Mastering Embedded System Online Diploma

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Student Management System

First Term (Final Project 2)

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1. Brief:

Student management system to store data of students, add, remove and display student data using queues, as per guidelines the max. number of students 50.

2. Functions implementations and analysis: -

2.1. Add Student manually:

2.1.1. Implementation.

```
                                        /** Add Student Manually **/
Buffer_STATUS Add_Student_Manually(FIFO_Buf_t* FIFO_Buf)
{
    int temp;

    if(List_Status(FIFO_Buf) != FIFO_No_Error && List_Status(FIFO_Buf) != FIFO_Is_Empty)
    {
        return List_Status(FIFO_Buf);
    }
    else
    {
        Message(Add Student Details);
        printf("\t| Enter Student Roll Number : ");
        scanf("%d", &temp);
        if (Check_Roll_Number(FIFO_Buf, temp) != NULL)
        {
            Error("Roll Number %d is already taken \n", temp);
            return error;
        }
        else
        {
            FIFO_Buf->head->rollNumber = temp;
        }

        printf("\t| Enter Student First Name : ");
        scanf("%s", FIFO_Buf->head->fName);

        printf("\t| Enter Student Second Name : ");
        scanf("%s", FIFO_Buf->head->sName);

        printf("\t| Enter GPA obtained : ");
        scanf("%f", &FIFO_Buf->head->GPA);

        printf("\t| Enter Course ID For Each Course : \n");
        printf("\t| ------------------------ \n");
        for (i = 0; i < 5; i++)
        {
            printf("\t\t| Course %d ID : ", i + 1);
            scanf("%d", &temp);
            while (Check_Course_ID(FIFO_Buf, temp) == 1)
            {
                Error("This Course ID Already Chosen \n");
                printf("\t\t| Course %d ID : ", i + 1);
                scanf("%d", &temp);
            }
            FIFO_Buf->head->course_ID[i] = temp;
        }

        FIFO_Buf->count++;
        if (FIFO_Buf->head == buffer_top) {FIFO_Buf->head = FIFO_Buf->base;}
        else { FIFO_Buf->head++;}

        printf("---------------------------------- \n");
        Info("Student Details is Added Successfully \n");
        printf("---------------------------------- \n");
        Count_Student(FIFO_Buf);

        return Student_Added;
    }
}
```

2.1.2. Run code:

```
PS D:\Mastering_embedded_systems\GitHub_Repo\Embedded_Systems_Online_Diploma\First_Term\Second_Project_Student_DataStructure> ./main

         *** Welcome To Student Management System ***
             ------------------------------------
Choose The Task You Want To Perform
------------------------------------
1. Add Student Details Manually.
2. Add Student Details From Text File.
3. Find Student Details By Roll Number.
4. Find Student Details By First Name.
5. Find Student Details By Course ID.
6. Find Total Number Of Student.
7. Delete Student Details By Roll Number.
8. Update Student Details By Roll Number.
9. Show All Students Details.
10. Exit.
------------------------------------
Please Enter Your Choice To Perform The Task: 1
------------------------------------
Add Student Details
------------------------------------
        | Enter Student Roll Number : 1
        | Enter Student First Name : Mina
        | Enter Student Second Name : Gamil
        | Enter GPA obtained : 3.3
        | Enter Course ID For Each Course :
        | ------------------------
                | Course 1 ID : 1
                | Course 2 ID : 2
                | Course 3 ID : 4
                | Course 4 ID : 3
                | Course 5 ID : 5
------------------------------------
[INFO] Student Details is Added Successfully
------------------------------------
[INFO] Total Number Of Student is 1
[INFO] You Can Add Up To 50 Students
[INFO] You Can Add 49 More Students
------------------------------------
Choose The Task You Want To Perform
------------------------------------
1. Add Student Details Manually.
2. Add Student Details From Text File.
3. Find Student Details By Roll Number.
4. Find Student Details By First Name.
5. Find Student Details By Course ID.
6. Find Total Number Of Student.
7. Delete Student Details By Roll Number.
8. Update Student Details By Roll Number.
9. Show All Students Details.
10. Exit.
------------------------------------
Please Enter Your Choice To Perform The Task: 9
------------------------------------
        | ------------------------
        | Student First Name  is Mina
        | Student Second Name is Gamil
        | Student Roll Number is 1
        | Student GPA Number  is 3.30
          | Student Course 1 ID is 1
          | Student Course 2 ID is 2
          | Student Course 3 ID is 4
          | Student Course 4 ID is 3
          | Student Course 5 ID is 5
```

