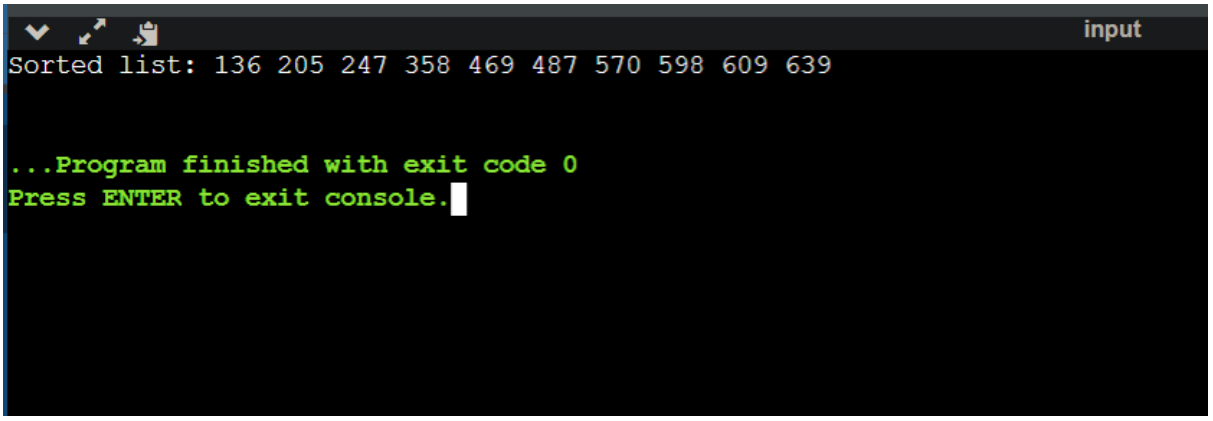
AVANISH RAJ SRIVASTAVA
BT22CSH031
DSA ASSIGNMENT 2

Q1)

```
#include <iostream>
#include <algorithm>

using namespace std;

void countingSort(int arr[], int n, int exp) {
    int output[n];
    int count[10] = {0};

    for (int i = 0; i < n; ++i) {
        int index = arr[i] / exp;
        count[index % 10]++;
    }

    for (int i = 1; i < 10; ++i) {
        count[i] += count[i - 1];
    }

    for (int i = n - 1; i >= 0; --i) {
        int index = arr[i] / exp;
        output[count[index % 10] - 1] = arr[i];
        count[index % 10]--;
    }

    for (int i = 0; i < n; ++i) {
        arr[i] = output[i];
    }
}

void radixSort(int arr[], int n) {
    int max_value = *max_element(arr, arr + n);
    int exp = 1;

    while (max_value / exp > 0) {
        countingSort(arr, n, exp);
        exp *= 10;
    }
}
```

```
int main() {
    int input_list[] = {136, 487, 358, 469, 570, 247, 598, 639, 205, 609};
    int n = sizeof(input_list) / sizeof(input_list[0]);

    radixSort(input_list, n);

    cout << "Sorted list:";
    for (int i = 0; i < n; ++i) {
        cout << " " << input_list[i];
    }
    cout << endl;

    return 0;
}
```



TIME COMPLEXITY ANALYSIS

- BEST CASE : O(n*k)
- AVERAGE CASE : O(n*k)
- WORST CASE : O(n*k)
  Where n = number of elements and k = number of passes

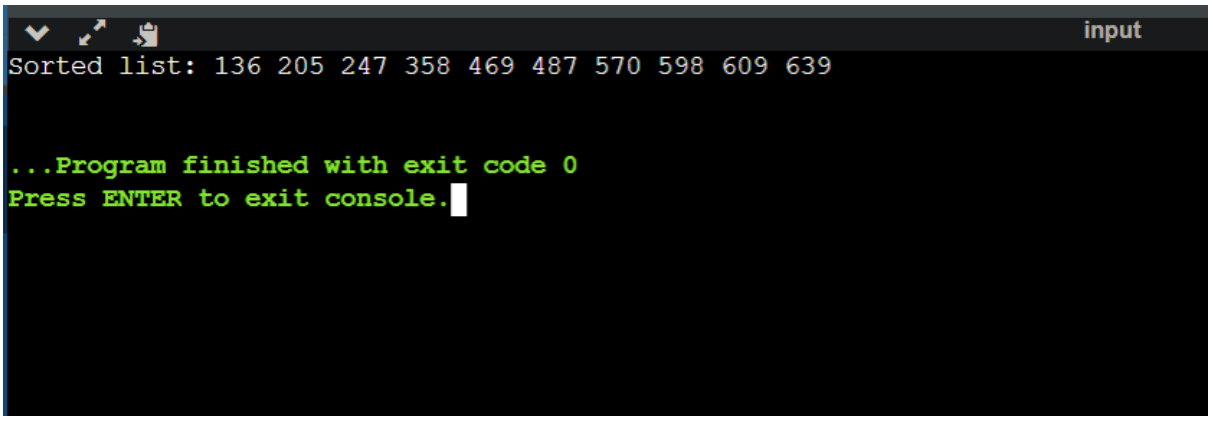
Q2)

```
#include <iostream>
#include <cmath>

using namespace std;

struct Node {
    int data;
    Node* next;
    Node(int val) : data(val), next(nullptr) {}
};
```

```
void insert(Node*& head, int val) {
    Node* newNode = new Node(val);
    if (!head) {
        head = newNode;
    } else {
        Node* temp = head;
        while (temp->next) {
            temp = temp->next;
        }
        temp->next = newNode;
    }
}


int getDigit(int num, int place) {
    return (num / place) % 10;
}


void countingSort(Node*& head, int exp) {
    if (!head) return;

    int count[10] = {0};
    Node* current = head;
    Node* output = nullptr;

    while (current) {
        int index = getDigit(current->data, exp);
        count[index]++;
        current = current->next;
    }

    for (int i = 1; i < 10; ++i) {
        count[i] += count[i - 1];
    }

    current = head;
    while (current) {
        int index = getDigit(current->data, exp);
        Node* newNode = new Node(current->data);
        newNode->next = output;
        output = newNode;
        count[index]--;
        current = current->next;
    }

    current = head;
    Node* sortedCurrent = output;
```

```
    while (sortedCurrent) {
        current->data = sortedCurrent->data;
        current = current->next;
        sortedCurrent = sortedCurrent->next;
    }

    while (output) {
        Node* temp = output;
        output = output->next;
        delete temp;
    }
}
void radixSort(Node*& head) {
    int max_val = 0;
    Node* current = head;


    while (current) {
        max_val = max(max_val, current->data);
        current = current->next;
    }

    int exp = 1;
    while (max_val / exp > 0) {
        countingSort(head, exp);
        exp *= 10;
    }
}

int main() {
    Node* input_list = nullptr;


    int elements[] = {136, 487, 358, 469, 570, 247, 598, 639, 205, 609};
    int n = sizeof(elements) / sizeof(elements[0]);
    for (int i = 0; i < n; ++i) {
        insert(input_list, elements[i]);
    }


    radixSort(input_list);


    cout << "Sorted list:";
    Node* current = input_list;
    while (current) {
        cout << " " << current->data;
        current = current->next;
```

```
    }
    cout << endl;

    while (input_list) {
        Node* temp = input_list;
        input_list = input_list->next;
        delete temp;
    }

    return 0;
}
```



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