CSN-261:Data Structures Laboratory

Assignment-1

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Sub Batch- O2

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Problem Statement 1:

Write a C program to create a student management system, where the students’ information are stored in a doubly circular linked list, as shown in Figure 1. The structure of each node from the list is shown in Figure 2. Initially, the circular doubly linked list is empty and the student personal data is entered from the filename “StudentData.xlsx” that contains the data of 13 students (name, D.O.B., address and phone no) in tabular form. The StudentData.xlsx file can be converted into a CSV file using Libreoffice or into any other file format readable from your C program. The program should have the following operations: insert, delete, search, modify, sort and print. While inserting, a unique roll number in the linked list is assigned to each student, where the starting roll number should be 101 and the list should always be in sorted according to their roll number (ascending order). However, when a deletion operation is performed, the roll number of the deleted student node is stored in a queue named unusedRollNo. These deleted roll numbers from the unusedRollNo queue will be allotted to the new students on next insertion operations.

Perform the testing of your code with the following TestCases:

(Initially the list is empty)
1. delete (roll number 108) - delete the student node with roll number 108
2. insert - insert first student data from the “StudentData.xlsx” file (Row2)
3. insert - insert second student data from the “StudentData.xlsx” file (Row3)
4. insert - insert 3rd student data from the “StudentData.xlsx” file (Row4)
5. insert - insert 4th student data from the “StudentData.xlsx” file (Row5)
6. delete (roll number 102) - delete the student node with roll number 102
7. delete (roll number 101) - delete the student node with roll number 101
8. insert - insert 5th student data from the “StudentData.xlsx” file (Row6)
9. insert - insert 6th student data from the “StudentData.xlsx” file (Row7)
10. insert - insert 7th student data from the “StudentData.xlsx” file (Row8)
11. print - print the linked list with the roll number, name and D.O.B
12. sort (name) - sort the name according to student names

13. print - print the linked list with the roll number, name and D.O.B
14. modify (roll number 103) - modify the student node having roll number 103
15. print - print the linked list with all the records for each student
Note: In ‘modify’ function, the programmer can update the other fields except the roll number of a student.

Algorithms and Data Structures used in the implementation

Data Structures Used - Doubly Linked List , Queue

Algorithm -

=>Implemented a linked list to store data of students like Name , Roll number , Date of Birth , Address , Phone number.

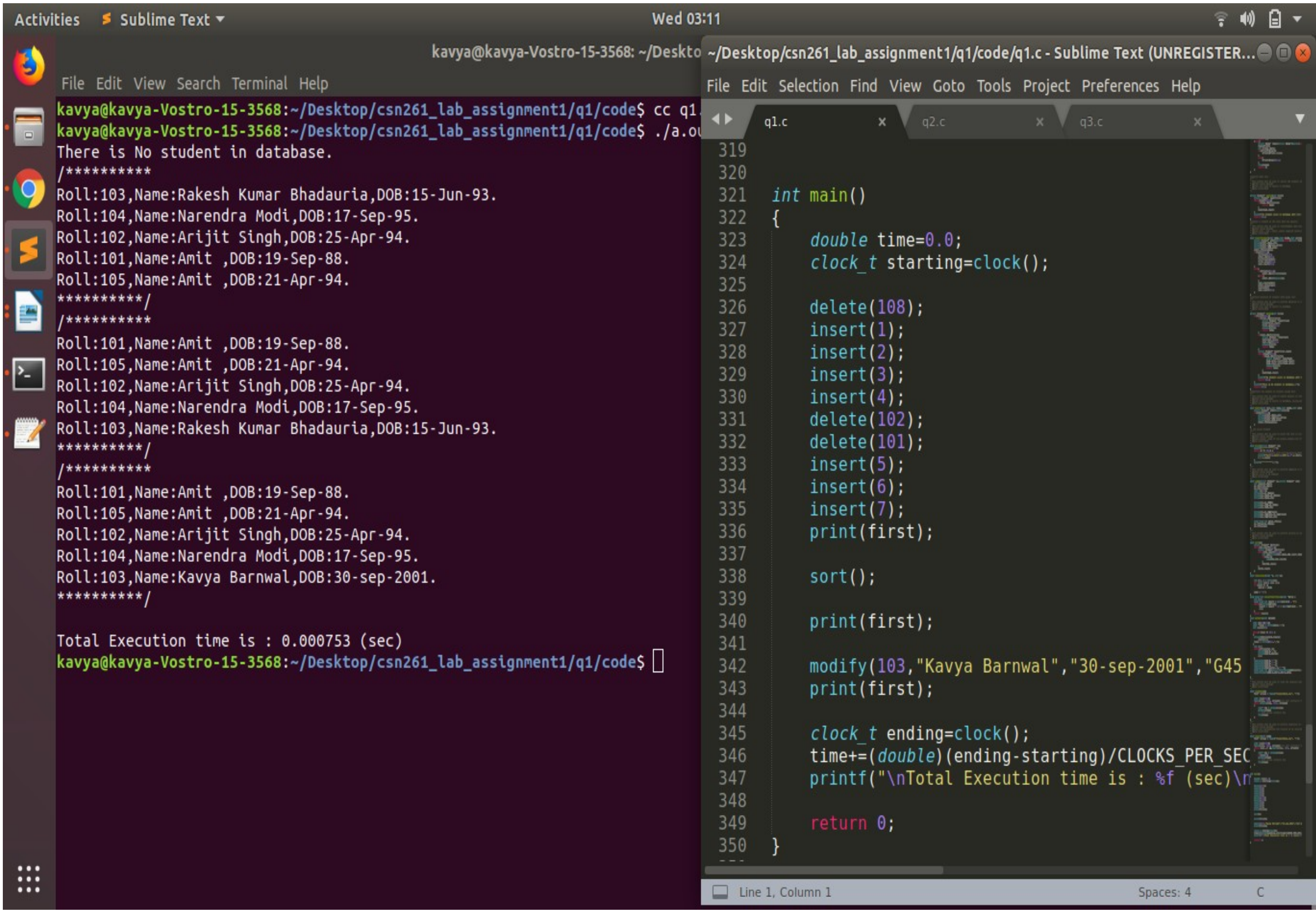
=>”StudentData.xlsx” is converted into “StudentData.csv” .