2.2. Add Student from Files:

2.2.1. Implementations:

```
                                        /** Add Student From File **/
Buffer_STATUS Add_Student_From_File(FIFO_Buf_t* FIFO_Buf)
{
    FILE* fptr = fopen("Student.txt", "r");
    int temp;

    if(List_Status(FIFO_Buf) != FIFO_No_Error && List_Status(FIFO_Buf) != FIFO_Is_Empty)
    {
        return List_Status(FIFO_Buf);
    }
    else
    {
        while (!feof(fptr))
        {
            fscanf(fptr,"%d", &temp);
            if (Check_Roll_Number(FIFO_Buf, temp) != NULL)
            {
                Error("Roll Number %d is already taken \n", temp);
                fscanf(fptr,"%*s %*s %*f %*d %*d %*d %*d");
            }
            else
            {
                FIFO_Buf->head->rollNumber = temp;
                fscanf(fptr,"%s", FIFO_Buf->head->fName);
                fscanf(fptr,"%s", FIFO_Buf->head->sName);
                fscanf(fptr,"%f", &FIFO_Buf->head->GPA);
                for (i = 0; i < 5; i++)
                {
                    fscanf(fptr, "%d", &FIFO_Buf->head->course_ID[i]);
                }
                Info("Roll Number %d saved successfully\n", FIFO_Buf->head->rollNumber);
                FIFO_Buf->count++;
                if (FIFO_Buf->head == buffer_top) {FIFO_Buf->head = FIFO_Buf->base;}
                else { FIFO_Buf->head++;}
            }
        }
        fclose(fptr);
        printf("---------------------------------- \n");
        Info("Students Details Added Successfully.\n");
        printf("---------------------------------- \n");
        Count_Student(FIFO_Buf);

        return Student_Added;
    }
}
```

2.2.2. Run Code:

```
-----------------------------------
Choose The Task You Want To Perform
-----------------------------------
1. Add Student Details Manually.
2. Add Student Details From Text File.
3. Find Student Details By Roll Number.
4. Find Student Details By First Name.
5. Find Student Details By Course ID.
6. Find Total Number Of Student.
7. Delete Student Details By Roll Number.
8. Update Student Details By Roll Number.
9. Show All Students Details.
10. Exit.
-----------------------------------
Please Enter Your Choice To Perform The Task: 2
-----------------------------------
| [ERROR] Roll Number 1 is already taken
-----------------------------------

-----------------------------------
| [ERROR] Roll Number 1 is already taken
-----------------------------------
[INFO] Roll Number 2 saved successfully
[INFO] Roll Number 3 saved successfully
[INFO] Roll Number 4 saved successfully
[INFO] Roll Number 5 saved successfully
-----------------------------------
[INFO] Students Details Added Successfully.
-----------------------------------
[INFO] Total Number Of Student is 5
[INFO] You Can Add Up To 50 Students
[INFO] You Can Add 45 More Students
-----------------------------------
Choose The Task You Want To Perform
-----------------------------------
1. Add Student Details Manually.
2. Add Student Details From Text File.
3. Find Student Details By Roll Number.
4. Find Student Details By First Name.
5. Find Student Details By Course ID.
6. Find Total Number Of Student.
7. Delete Student Details By Roll Number.
8. Update Student Details By Roll Number.
9. Show All Students Details.
10. Exit.
-----------------------------------
```

```
-----------------------------------
Please Enter Your Choice To Perform The Task: 9
-----------------------------------
        | --------------------------
        | Student First Name  is Mina
        | Student Second Name is Gamil
        | Student Roll Number is 1
        | Student GPA Number  is 3.30
          | Student Course 1 ID is 1
          | Student Course 2 ID is 2
          | Student Course 3 ID is 4
          | Student Course 4 ID is 3
          | Student Course 5 ID is 5
        | --------------------------
        | Student First Name  is Moudi
        | Student Second Name is Gamil
        | Student Roll Number is 2
        | Student GPA Number  is 3.80
          | Student Course 1 ID is 2
          | Student Course 2 ID is 3
          | Student Course 3 ID is 4
          | Student Course 4 ID is 5
          | Student Course 5 ID is 6
        | --------------------------
        | Student First Name  is Marcello
        | Student Second Name is Gamil
        | Student Roll Number is 3
        | Student GPA Number  is 3.70
          | Student Course 1 ID is 5
          | Student Course 2 ID is 6
          | Student Course 3 ID is 7
          | Student Course 4 ID is 8
          | Student Course 5 ID is 9
        | --------------------------
        | Student First Name  is Mina
        | Student Second Name is Emad
        | Student Roll Number is 4
        | Student GPA Number  is 3.30
          | Student Course 1 ID is 2
          | Student Course 2 ID is 5
          | Student Course 3 ID is 8
          | Student Course 4 ID is 4
          | Student Course 5 ID is 6
        | --------------------------
        | Student First Name  is Mina
        | Student Second Name is Wagdy
        | Student Roll Number is 5
        | Student GPA Number  is 3.80
          | Student Course 1 ID is 3
          | Student Course 2 ID is 4
          | Student Course 3 ID is 6
          | Student Course 4 ID is 7
          | Student Course 5 ID is 9
```

