Northeastern University
College of Engineering
Department of Electrical and Computer Engineering

EECE 2140: COMPUTING FUNDAMENTALS FOR ENGINEERS
Fall 2022

Final Project
Due at 11:59 p.m. on Friday, December 16, 2022

The final project should demonstrate your proficiency in the concepts learned in class by developing a medium-size application in Python. You can write a program on whatever interests you. Below you will find a list of sample projects you may choose from, though you can propose your own system. Completion of the project will include a final report and your developed code.

You can work alone or with at most two partners (i.e., a group of 1, 2, or 3). If working with a partner, you will be graded accordingly, with the expectation that the project is more substantial than a single-person project.

Sample Project Ideas
This section provides some examples for applications that you may develop.

1. Develop an application that implements the unsupervised K-means and supervised K-nearest neighbor classification algorithms.
   You need to develop a Python class that implements both of these classification algorithms with potting functionalities.

2. Develop a Python class that finds the root of a function in a given interval using several well-known solver methods (e.g., bisection method, Newton's method, and secant method).
   If you work in a team, having the plotting functionality to show the progress of your algorithm is a requirement.

3. Design and implement a spell-checker application.
   Create a text file that has some words spelled correctly and some misspelled. Your Python script should look up each word in the dictionary, point out each incorrect word, and suggest some correct alternatives that might have been what was intended.
   For example, you can try all possible single transpositions of adjacent letters to discover that the word "defualt" is a direct match for "default." Of course, this implies that your application will check all other single transpositions, such as "edfault", "dfeault", "deafult", "defalut" and "defautl". When you find a new transposition that matches a word in the dictionary, print it in a message, such as "Did you mean default?" Implement other tests, such as replacing each double letter with a single letter, and any other tests you can develop to improve the value of your spell checker.

4. Develop an automatic grader for students' assignments.
   Write a Python program that goes over a folder containing students' assignments in a Python programming course (in the format of .py files). The program should execute each Python script on a set of predefined inputs and verify that it generates the expected outputs. The set of test inputs and their expected outputs should be defined in an external text file. The program would then grade each of the assignments based on the number of correct outputs and generate a file with the final grades of the students.

5. Develop a Sudoku generator and solver.
   A Sudoku game is a number-placement puzzle. The objective is to fill a 9-by-9 grid with digits so that each column, each row, and each of its nine 3-by-3 blocks contain all of the digits from 1 to 9. Your task is to design an algorithm to create a Sudoku grid. The generated grid should have enough clues (numbers in cells) to be solvable resulting in a unique solution. Your Sudoku generator algorithm may need to use a Sudoku solver algorithm in order to test whether a generated grid is solvable and to check that it gives a single solution. The most common type of Sudoku solver algorithm is based on a backtracking algorithm used to investigate all possible solutions of a given grid.

Project Guidelines

- Design and plan the structure of your program before writing any code.
- Separate the user interface from the logic of the application by using different modules/classes.
- The source code should be well commented and organized and run without errors.
- All classes and methods should be documented with docstrings.
- Follow python coding standards regarding variable names, indentation, spaces, etc.

Project Proposal

The project proposal is a short one- to two-paragraph document that describes what you plan to do for the project. The project proposal is due at 11:59 p.m. on Sunday, December 11, 2022. It should specify the following items:

1. Project title.
2. Project participants and team members: If you are working with a partner, is there a clear division of labor?
3. Application description: Describe the main features of the system you are going to develop.
4. Application design: What will be the structure of your program? What will be its main classes/components?
5. Results: What is the ideal outcome of the project? Are there risks for not getting your project done on time? If so, what will you do about it?

We will review all project proposals, and they will be part of your grade on the project.

Project Report

The project report should be submitted in a PDF format and include the following items:

1. Introduction: A brief overview of the system that you have developed and its main features.
2. Application design: What are the main classes in the system? What are the main attributes and methods of each class? How the classes interact with each other?
3. Your complete Python code and a demo of the system to show how it runs for different inputs.
4. Instructions on how to run your system.
5. Libraries and tools: What external libraries and tools did you use in your project (if any)? Provide references where applicable.
6. Lessons learned: What did you learn from conducting the project? If you had more time to spend on the project, what would you have liked to do next? What advice about the project would you give to future EECE 2140 students?

The project report and code are due at 11:59 p.m. on Friday, December 16, 2022.

Grade Breakdown

- Project proposal: 10%
- Final project report: 20%
- Developed code: 70%

Academic Integrity

You are *not* allowed to use any code from an online resource without explicit permission from the instructor and proper citation ad acknowledgement. Your project should be built entirely by yourself from the ground up. Any project suspected of plagiarism will automatically receive a grade of 0 and report to the Northeastern University's Office of Student Conduct and Conflict Resolution (OSCCR).