=>This file is read by using fopen and read line by line using fgets.

=>Creating array to store lines and using strtok to separate contents of line by removing inverted comma and storing remaining data in the nodes through other function.

=>delete function to remove a student and it’s roll number is stored in a Queue.

=>Sort function to sort by name and modify details of users.


Activities
Sublime Text
Wed 03:11
kavya@kavya-Vostro-15-3568: ~/Deskto
File Edit View Search Terminal Help
~/Desktop/csn261_lab_assignment1/q1/code/q1.c - Sublime Text (UNREGISTER...
File Edit Selection Find View Goto Tools Project Preferences Help
q1.c
q2.c
q3.c
Line 1, Column 1
Spaces: 4
C

```
kavya@kavya-Vostro-15-3568:~/Desktop/csn261_lab_assignment1/q1/code$ cc q1.
kavya@kavya-Vostro-15-3568:~/Desktop/csn261_lab_assignment1/q1/code$ ./a.ou
There is No student in database.
/**********
Roll:103,Name:Rakesh Kumar Bhadauria,DOB:15-Jun-93.
Roll:104,Name:Narendra Modi,DOB:17-Sep-95.
Roll:102,Name:Arijit Singh,DOB:25-Apr-94.
Roll:101,Name:Amit ,DOB:19-Sep-88.
Roll:105,Name:Amit ,DOB:21-Apr-94.
**********/
/**********
Roll:101,Name:Amit ,DOB:19-Sep-88.
Roll:105,Name:Amit ,DOB:21-Apr-94.
Roll:102,Name:Arijit Singh,DOB:25-Apr-94.
Roll:104,Name:Narendra Modi,DOB:17-Sep-95.
Roll:103,Name:Rakesh Kumar Bhadauria,DOB:15-Jun-93.
**********/
/**********
Roll:101,Name:Amit ,DOB:19-Sep-88.
Roll:105,Name:Amit ,DOB:21-Apr-94.
Roll:102,Name:Arijit Singh,DOB:25-Apr-94.
Roll:104,Name:Narendra Modi,DOB:17-Sep-95.
Roll:103,Name:Kavya Barnwal,DOB:30-sep-2001.
**********/

Total Execution time is : 0.000753 (sec)
kavya@kavya-Vostro-15-3568:~/Desktop/csn261_lab_assignment1/q1/code$ 
```

```c


int main()
{
    double time=0.0;
    clock_t starting=clock();

    delete(108);
    insert(1);
    insert(2);
    insert(3);
    insert(4);
    delete(102);
    delete(101);
    insert(5);
    insert(6);
    insert(7);
    print(first);

    sort();

    print(first);

    modify(103,"Kavya Barnwal","30-sep-2001","G45
    print(first);

    clock_t ending=clock();
    time+=(double)(ending-starting)/CLOCKS_PER_SEC
    printf("\nTotal Execution time is : %f (sec)\n

    return 0;
}
```

Total execution time is around 0.000753 seconds.