2.3. Find Student by Roll Number:

2.3.1. Implementation:

```c
                                        /** Find Student Using Roll Numbr **/
Buffer_STATUS Find_Student_By_RollNumber(FIFO_Buf_t* FIFO_Buf)
{
    int temp;
    Element_Type* temp_ptr;

    if(List_Status(FIFO_Buf) != FIFO_No_Error && List_Status(FIFO_Buf) != FIFO_Is_Full)
    {
        return List_Status(FIFO_Buf);
    }
    else
    {
        printf("---------------------------------- \n");
        printf("Enter Student Roll Number : ");
        scanf("%d", &temp);

        temp_ptr = Check_Roll_Number(FIFO_Buf, temp);

        if (temp_ptr)
        {
            printf("---------------------------------- \n");
            printf("Student Roll Number %d Details :-\n", temp);
            printf("---------------------------------- \n");
            print_One_Student(temp_ptr);
            printf("---------------------------------- \n");
            return FIFO_No_Error;
        }

        Error("Roll Number %d Not Found. \n", temp);
        return Student_Not_Found;
    }
}
```

2.3.2. Run Code:

```
          | Student Course 4 ID is 4
          | Student Course 5 ID is 6
        | ------------------------
        | Student First Name  is Mina
        | Student Second Name is Wagdy
        | Student Roll Number is 5
        | Student GPA Number  is 3.80
          | Student Course 1 ID is 3
          | Student Course 2 ID is 4
          | Student Course 3 ID is 6
          | Student Course 4 ID is 7
          | Student Course 5 ID is 9
-----------------------------------
Choose The Task You Want To Perform
-----------------------------------
1. Add Student Details Manually.
2. Add Student Details From Text File.
3. Find Student Details By Roll Number.
4. Find Student Details By First Name.
5. Find Student Details By Course ID.
6. Find Total Number Of Student.
7. Delete Student Details By Roll Number.
8. Update Student Details By Roll Number.
9. Show All Students Details.
10. Exit.
-----------------------------------
Please Enter Your Choice To Perform The Task: 3
-----------------------------------
Enter Student Roll Number : 5
-----------------------------------
Student Roll Number 5 Details :-
-----------------------------------
        | ------------------------
        | Student First Name  : Mina
        | Student Second Name : Wagdy
        | Student Roll Number : 5
        | Student GPA Number  : 3.80
          | Student Course 1 ID 3
          | Student Course 2 ID 4
          | Student Course 3 ID 6
          | Student Course 4 ID 7
          | Student Course 5 ID 9
-----------------------------------
Choose The Task You Want To Perform
-----------------------------------
1. Add Student Details Manually.
2. Add Student Details From Text File.
3. Find Student Details By Roll Number.
4. Find Student Details By First Name.
5. Find Student Details By Course ID.
6. Find Total Number Of Student.
7. Delete Student Details By Roll Number.
8. Update Student Details By Roll Number.
9. Show All Students Details.
10. Exit.
-----------------------------------
Please Enter Your Choice To Perform The Task: 3
-----------------------------------
Enter Student Roll Number : 6
-----------------------------------
| [ERROR] Roll Number 6 Not Found.
-----------------------------------
Choose The Task You Want To Perform
-----------------------------------
1. Add Student Details Manually.
2. Add Student Details From Text File.
3. Find Student Details By Roll Number.
4. Find Student Details By First Name.
5. Find Student Details By Course ID.
6. Find Total Number Of Student.
7. Delete Student Details By Roll Number.
8. Update Student Details By Roll Number.
9. Show All Students Details.
10. Exit.
-----------------------------------
```

