Assignment 5: Linked lists - 2, dynamic tables

1. Consider a dynamic table with the following properties.
   a. Elements are stored in a dynamic array
   b. Capacity is the size of the dynamic array
   c. Size is defined is the number of elements stored in the array

   Insert elements into dynamic table. Double capacity if size is equal to capacity before `push_back()`

   Input: (n, elements)
   ```
   9
   6 7 8 12 4 10 11 1 15
   ```
   Output:
   ```
   capacity = 1; size = 1; elements = 6
   capacity = 2; size = 2; elements = 6 7
   capacity = 4; size = 3; elements = 6 7 8
   capacity = 4; size = 4; elements = 6 7 8 12
   capacity = 8; size = 5; elements = 6 7 8 12 4
   capacity = 8; size = 6; elements = 6 7 8 12 4 10
   capacity = 8; size = 7; elements = 6 7 8 12 4 10 11
   capacity = 8; size = 8; elements = 6 7 8 12 4 10 11 1
   capacity = 16; size = 9; elements = 6 7 8 12 4 10 11 1 15
   ```

   Hint:
   ```
   +---+
   | 6 |
   +---+
   +---+---+
   | 6 | 7 |
   +---+---+
   +---+---+---+---+
   | 6 | 7 |8  |   |
   +---+---+---+---+
   +---+---+---+---+
   | 6 | 7 |8  |12 |
   +---+---+---+---+
   +---+---+---+---+---+---+---+---+
   | 6 | 7 |8  |12 | 4 |   |   |   |
   +---+---+---+---+---+---+---+---+
   +---+---+---+---+---+---+---+---+
   | 6 | 7 |8  |12 | 4 |10 |   |   |
   +---+---+---+---+---+---+---+---+
   +---+---+---+---+---+---+---+---+
   | 6 | 7 |8  |12 | 4 |10 |11 |   |
   +---+---+---+---+---+---+---+---+
   +---+---+---+---+---+---+---+---+
   | 6 | 7 |8  |12 | 4 |10 |11 | 1 |
   +---+---+---+---+---+---+---+---+
   +---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
   | 6 | 7 |8  |12 | 4 |10 |11 | 1 | 15|   |   |   |   |   |   |   |
   +---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
   ```

2. Implement `pop_back()` function that deletes the last element. If size is less than or equal to one fourth of the capacity then decrease the capacity by half.

   Input: (capacity, size, elements, # of `pop_back()` calls.
   ```
   16
   9
   6 7 8 12 4 10 11 1 15
   5
   ```

Output:
```
capacity = 16; size = 8; elements = 6 7 8 12 4 10 11 1
capacity = 16; size = 7; elements = 6 7 8 12 4 10 11
capacity = 16; size = 6; elements = 6 7 8 12 4 10
capacity = 16; size = 5; elements = 6 7 8 12 4
capacity = 8;  size = 4; element = 6 7 8 12
```

Hint:
```
Initial:
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
| 6 | 7 |8  |12 | 4 |10 |11 |1  |15 |   |   |   |   |   |   |   |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
4 pop_backs:
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
| 6 | 7 |8  |12 | 4 |10 |11 | 1 |   |   |   |   |   |   |   |   |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
| 6 | 7 |8  |12 | 4 |10 | 11|   |   |   |   |   |   |   |   |   |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
| 6 | 7 |8  |12 | 4 | 10|   |   |   |   |   |   |   |   |   |   |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
+---+---+---+---+---+---+---+---+
| 6 | 7 |8  |12 |  4|   |   |   |
+---+---+---+---+---+---+---+---+
```

3. From a given dynamic table perform following operations:
    a. Delete an item by index
    b. Delete the first item by value
    c. Delete all items by value

    Input: (capacity, size, elements, index, first_value, all_value)
    ```
    16
    10
    4 2 3 4 3 5 3 4 4 3
    2
    3
    ```
    Output:
    ```
    capacity = 16; size = 9; elements = 4 2 4 3 5 3 4 4 3
    capacity = 16; size = 8; elements = 4 2 4 5 3 4 4 3
    capacity = 8; size = 4; elements = 2 5 3 3
    ```

4. Implement the following operations on a doubly linked list stored as a file.
    a. Insert
    b. Search
    c. Delete

5. Implement insertion sort in a linked list stored as a file.