Problem Statement -2

Write a C Program for resizeable deque using dynamic memory allocation, where a deque can perform the insertion and deletion operations at its both ends. The capacity of the deque depends on the number of elements currently stored in it, according to the following two rules:

● If an element is being inserted into a deque, when it is already full, then its capacity is doubled of its current size.

●After removing an element from a deque, if the number of elements are equal to half of the capacity of the deque, then its capacity is made half of its current size. The program should have the following three functions: insert(), delete() and print(). The function print() should display the current size of the deque (capacity of deque) in terms of number of bytes.

Data Structure Used – Deque implemented by using array.

=>Creating a deque by array implentation.

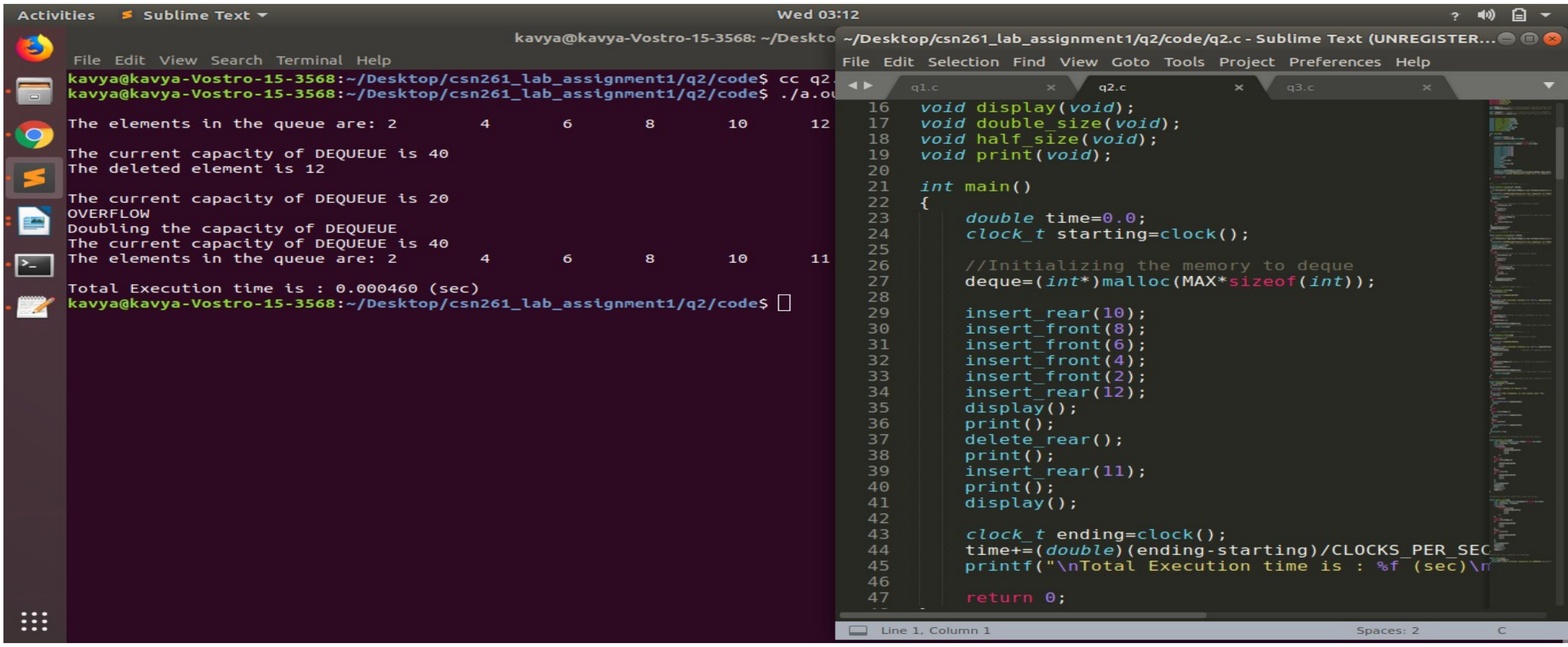
=>Giving it a Capacity and current Size.

=>Dynamic array is created by using malloc function.

=>Using Front and Rear to indicate start and end of the deque.

=>Capacity is halved when the array is filled half of it’s capacity.

=>Capacity is doubled when the array is fully filled and we have to perform insert.