2.4. Find Student by First Name:

2.4.1. Implementation:

```
                                        /** Find Student Using First Name **/
Buffer_STATUS Find_Student_By_FirstName(FIFO_Buf_t* FIFO_Buf)
{
    char temp_Name[30];
    int flag = 0;
    int temp_count = 0;
    Element_Type* temp_ptr;

    if(List_Status(FIFO_Buf) != FIFO_No_Error && List_Status(FIFO_Buf) != FIFO_Is_Full)
    {
        return List_Status(FIFO_Buf);
    }
    else
    {
        temp_ptr = FIFO_Buf->base;

        printf("---------------------------------- \n");
        printf("Enter Student First Name : ");
        scanf("%s", temp_Name);


        while (temp_count != FIFO_Buf->count)
        {
            if (strcmpi(temp_Name, temp_ptr->fName) == 0)
            {
                printf("---------------------------------- \n");
                printf("Student with First Name %s Details :-\n", temp_Name);
                printf("---------------------------------- \n");
                print_One_Student(temp_ptr);
                flag++;
            }
            temp_count++;
            temp_ptr++;
        }
        printf("---------------------------------- \n");
        if (flag == 0)
        {
            Error("No Student With First Name %s. \n", temp_Name);
            return Student_Not_Found;
        }
        else
        {
            return Student_Found;
        }
    }
}
```

2.4.2. Run Code:

```
------------------------------------
Choose The Task You Want To Perform
------------------------------------
1. Add Student Details Manually.
2. Add Student Details From Text File.
3. Find Student Details By Roll Number.
4. Find Student Details By First Name.
5. Find Student Details By Course ID.
6. Find Total Number Of Student.
7. Delete Student Details By Roll Number.
8. Update Student Details By Roll Number.
9. Show All Students Details.
10. Exit.
------------------------------------
Please Enter Your Choice To Perform The Task: 9
------------------------------------
        | ---------------------------
        | Student First Name  is Mina
        | Student Second Name is Gamil
        | Student Roll Number is 1
        | Student GPA Number  is 3.50
          | Student Course 1 ID is 1
          | Student Course 2 ID is 2
          | Student Course 3 ID is 3
          | Student Course 4 ID is 4
          | Student Course 5 ID is 5
        | ---------------------------
        | Student First Name  is Moudi
        | Student Second Name is Gamil
        | Student Roll Number is 2
        | Student GPA Number  is 3.80
          | Student Course 1 ID is 2
          | Student Course 2 ID is 3
          | Student Course 3 ID is 4
          | Student Course 4 ID is 5
          | Student Course 5 ID is 6
        | ---------------------------
        | Student First Name  is Marcello
        | Student Second Name is Gamil
        | Student Roll Number is 3
        | Student GPA Number  is 3.70
          | Student Course 1 ID is 5
          | Student Course 2 ID is 6
          | Student Course 3 ID is 7
          | Student Course 4 ID is 8
          | Student Course 5 ID is 9
        | ---------------------------
        | Student First Name  is Mina
        | Student Second Name is Emad
        | Student Roll Number is 4
        | Student GPA Number  is 3.30
          | Student Course 1 ID is 2
          | Student Course 2 ID is 5
          | Student Course 3 ID is 8
          | Student Course 4 ID is 4
          | Student Course 5 ID is 6
        | ---------------------------
        | Student First Name  is Mina
        | Student Second Name is Wagdy
        | Student Roll Number is 5
        | Student GPA Number  is 3.80
          | Student Course 1 ID is 3
          | Student Course 2 ID is 4
          | Student Course 3 ID is 6
          | Student Course 4 ID is 7
          | Student Course 5 ID is 9
------------------------------------
```

```
------------------------------------
Choose The Task You Want To Perform
------------------------------------
1. Add Student Details Manually.
2. Add Student Details From Text File.
3. Find Student Details By Roll Number.
4. Find Student Details By First Name.
5. Find Student Details By Course ID.
6. Find Total Number Of Student.
7. Delete Student Details By Roll Number.
8. Update Student Details By Roll Number.
9. Show All Students Details.
10. Exit.
------------------------------------
Please Enter Your Choice To Perform The Task: 4
------------------------------------
Enter Student First Name : Mina
------------------------------------
Student with First Name Mina Details :-
------------------------------------
        | ---------------------------
        | Student First Name  : Mina
        | Student Second Name : Gamil
        | Student Roll Number : 1
        | Student GPA Number  : 3.50
          | Student Course 1 ID 1
          | Student Course 2 ID 2
          | Student Course 3 ID 3
          | Student Course 4 ID 4
          | Student Course 5 ID 5
------------------------------------
Student with First Name Mina Details :-
------------------------------------
        | ---------------------------
        | Student First Name  : Mina
        | Student Second Name : Emad
        | Student Roll Number : 4
        | Student GPA Number  : 3.30
          | Student Course 1 ID 2
          | Student Course 2 ID 5
          | Student Course 3 ID 8
          | Student Course 4 ID 4
          | Student Course 5 ID 6
------------------------------------
Student with First Name Mina Details :-
------------------------------------
        | ---------------------------
        | Student First Name  : Mina
        | Student Second Name : Wagdy
        | Student Roll Number : 5
        | Student GPA Number  : 3.80
          | Student Course 1 ID 3
          | Student Course 2 ID 4
          | Student Course 3 ID 6
          | Student Course 4 ID 7
          | Student Course 5 ID 9
------------------------------------
Choose The Task You Want To Perform
------------------------------------
1. Add Student Details Manually.
2. Add Student Details From Text File.
3. Find Student Details By Roll Number.
4. Find Student Details By First Name.
5. Find Student Details By Course ID.
6. Find Total Number Of Student.
7. Delete Student Details By Roll Number.
8. Update Student Details By Roll Number.
9. Show All Students Details.
10. Exit.
------------------------------------
Please Enter Your Choice To Perform The Task: 4
------------------------------------
Enter Student First Name : Joseph
------------------------------------
------------------------------------
| [ERROR] No Student With First Name Joseph.
------------------------------------
Choose The Task You Want To Perform
------------------------------------
```

