Semester Project – Section C

This problem statement is only for section C students

Problem Statement

You have started a business of making cardboard boxes for pets during your free time. For this purpose, you use any available cardboard to create the box. Customers have the option to bring raw material (cardboard piece) of their own. To make the box accessible to the pets, it needs to have an open top as well as one open side. Some customers, however, prefer a box with all four sides and just open top. The first customer has brought a cardboard piece that is 35 inches wide and 60 inches long and wishes to know the maximum volume that is possible for both designs. You plan to cut two squares of equal size from two corners on the long side of the cardboard and fold up the three or four rectangular flaps to form the box as per required design. The goal is to maximize the volume of the box.

Because every customer will bring a different size cardboard, you have decided to use MATLAB to write a program which will provide you the optimal dimensions to maximize the volume, depending on the opted design. The program will take dimensions of the cardboard as input and return the volume and dimensions of the box after applying optimization technique learnt in class. Furthermore, if the material cost is $5 per unit length, and the budget of the company is $2 million, how many boxes of required design will the company be able to make?

Program requirements

1. On (every) first run, the program must display name of your software house, and your programming team along with student ids.
2. At this stage, a message should be displayed to press any key to continue.
3. The program should ask the user about the required design (three sides closed or all four sides closed) and dimensions of the cardboard sheet.
4. The program should apply the optimization technique learnt in class to find the solution. Relevant MATLAB commands should be used to find derivative and solution of the problem. Using the final equations obtained through by-hand solution will not result in any marks.
5. The dimensions of the box and the maximum volume should be displayed as output for the desired design. The total number of boxes that the company will be able to make in its budget should also be displayed.

6. At this stage, the program must ask the user if they wish to run another query or terminate the program. Based on user input, program must act accordingly.

Report Requirements

Students are required to submit a complete report of the project prepared in MS Word in their own words, including:

Sr. No.	Deliverable	Marks
1.	Objectives and introduction of the problem.	5
2.	A step-by-step by-hand solution. Clearly state the assumptions and values that you use for the solution.	15
3.	A well commented MATLAB code with line-by-line explanation. This part must include the explanation of the commands, functions, and toolboxes used.	10
4.	A step-by-step example demonstrating the MATLAB solution. Also provide an instruction's manual to run the MATLAB program to obtain the MATLAB solution demonstrated in the example.	10
5.	Detailed results section. Present results and graphs of your analytical and MATLAB solution in this section, compare and discuss your results including their physical interpretation.	10
6.	Flowchart of the solution methodology.	5
7.	3D figure of the one side open design.	5
8.	Conclusions. In this section include conclusions related to this project, summary of problem and results, the difficulties that you faced during this project and how you overcame those difficulties.	5
9.	Contribution. In this section clearly state the contribution of each group member. Generic statements such as 'each group member contributed equally' are not acceptable answers.	5

Each report element should be documented under a separate heading. Report must not exceed 12 A4 size pages including table of contents as well as a single title page with project title, student names, ids, section, and name of the course. 3 marks will be deducted from obtained marks for every extra page. Each page should be numbered. The report should be written in

Calibri or Times New Roman typeface only. The size of the font should be 12. The size of first and second level of headings should be 14 bold, and 12 bold, respectively. The alignment of the report should be justified, while pictures and tables should be center aligned with relevant captions. The option to align the text left, right, center, and justify can be found under paragraph options on *Home* tab. Line and paragraph spacing should be set as 1.5.

Project Submission Guidelines

This project is an open-ended problem designed to demonstrate the application of differentiation and optimization in real life. The open-ended nature of the problem means that this problem can be solved in more than one way using various techniques and methodologies, some of these techniques have been covered in this course. You are free to adopt any technique and solution methodology to solve this problem. Solution techniques and methodologies that are not part of the course outline can also be used to solve the problem. However, you are required to take approval of such a solution technique before starting the project. You will have to do extensive research to completely solve the problem.