Activities
Sublime Text
Wed 03:12
kavya@kavya-Vostro-15-3568: ~/Deskto
File Edit View Search Terminal Help
~/Desktop/csn261_lab_assignment1/q2/code/q2.c - Sublime Text (UNREGISTER...
File Edit Selection Find View Goto Tools Project Preferences Help
q1.c
q2.c
q3.c
Line 1, Column 1
Spaces: 2
C

```
kavya@kavya-Vostro-15-3568:~/Desktop/csn261_lab_assignment1/q2/code$ cc q2.
kavya@kavya-Vostro-15-3568:~/Desktop/csn261_lab_assignment1/q2/code$ ./a.ou

The elements in the queue are: 2        4       6       8       10      12

The current capacity of DEQUEUE is 40
The deleted element is 12

The current capacity of DEQUEUE is 20
OVERFLOW
Doubling the capacity of DEQUEUE
The current capacity of DEQUEUE is 40
The elements in the queue are: 2        4       6       8       10      11

Total Execution time is : 0.000460 (sec)
kavya@kavya-Vostro-15-3568:~/Desktop/csn261_lab_assignment1/q2/code$ 
```

```c
void display(void);
void double_size(void);
void half_size(void);
void print(void);

int main()
{
    double time=0.0;
    clock_t starting=clock();

    //Initializing the memory to deque
    deque=(int*)malloc(MAX*sizeof(int));

    insert_rear(10);
    insert_front(8);
    insert_front(6);
    insert_front(4);
    insert_front(2);
    insert_rear(12);
    display();
    print();
    delete_rear();
    print();
    insert_rear(11);
    print();
    display();

    clock_t ending=clock();
    time+=(double)(ending-starting)/CLOCKS_PER_SEC
    printf("\nTotal Execution time is : %f (sec)\n

    return 0;
```

Total Execution Time is around 0.000460 seconds

Problem Statement 3-

Given three 2D arrays (for red, green and blue color pixels) of a digital image. For a particular image pixel, the color shade of that pixel is Red if the pixel value at that position of the matrix corresponding to RED is greater than that of GREEN and BLUE. Same goes for GREEN and BLUE shades also. Write a C program that can perform following operations on the given image file:

- Remove all Red shades.
- Remove all Green shades.
- Remove all Blue shades.
- RedOnly: Preserve any red shades in the image, but remove all green and blue.
- GreenOnly: Preserve any green shades in the image, but remove all red and blue.
- BlueOnly: Preserve any blue shades in the image, but remove all red and green.

Write a function pixelValue() that has x and y as two parameters and displays the current pixel (RED, GREEN and BLUE) values of the input image at the point with coordinates (x,y), where xand y are the row and column numbers in that image file, respectively.

Perform the testing of your code with the following TestCases:

Input: Q3_ip_Red.dat, Q3_ip_Green.dat and Q3_ip_Blue.dat are the three files with red, green and blue pixel values for the image file Q3_ip.jpg

Output after removing only green: Q3_op_Red.dat, Q3_op_Green.dat and Q3_op_Blue.dat are the output files w.r.t. red, green and blue pixel values after removing green from the input file Q3_ip.jpg, respectively.