2.5. Find Student by Course ID:

2.5.1. Implementation:

```
                                        /** Find Student Using Course ID **/
Buffer_STATUS Find_Student_By_CourseID(FIFO_Buf_t* FIFO_Buf)
{
    int temp, flag = 0;
    int temp_count = 0;
    Element_Type* temp_ptr;

    if(List_Status(FIFO_Buf) != FIFO_No_Error && List_Status(FIFO_Buf) != FIFO_Is_Full)
    {
        return List_Status(FIFO_Buf);
    }
    else
    {
        temp_ptr = FIFO_Buf->base;

        printf("---------------------------------- \n");
        printf("Enter Student Course ID : ");
        scanf("%d", &temp);
        printf("---------------------------------- \n");
        printf("Students Enroll Course ID %d Details :-\n", temp);
        printf("---------------------------------- \n");

        while (temp_count != FIFO_Buf->count)
        {
            for (i = 0; i < 5; i++)
            {
                if (temp == temp_ptr->course_ID[i])
                {
                    printf("\t| ------------------------ \n");
                    printf("\t| Student First Name  : %s\n", temp_ptr->fName);
                    printf("\t| Student Second Name : %s\n", temp_ptr->sName);
                    printf("\t| Student Roll Number : %d\n", temp_ptr->rollNumber);
                    printf("\t| Student GPA Number  : %.2f\n", temp_ptr->GPA);
                    flag++;
                }
            }
            temp_count++;
            temp_ptr++;
        }

        if (flag == 0)
        {
            Error("No Student Enrolled Course ID %d. \n", temp);
            return Student_Not_Found;
        }
        else
        {
            printf("---------------------------------- \n");
            return Student_Found;
        }
    }
}
```

