# Complex Engineering Problem

Course Code and Title: CS2002 Data Structures &Algorithms

Semester: Fall2024

Instructor: Shazia Haque & Ahmed Hamza

Total Marks: 100

Deadline: 30th November 2024 till 4pm on slate

# CLOs and PLOs for Complex Engineering Problem

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| --- | --- | --- | --- | --- |
| **CLOs** |  | **Description** | **Taxonomy Levels** | **PLO** |
| CLO 4 | Theory | Apply the best searching/sorting algorithm to solve a problem | C3 | 5 |

# Instructions

* Archive your files (.h and .cpp) in a zip file named as your roll number(s). Upload this file on slate.
* Academic integrity is expected of all the students. Plagiarism or cheating in any assessment will result in negative marking or an **F** grade in the course, and possibly more severe penalties.

# Problem Statement

You have to **apply** appropriate data structures and algorithms to **construct** an online groceries store where the system should not only be able to manage the grocery items but also cater for their online delivery to customers

Customer:

The information kept about each borrower would include the following info:

* CNIC number
* Name
* Mobile number
* Address

Your system should store above features against each customer using an appropriate search structure. If you use a Binary Seach Tree please input data from a file such that the height of the resulting BST is as close to log(n) as possible.

GroceryItem:

The data kept about books is as follows:

* barcode
* title
* unit price
* quantity available

Your system should store above features against each groceryItem in a data structure where data access time is no worse than O(1).

Groceries Delivery:

Add functionality for the customers where they will be able to get the groceries delivered from the store to their respective addresses. **The map of each student doing this project should be different** and consist of atleast 10 nodes. Once loaded your source would be the store location and destination would be the customer’s address. Your system should generate the shortest path between the source and destination to give to one of its drivers for delivery purpose.

# Objectives:

1. Prepare enough data to start with for the customers, street network and grocery items. You may read the data from file and place in chosen data structure.
2. Write program for the functionalities of insert/update/delete operations
3. Add functionality of search where a grocery item can be searched by barcode/title or both.
4. Display the path that a rider would take to deliver an order.
5. Update the quantity available once a grocery item has been sent for successful delivery

# Deliverables

Your C++ code and a report on how you designed the solution to the problem

# Complex Engineering Problem Attributes

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **WP1:** Depth of knowledge **WP2:** Range of conflicting requirements  **WP3:** Depth of analysis  **WP4:** Familiarity of issues  **WP5:** Extent of applicable codes **WP6:** Extent of stakeholders  **WP7:** Interdependence | Please fill according to the WPs covered in the course CEP, example is shown here.   * ***WP1: Depth of Knowledge*** -- Requires understanding of data structures (e.g., Binary Search Tree, hash tables) for customer and grocery item storage, and graph algorithms for delivery pathfinding. * ***WP2: Range of conflicting requirements*** – Suggested use of BST to carry Customer data with log(n) performance. * ***WP3: Depth of analysis*** -- Involves analyzing multiple data structures to meet performance requirements and includes optimizing pathfinding in varying city maps. * ***WP7: Interdependence*** -- Requires integration of different functionalities (customer management, inventory management, and delivery routing) into a cohesive system. | | | |
| Rubrics | | Marks | Obtained Marks |
|  | WP1 | 15 |  |
| Demonstrates understanding of data structures like Binary Search Trees and hash tables selecting appropriate data structures for customers and grocery items |
| Shows knowledge of graph algorithms for shortest path delivery routing. | WP1 | 15 |  |
| Suggested use of BST to carry Customer data with log(n) performance. BST has a default performance of O(n) | WP2 | 10 |  |
| Compares and justifies choice of data structures and algorithms for inventory, customer, and delivery management given the performance requirements. | WP3 | 20 |  |
| Integrates customer, inventory, and delivery systems, demonstrating ability to maintain data consistency across functions. | WP7 | 20 |  |
|  | Completes a report with logical explanations, solution design, and performance analysis, showing application of C++ principles and academic integrity. |  | 20 |  |