MIT AITI
Python Software Development

Lab 04: Data Structures

We have demonstrated in lecture how lists, tuples, and dictionaries each provide a valuable way to store information. Through the activities in this lab, you will have the opportunity to explore the capabilities and limitations of these data structures. At the conclusion of this lab, you will know how to choose the right data structure for your software development needs!

1. Messi and Xavi, the stars of Lecture 4, have just finished up a long afternoon of football and decide to head to the grocery store. They have a list of groceries that they would like to pick up at Uchumi. Their list, `groceries`, is initialized as follows:

   ```
   groceries = ['bananas','strawberries','apples','bread']
   ```

   a. They want to celebrate their victory and add champagne to the end of their original grocery list. Write the code to modify `groceries` accordingly.

   b. Messi decides he doesn't need bread. Write the code to remove this from `groceries`.

   c. The store has 26 aisles, labeled 'a', 'b', 'c', … 'z' from the left side of the store to the 'right' (apples are found in the 'a' aisle, strawberries in the 's' aisle, etc.). What operation could Messi perform on the list to make it easier for him to find the items he needs in the store? Write the code below.

2. The store wants to design a catalog of all items in stock and their prices.
   a. What data structure would you choose to store this information and why?

   b. Prices at the store are shown in the table below; write code to store this information in the data structure you chose in part (a).

Item	Price
Apples	KSH 50
Bananas	KSH 25
Bread	KSH 200
Carrots	KSH 200
Champagne	KSH 2000
Strawberries	KSH 500

c. The price of strawberries goes up in the winter to KSH 750; how would you modify the price in your data structure?

d. Soccer players insisted on more protein options for their diets, so the store decided to sell chicken at a rate of KSH 500. Write the code to add this information to the data structure from part (c).

3. Uchumi changes some of its items over time, but it *always* carries those in the list above. The CEO of Uchumi Company wants a list of items that their stores *always* carry so they can ensure that these items are available for customers to buy at all times.

    a. Describe the data structure that would best fit this data.

    b. Given the data structure chosen in part a, create the collection of items that will be sent to the CEO.

The CEO is puzzled because one of his stores sent him two lists with different items. It turns out that the store sent in one list, but forgot some of the items, so they sent in a second list.

The CEO thinks it would be much easier to have all these items on *ONE* list, but he is unsure how he can link two *tuples*.

c. Given your knowledge of tuples, suggest a way that the CEO can combine the two lists.

4. Messi and Xavi are outraged at the prices in this store; they want to check around at a few other stores. For example, apples cost KSH 50 at the current store and KSH 45 at another store.

   a. What data structure could they use to store different market prices associated with all the items on their grocery list?

   b. Given a sorted list of prices (e.g., KSH 50, KSH 125, KSH 150), design a function that will insert another price into the list. Maintain the price order without re-sorting the entire list (hint: use binary search).

```
def binary_insert(new_float,some_list_of_floats):
     #modifies the input list to include the new_float

     return
```

   c. Write a function that returns the minimum amount of money that Messi and Xavi will have to spend on their grocery list.

```
def min_cost(grocery_list,item_to_price_list_dict):
     #grocery_list is a list of strings (item names)

     #item_to_price_list_dict is a dictionary with key-value
     # pairs as follows: the item name (strings) is the key
     # and the list of prices (floats) at different grocery is
```

```
  # the value

return
```