2.5.2. Run Code:

```
-----------------------------------
Choose The Task You Want To Perform
-----------------------------------
1. Add Student Details Manually.
2. Add Student Details From Text File.
3. Find Student Details By Roll Number.
4. Find Student Details By First Name.
5. Find Student Details By Course ID.
6. Find Total Number Of Student.
7. Delete Student Details By Roll Number.
8. Update Student Details By Roll Number.
9. Show All Students Details.
10. Exit.
-----------------------------------
Please Enter Your Choice To Perform The Task: 9
-----------------------------------
        | --------------------------
        | Student First Name  is Mina
        | Student Second Name is Gamil
        | Student Roll Number is 1
        | Student GPA Number  is 3.50
          | Student Course 1 ID is 1
          | Student Course 2 ID is 2
          | Student Course 3 ID is 3
          | Student Course 4 ID is 4
          | Student Course 5 ID is 5
        | --------------------------
        | Student First Name  is Moudi
        | Student Second Name is Gamil
        | Student Roll Number is 2
        | Student GPA Number  is 3.80
          | Student Course 1 ID is 2
          | Student Course 2 ID is 3
          | Student Course 3 ID is 4
          | Student Course 4 ID is 5
          | Student Course 5 ID is 6
        | --------------------------
        | Student First Name  is Marcello
        | Student Second Name is Gamil
        | Student Roll Number is 3
        | Student GPA Number  is 3.70
          | Student Course 1 ID is 5
          | Student Course 2 ID is 6
          | Student Course 3 ID is 7
          | Student Course 4 ID is 8
          | Student Course 5 ID is 9
        | --------------------------
        | Student First Name  is Mina
        | Student Second Name is Emad
        | Student Roll Number is 4
        | Student GPA Number  is 3.30
          | Student Course 1 ID is 2
          | Student Course 2 ID is 5
          | Student Course 3 ID is 8
          | Student Course 4 ID is 4
          | Student Course 5 ID is 6
        | --------------------------
        | Student First Name  is Mina
        | Student Second Name is Wagdy
        | Student Roll Number is 5
        | Student GPA Number  is 3.80
          | Student Course 1 ID is 3
          | Student Course 2 ID is 4
          | Student Course 3 ID is 6
          | Student Course 4 ID is 7
          | Student Course 5 ID is 9
```

```
-----------------------------------
Choose The Task You Want To Perform
-----------------------------------
1. Add Student Details Manually.
2. Add Student Details From Text File.
3. Find Student Details By Roll Number.
4. Find Student Details By First Name.
5. Find Student Details By Course ID.
6. Find Total Number Of Student.
7. Delete Student Details By Roll Number.
8. Update Student Details By Roll Number.
9. Show All Students Details.
10. Exit.
-----------------------------------
Please Enter Your Choice To Perform The Task: 5
-----------------------------------
Enter Student Course ID : 5
-----------------------------------
Students Enroll Course ID 5 Details :-
-----------------------------------
        | --------------------------
        | Student First Name  : Mina
        | Student Second Name : Gamil
        | Student Roll Number : 1
        | Student GPA Number  : 3.50
        | --------------------------
        | Student First Name  : Moudi
        | Student Second Name : Gamil
        | Student Roll Number : 2
        | Student GPA Number  : 3.80
        | --------------------------
        | Student First Name  : Marcello
        | Student Second Name : Gamil
        | Student Roll Number : 3
        | Student GPA Number  : 3.70
        | --------------------------
        | Student First Name  : Mina
        | Student Second Name : Emad
        | Student Roll Number : 4
        | Student GPA Number  : 3.30
-----------------------------------
Choose The Task You Want To Perform
-----------------------------------
1. Add Student Details Manually.
2. Add Student Details From Text File.
3. Find Student Details By Roll Number.
4. Find Student Details By First Name.
5. Find Student Details By Course ID.
6. Find Total Number Of Student.
7. Delete Student Details By Roll Number.
8. Update Student Details By Roll Number.
9. Show All Students Details.
10. Exit.
-----------------------------------
Please Enter Your Choice To Perform The Task: 5
-----------------------------------
Enter Student Course ID : 10
-----------------------------------
Students Enroll Course ID 10 Details :-
-----------------------------------

-----------------------------------
| [ERROR] No Student Enrolled Course ID 10.
-----------------------------------
```

2.6. Find Total Number of Student:

2.6.1. Implementation:

```
                                    /** Find Total Number of Students **/
Buffer_STATUS Count_Student(FIFO_Buf_t* FIFO_Buf)
{
    if(List_Status(FIFO_Buf) != FIFO_No_Error && List_Status(FIFO_Buf) != FIFO_Is_Full)
    {
        return List_Status(FIFO_Buf);
    }
    else
    {
        Info("Total Number Of Student is %d \n", FIFO_Buf->count);
        Info("You Can Add Up To %d Students \n", FIFO_Buf->length);
        Info("You Can Add %d More Students \n", FIFO_Buf->length - FIFO_Buf->count);
        printf("---------------------------------- \n");
        return FIFO_No_Error;
    }
}
```

2.6.2. Run Code:

```
----------------------------------
Choose The Task You Want To Perform
----------------------------------
1. Add Student Details Manually.
2. Add Student Details From Text File.
3. Find Student Details By Roll Number.
4. Find Student Details By First Name.
5. Find Student Details By Course ID.
6. Find Total Number Of Student.
7. Delete Student Details By Roll Number.
8. Update Student Details By Roll Number.
9. Show All Students Details.
10. Exit.
----------------------------------
Please Enter Your Choice To Perform The Task: 6
----------------------------------
[INFO] Total Number Of Student is 5
[INFO] You Can Add Up To 50 Students
[INFO] You Can Add 45 More Students
----------------------------------
```

2.7. Delete Student by Roll Number:

2.7.1. Implementation:

```
                                        /** Remove Student Using Roll Numbr **/
Buffer_STATUS Remove_Student_By_RollNumber(FIFO_Buf_t* FIFO_Buf)
{
    int temp;
    Element_Type* temp_ptr = NULL;
    Element_Type* Dest_ptr = NULL;

    if(List_Status(FIFO_Buf) != FIFO_No_Error && List_Status(FIFO_Buf) != FIFO_Is_Full)
    {
        return List_Status(FIFO_Buf);
    }
    else
    {
        printf("---------------------------------- \n");
        printf("Enter Student Roll Number to Delete: ");
        scanf("%d", &temp);

        Dest_ptr = Check_Roll_Number(FIFO_Buf, temp);
        temp_ptr = Dest_ptr;

        if (!Dest_ptr)
        {
            Error("Student Roll Number %d Not Found\n", temp);
            return Student_Not_Found;
        }
        else
        {
            struct sinfo Zero;
            while (temp_ptr != FIFO_Buf->head)
            {
                temp_ptr++;
                *(Dest_ptr) = *(temp_ptr);
                *(temp_ptr) = Zero;
                Dest_ptr++;
            }
            printf("---------------------------------- \n");
            Info("Student Roll Number %d Removed Successfully.\n", temp);
            printf("---------------------------------- \n");
            FIFO_Buf->count--;
            FIFO_Buf->head--;
            return Student_Removed;
        }
    }
}
```

