Ain Shams University
Faculty of Engineering
Computer Engineering and Software Systems Program

CSE332/CSE224: Design and Analysis of Algorithm – Spring 2021

P R O J E C T R E Q U I R E M E N T S

This project is a group project with each group has 4 or 5 students. Each team must do the following Tasks:

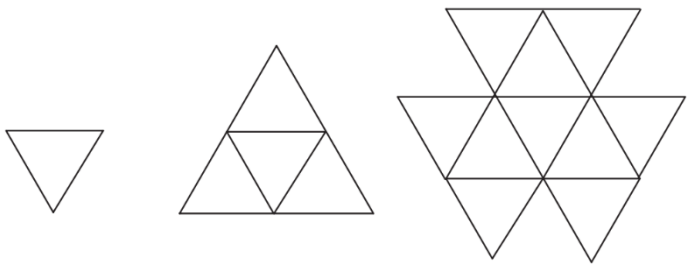
Task 1
You need to write an greedy algorithm that finds the minimum number of cuts required if you have a stick *n* unit long needs to be cut into *n* unit pieces. You are allowed to cut several stick pieces at the same time.

Task 2
Using dynamic programming methodology to write an algorithm that:

a) Finds all the values of n ≥ 3 such that if you have an n × n table whose cells are to be filled with integers 1 through 9, inclusive, one number per cell then every 3 × 3 square in it is a magic square.
b) Finds all the values of n ≥ 3 for which it is possible to fill an n × n table with integers 1 through 9, inclusive, so that every 3 × 3 square in it is a pseudo-magic square.

Task 3
Use iterative improvement methodology to write an algorithm that turns all the lights on by flipping the minimum number of switches if you have a circle of n > 2 lights with a switch next to each of them. Each switch can be flipped between two positions, thereby toggling the on/off states of three lights: its own and the two lights adjacent to it. Initially all the lights are off.Then write your algorithm in pseudo-code.

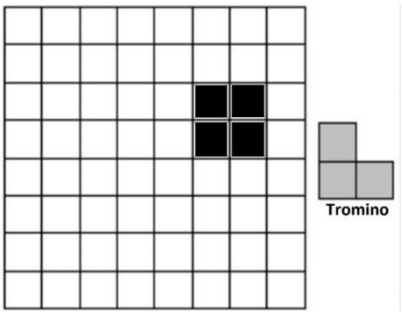
Task 4
You need to write a brute-force algorithm to find how many small triangles will be there after the n^{th} iteration. the algorithm starts with a single equilateral triangle and on each subsequent iteration adds new triangles all around the outside. The results for the first three values of n are shown in Figure.



Task 5
Design an algorithm based on divide and conquer methodology that determines the fake in the minimum number of weighing on a spring scale. If You have n > 1 identical-looking coins: n − 1 of them are genuine with a known weight g, and one of them (of an unknown weight different from g) is counterfeit. Assume that the spring scale indicates the exact weight of the coins being weighed.

Task 6

A tromino is an L-shaped tile formed by adjacent squares as shown at the right of the given figure. Design a dynamic programming algorithm to cover all the $2^n \times 2^n$ tiles board with nonoverlapping trominos except for the four adjacent tiles (shown in black in the given figure) that can be located anywhere on the board.



The report MUST contain each of the following items (items 2 to 8 should be provided for each task separately):

1. Cover page that shows the group names, college name, program name, course code, course name … etc.
2. Detailed assumptions.
3. Problem description.
4. Detailed solution including the pseudo-code and the description of the steps of your solution.
5. Complexity analysis for the algorithm.
6. A comparison between your algorithm and at least one other algorithm that can be used to solve the problem.
7. Sample output of the solution for the different cases of the algorithms with proper description for the output.
8. Conclusion.
9. References that should be clearly cited inside the document.
10. Any additional needed sections.

Project Deliverable

All deliverable must be submitted on the LMS, no deliverable will be accepted by any other means. The following are required to be delivered by the due date:

1. Project code using any programming language. It must be submitted as a zip/rar archive.
2. A presentation (in .pptx format) of the different phases of the project. Each group will do the presentation and project demo via Microsoft-Team after submitting the project.
3. Project document (in .docx format) that contains at least the above mentioned sections.

The following instructions MUST be taken into consideration while doing your project

- Use a professional drawing tool (e.g., MS-VISIO) to draw the diagrams (if any) in your document.
- Use consistent document format (font sizes, titles, subtitles, captions, paragraph formatting … etc.). Recommended font sizes are: main title 14pt, subtitles 12pt, main text 12pt, and captions 10 pt. Recommended font type is bold "**Calibri**" for titles and subtitles, and regular "Calibri" for all other texts. Recommended spaces before and after paragraphs are 12pt before and 6pt after each paragraph, and 1.5 spacing is highly recommended. Justified paragraphs from both sides are also recommended.
- Figures and tables must be centred in the pages, and they should be numbered separately. Each figure must have a caption that appears below the figure, and each table must have a title above it.
- Pages must be numbered consistently except for the cover page.
- Table of Contents must be included in your document that shows the titles and sub-titles of your report with the corresponding page numbers.
- List of figures and list of tables must be included in your document if you have figures/tables in your document.
- All reports must be written in English, always avoid typos and grammatical errors.
- All submitted files will undergo plagiarism check.
- All project deliverables must be uploaded to the LMS, no hardcopy is accepted, and please do not send your project deliverables by email. No other means of submission will be accepted.
- Online presentation, discussion, and demo are required after delivering the project.