another examinee; using an unauthorised calculator during the examination or storing unauthorised material in the memory of a programmable calculator which is taken into the examination; copying coursework.*
- (ii) *Falsifying data in experimental results.*
- (iii) *Personation, where a substitute takes an examination or test on behalf of the candidate. Both candidate and substitute may be guilty of an offence under these Regulations.*
- (iv) *Bribery or attempted bribery of a person thought to have some influence on the candidate's assessment.*
- (v) *Collusion to present joint work as the work solely of one individual.*
- (vi) *Plagiarism, where the work or ideas of another are presented as the candidate's own.*
- (vii) *Other conduct calculated to secure an advantage on assessment.*
- (viii) *Assisting in any of the above.*

Some notes on what this means for students:

1. Copying another student's work is an offence, whether from a copy on paper or from a computer file, and in whatever form the intellectual property being copied takes, including text, mathematical notation, and computer programs.
2. Taking extracts from published sources *without attribution* is an offence. To quote ideas, sometimes using extracts, is generally to be encouraged. Quoting ideas is achieved by stating an author's argument and attributing it, perhaps by quoting, immediately in the text, his or her name and year of publication, e.g. " $e = mc^2$ (Einstein 1905)". A reference section at the end of your work should then list all such references in alphabetical order of authors' surnames. (There are variations on this referencing system which your tutors may prefer you to use.) If you wish to quote a paragraph or so from published work then indent the quotation on both left and right margins, using an italic font where practicable, and introduce the quotation with an attribution.

School of Computing, FLSC
MA4001NI: Logic and Problem Solving

Problem 1 [25 Marks]

Write a procedure, tax, to calculate (*in Indian rupees, Rs.*) the tax a person owes, depending on his/her income. Calculate the tax using this table:

Taxable income	Income tax rates (in Percent)
0 to 250000	0%
250,000 to 500,000	5%
500,000 to 750000	10%
750,000 to 10,00,000	15%
10,00,000 to 12,50,000	20%
12,50,000 to 15,00,000	25%
15,00,000 and above	30%

The procedure should show.

- i) The salary,
- ii) The tax rate,
- iii) The amount of tax
- iv) The amount left after tax and
- v) Be able to deal with any input, valid or not.

Your tests of procedure should include the following values, which should be included in your final presentation.

- a) tax (Rs. 4,005,000)

Deductions:

- Employees provident fund organization: (Rs. 415,330)

- b) tax (Rs. 13,550,010)

Deductions:

- Employees provident fund organization: (Rs. 112,245)
- Life Insurance premium: (Rs. 68,000)

- c) tax (Rs. 620,000)

Deductions:

- Employees provident fund organization: (Rs. 17,007)
- Life Insurance premium: (Rs. 32,000)

d) tax (Rs. 9,19,887)

Deductions:

Employees provident fund organization: (Rs. 92,224)

e) tax (Rs. 18,009,000)

Deductions:

Employees provident fund organization: (114,221)

f) tax (Rs. - 7,050,000)

Deductions:

Employees provident fund organization: (Rs. 88,526)

Problem 2 [50 Marks]

Part A [35 Marks]

The Newcastle company manufactures three products: A , B and C. Their contribution to profit is \$3,\$5 and \$2 per unit respectively. The sales department currently has firm orders for 150 units of A and 100 units of C for the week which must be fulfilled. All three products must go through a bottleneck machine, which has only 80 hours of processing time available each week. The time requirements are 10,10 and 5 minutes per unit for products A ,B and C respectively.

Questions

You should answer the following questions and incorporate your answers into a word-processed report to form part of your final pdf. The sections of your report should correspond to the individual questions following.

- a) Formulate the problem as a linear programming model, clearly defining the variables, the objective function, and the constraints.
- b) Solve the problem using Simplex method.
- c) Solve the problem using the Excel Solver and interpret the results.
- d) For the final part of your report, in your capacity as an Adviser, you should present a memorandum to the **Newcastle Company**. Describe your main conclusions in simple, non-technical English, i.e., do not use technical terms like variable, objective function, or dual price. Don't worry about repeating some or all the points that you have already made in answer to earlier questions. The aim is to communicate your conclusions clearly to someone who is knowledgeable about the combination of contents used in the production, but who knows nothing about the subject of linear programming. You may use tables and charts if you wish.

Part B [15 Marks]

Solve the following linear programming problem graphically:

Maximize and minimize:

$$z = 4x + 7y$$

Subjected to the constraints.

$$2x + 3y \leq 60$$

$$x + y \geq 12$$

$$x \leq y$$

$$x \leq 0, y \leq 0$$

Problem 3 [25 Marks]

In a survey of a research department, a company that produces certain type of spare parts has the price-demand function found to be $p(x) = 3000 - 55x$, where $p(x)$ is the price per spare part in dollars at which x number of spare parts can be sold. The company's fixed cost is \$3000, and the production cost per spare part is \$400.

You should answer the following questions and incorporate your answers into a word-processed report. The sections of your report should correspond to the individual questions below.

- (a) Find the cost function and the revenue function.
- (b) Find the break-even point.
- (c) Plot the break-even points in graph paper. Label the points accurately.
- (d) Find the output level that maximizes the revenue and find the maximum revenue. Round the answers in the nearest integer values.

Presentation of the documentation

Note: This work is to be completed by the group. All stages of the work: the problem formulation, Excel spreadsheet work, interpretation and documentation should be shared. The documentation must include a log of meetings and this should indicate that all students have taken part at each stage. If the group does not agree that a particular member(s) of the group should have the same mark as the rest of the group, all group members need to complete the confidential peer assessment form and email this form to Ashok Dhungana (ashok.dhungana@islingtoncollege.edu.np).

Files must be uploaded to Google classroom by the deadline:

A single .pdf of all three questions with their answers, the group's log, and a cover sheet which must show the group's name, the students' names and their ID saved with the appropriate file name. All questions and their answers must be distinguishable.

-END-

Marking Scheme for Group Coursework:

Marks Title	Marks
Problem 1 For each procedure - 1 mark each total 5 marks For screen shot of template and formula 2 marks For each tax calculation - 3 marks each total 18 marks	/25
Problem 2 - Part A	
Question No.(a) Decision variables - 1 mark Objective function – 2 marks Constraints – 3 marks	/6
Question No.(b) Up to correct standard equation for simplex table- 4 marks For correct simplex table – 10 marks For correct answer and conclusion – 2 marks	/16
Question No.(c) For correct procedure and screen shots – 5 marks Explanation and conclusions – 2 marks	/7
Question No.(d) For best memorandum with no technical terms – 6 marks	/6
Problem 2 - Part B	
For correct solution up to origin tests – 6 marks Graph – 5 marks For correct answer of maximum & minimum values and conclusion – 4 marks	/15
Problem 3	
Question No (a) For finding correct cost function – 1.5 marks For finding correct revenue function – 1.5 marks	/3
Question No (b) For equating cost and revenue functions – 1 mark	/10

For correct equation – 2 marks For comparing and using the formula – 4 marks For correct break-even points – 3 marks	
Question No (c) For correct graphical solution and breakeven points – 5 marks	/5
Question No (d) For correct profit function – 2 marks For correct comparison – 1 mark For correct level of profit – 2 marks For correct maximum profit - 2 marks	/7