2.7.2. Run Code:

```
-----------------------------------
Choose The Task You Want To Perform
-----------------------------------
1. Add Student Details Manually.
2. Add Student Details From Text File.
3. Find Student Details By Roll Number.
4. Find Student Details By First Name.
5. Find Student Details By Course ID.
6. Find Total Number Of Student.
7. Delete Student Details By Roll Number.
8. Update Student Details By Roll Number.
9. Show All Students Details.
10. Exit.
-----------------------------------
Please Enter Your Choice To Perform The Task: 9
-----------------------------------
        | --------------------------
        | Student First Name  is Mina
        | Student Second Name is Gamil
        | Student Roll Number is 1
        | Student GPA Number  is 3.50
          | Student Course 1 ID is 1
          | Student Course 2 ID is 2
          | Student Course 3 ID is 3
          | Student Course 4 ID is 4
          | Student Course 5 ID is 5
        | --------------------------
        | Student First Name  is Moudi
        | Student Second Name is Gamil
        | Student Roll Number is 2
        | Student GPA Number  is 3.80
          | Student Course 1 ID is 2
          | Student Course 2 ID is 3
          | Student Course 3 ID is 4
          | Student Course 4 ID is 5
          | Student Course 5 ID is 6
        | --------------------------
        | Student First Name  is Marcello
        | Student Second Name is Gamil
        | Student Roll Number is 3
        | Student GPA Number  is 3.70
          | Student Course 1 ID is 5
          | Student Course 2 ID is 6
          | Student Course 3 ID is 7
          | Student Course 4 ID is 8
          | Student Course 5 ID is 9
        | --------------------------
        | Student First Name  is Mina
        | Student Second Name is Emad
        | Student Roll Number is 4
        | Student GPA Number  is 3.30
          | Student Course 1 ID is 2
          | Student Course 2 ID is 5
          | Student Course 3 ID is 8
          | Student Course 4 ID is 4
          | Student Course 5 ID is 6
        | --------------------------
        | Student First Name  is Mina
        | Student Second Name is Wagdy
        | Student Roll Number is 5
        | Student GPA Number  is 3.80
          | Student Course 1 ID is 3
          | Student Course 2 ID is 4
          | Student Course 3 ID is 6
          | Student Course 4 ID is 7
          | Student Course 5 ID is 9
```

```
-----------------------------------
Choose The Task You Want To Perform
-----------------------------------
1. Add Student Details Manually.
2. Add Student Details From Text File.
3. Find Student Details By Roll Number.
4. Find Student Details By First Name.
5. Find Student Details By Course ID.
6. Find Total Number Of Student.
7. Delete Student Details By Roll Number.
8. Update Student Details By Roll Number.
9. Show All Students Details.
10. Exit.
-----------------------------------
Please Enter Your Choice To Perform The Task: 7
-----------------------------------
Enter Student Roll Number to Delete: 5
-----------------------------------
[INFO] Student Roll Number 5 Removed Successfully.
-----------------------------------
Choose The Task You Want To Perform
-----------------------------------
1. Add Student Details Manually.
2. Add Student Details From Text File.
3. Find Student Details By Roll Number.
4. Find Student Details By First Name.
5. Find Student Details By Course ID.
6. Find Total Number Of Student.
7. Delete Student Details By Roll Number.
8. Update Student Details By Roll Number.
9. Show All Students Details.
10. Exit.
-----------------------------------
Please Enter Your Choice To Perform The Task: 9
-----------------------------------
        | --------------------------
        | Student First Name  is Mina
        | Student Second Name is Gamil
        | Student Roll Number is 1
        | Student GPA Number  is 3.50
          | Student Course 1 ID is 1
          | Student Course 2 ID is 2
          | Student Course 3 ID is 3
          | Student Course 4 ID is 4
          | Student Course 5 ID is 5
        | --------------------------
        | Student First Name  is Moudi
        | Student Second Name is Gamil
        | Student Roll Number is 2
        | Student GPA Number  is 3.80
          | Student Course 1 ID is 2
          | Student Course 2 ID is 3
          | Student Course 3 ID is 4
          | Student Course 4 ID is 5
          | Student Course 5 ID is 6
        | --------------------------
        | Student First Name  is Marcello
        | Student Second Name is Gamil
        | Student Roll Number is 3
        | Student GPA Number  is 3.70
          | Student Course 1 ID is 5
          | Student Course 2 ID is 6
          | Student Course 3 ID is 7
          | Student Course 4 ID is 8
          | Student Course 5 ID is 9
        | --------------------------
        | Student First Name  is Mina
        | Student Second Name is Emad
        | Student Roll Number is 4
        | Student GPA Number  is 3.30
          | Student Course 1 ID is 2
          | Student Course 2 ID is 5
          | Student Course 3 ID is 8
          | Student Course 4 ID is 4
          | Student Course 5 ID is 6
-----------------------------------
```