Data Structure Used- Static Array

Algorithm-

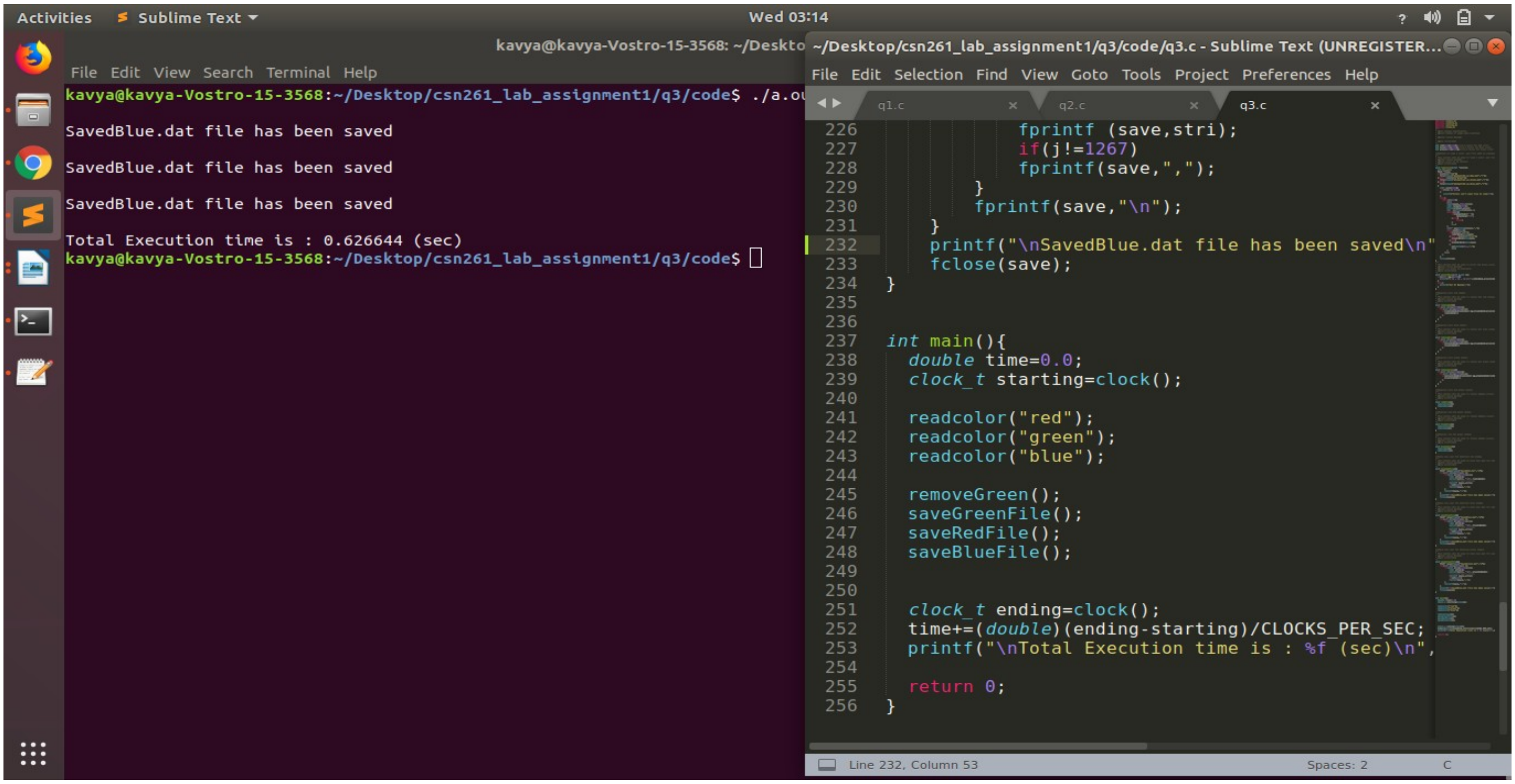
=>File is read by using fopen and read line by line using fgets.

=>An array is created to store lines and using strtok to separate of line by comma and pixel valuesof red, green , blue are stored in arrays.

=>Funtion to remove a dominant color pixel.

=>Funtion to preserve any color pixel by removing other two.

=>Taking output in files by writing the final arrays in file by using fopen with attribute write I.e “w” .


Activities
Sublime Text
Wed 03:14
kavya@kavya-Vostro-15-3568: ~/Deskto
File Edit View Search Terminal Help
~/Desktop/csn261_lab_assignment1/q3/code/q3.c - Sublime Text (UNREGISTER...
File Edit Selection Find View Goto Tools Project Preferences Help
q1.c
q2.c
q3.c
Line 232, Column 53
Spaces: 2
C

```
kavya@kavya-Vostro-15-3568:~/Desktop/csn261_lab_assignment1/q3/code$ ./a.ou

SavedBlue.dat file has been saved

SavedBlue.dat file has been saved

SavedBlue.dat file has been saved

Total Execution time is : 0.626644 (sec)
kavya@kavya-Vostro-15-3568:~/Desktop/csn261_lab_assignment1/q3/code$ 
```

```
                fprintf (save,stri);
                if(j!=1267)
                fprintf(save,",");
            }
            fprintf(save,"\n");
        }
        printf("\nSavedBlue.dat file has been saved\n"
        fclose(save);
    }


    int main(){
      double time=0.0;
      clock_t starting=clock();

      readcolor("red");
      readcolor("green");
      readcolor("blue");

      removeGreen();
      saveGreenFile();
      saveRedFile();
      saveBlueFile();


      clock_t ending=clock();
      time+=(double)(ending-starting)/CLOCKS_PER_SEC;
      printf("\nTotal Execution time is : %f (sec)\n",

      return 0;
    }
```

Total Execution Time is around 0.624466 seconds.

The new files are generated in the same directory as the program file namely newBlue.dat , newRed.dat , newGreen.dat .