CS-200 Midterm Lab 2
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Instructions:

1. Same submission instructions and naming convention as the previous labs.
2. You have to submit your midterm lab latest by 12:00PM on LMS.
3. Do **not** cheat/plagiarize.

Q1 (30 Marks):
Write a function to find if a sorted dynamic array A contains an element such that A[i] = i, (where A[i] is the ith element of A) **without iterating over the whole array**.
Note: The user will enter the size of the array and all its elements. You need to **ensure** that the function you make **always gets a sorted array** regardless of how the user has entered the values.
Sample:
Input: A = {-1, 2, 10, 20, 500}; Output: False
Input: A = {-6, 1, 10, 30, 50}; Output :True
Explanation: Note that for the second sample input/output, the element at position # 1 (i.e. i = 1) is 1, thus A[1] = 1, so the output is true. However, for the first sample input/output, there is no such element in A such that A[i] = i.
Marks' Distribution:
Input from the user, initializing dynamically allocated array, deallocating memory at the end of the program, and sorting if user enters unsorted array: [5]
Finding if there exists some i in A such that A[i] = i. [25]
If you iterate over the whole array to get your solution, the maximum marks you can get are [5] for allocation, deallocation, and sorting.

Q2 (70 Marks):
In this question, you are required to implement singly linked list and its concepts to solve the problems of a departmental store described in the scenario given below:

A departmental store has a variety of products to sell. Each product type has a unique ID and price associated with it (for example soaps can have an ID of 1 and price of 50 etc.). A customer comes to the store and starts putting items in his/her shopping cart. Once all the items have been placed in the shopping cart, the customer then proceeds to checkout but before that, he/she will sort (in **ascending** order of IDs) the shopping cart's items and proceed to remove all the duplicate items from the shopping cart, that is if two soaps have been added to the cart, **only 1** will be kept. At the checkout counter, he/she will then remove items from the cart by removing from the end of the shopping cart (linked list). A bill for that customer is then generated and printed.

You are required to implement this scenario using singly linked list for a customer named Maham who has entered the store with the following shopping list:

- Chips
- Cheese
- Chips
- Chips
- Facewash
- Icecream
- Chips
- Icecream
- Chips
- Icecream

Take the ID and price for these items as specified below. You should **hardcode** these values inside your initial linked list, user input for these details is not required:

- ID for chips: 10
- Price for each packet of chips: 50.00
- ID for cheese: 11
- Price for each pack of cheese: 125.30
- ID for ice cream: 12
- Price for each pack of ice cream: 180.00
- ID for face wash: 13
- Price for each face wash: 320.25

The total cost Maham would be paying will be: 675.55 (50.00 + 125.30 + 180.00 + 320.25)
Implementation guideline:
The shopping cart will be a singly linked list with two items being stored at each node (along with a pointer to connect the nodes together, obviously):

- ID
- Price

You are required to make functions for

1. duplicate item removal
2. Printing
3. Addition and Removal of items from the list
4. Sorting in ascending order.

Note: If you wish to make any helper functions, you are allowed to do so.

Important: Print the state of linked list (shopping cart) after

1. Inserting **all** items in it.
2. Sorting **all** items by ID.
3. Removing **all** duplicate items.
4. Placing **each** item on the counter.

Finally, print the total cost of items that were checked out at the end

You must hardcode the shopping list provided initially. Users should <u>not</u> be prompted to enter anything.

Marks' Distribution:
Addition of items in the list as per list's order and printing of accurate list: 10
Sorting of the cart and printing of accurate result of sorting: 25
Removal of duplicate items from the cart and printing of accurate state: 25
Removal of items in correct order (last to be removed first) and printing of the final bill amount: 10