2.8. Update Student by Roll Number:

2.8.1. Implementation:

```c
/** update Student Using Roll Numbr **/
Buffer_STATUS Update_Student_By_RollNumber(FIFO_Buf_t* FIFO_Buf)
{
    int temp,choice;
    Element_Type* temp_ptr = NULL;

    if(List_Status(FIFO_Buf) != FIFO_No_Error && List_Status(FIFO_Buf) != FIFO_Is_Full)
    {
        return List_Status(FIFO_Buf);
    }
    else
    {
        printf("---------------------------------- \n");
        printf("Enter Student Roll Number To Update : ");
        scanf("%d", &temp);

        temp_ptr = Check_Roll_Number(FIFO_Buf, temp);

        if(!temp_ptr)
        {
            Error("Student Roll Number %d Not Found\n", temp);
            return Student_Not_Found;
        }
        else
        {
            printf("---------------------- \n");
            printf("1. First Name.\n");
            printf("2. Second Name.\n");
            printf("3. Roll Number.\n");
            printf("4. GPA Number.\n");
            printf("5. Courses ID.\n");
            printf("Choose option to update : ");
            scanf("%d", &choice);
            printf("---------------------------------- \n");

            switch (choice)
            {
            case 1:
                printf("Enter New First Name : ");
                scanf("%s", temp_ptr->fName);
                break;

            case 2:
                printf("Enter New Second Name : ");
                scanf("%s", temp_ptr->sName);
                break;

            case 3:
                printf("Enter New Roll Number : ");
                scanf("%d", &temp);
                if(Check_Roll_Number(FIFO_Buf, temp) == NULL)
                {
                    temp_ptr->rollNumber = temp;
                }
                else
                {
                    Error("Roll Number %d is already taken \n", temp);
                    return error;
                }
                break;

            case 4:
                printf("Enter New GPA Number : ");
                scanf("%f", &temp_ptr->GPA);
                break;

            case 5:
                printf("\t Course 1 ID.\n");
                printf("\t Course 2 ID.\n");
                printf("\t Course 3 ID.\n");
                printf("\t Course 4 ID.\n");
                printf("\t Course 5 ID.\n");
                printf("\tChoose Course to update : ");
                scanf("%d", &temp);
                printf("Enter New Course %d ID : ", temp);
                scanf("%d", &temp_ptr->course_ID[temp-1]);
                break;

            default:
                break;
            }
            printf("---------------------------------- \n");
            Info("\tUPDATED SUCCESSFULLY!\n");
            printf("---------------------------------- \n");
        }
    }
```

2.8.2. Run Code:

```
------------------------------------
Choose The Task You Want To Perform
------------------------------------
1. Add Student Details Manually.
2. Add Student Details From Text File.
3. Find Student Details By Roll Number.
4. Find Student Details By First Name.
5. Find Student Details By Course ID.
6. Find Total Number Of Student.
7. Delete Student Details By Roll Number.
8. Update Student Details By Roll Number.
9. Show All Students Details.
10. Exit.
------------------------------------
Please Enter Your Choice To Perform The Task: 3
------------------------------------
Enter Student Roll Number : 4
------------------------------------
Student Roll Number 4 Details :-
------------------------------------
        | --------------------------
        | Student First Name  : Mina
        | Student Second Name : Emad
        | Student Roll Number : 4
        | Student GPA Number  : 3.30
          | Student Course 1 ID 2
          | Student Course 2 ID 5
          | Student Course 3 ID 8
          | Student Course 4 ID 4
          | Student Course 5 ID 6
------------------------------------
Choose The Task You Want To Perform
------------------------------------
1. Add Student Details Manually.
2. Add Student Details From Text File.
3. Find Student Details By Roll Number.
4. Find Student Details By First Name.
5. Find Student Details By Course ID.
6. Find Total Number Of Student.
7. Delete Student Details By Roll Number.
8. Update Student Details By Roll Number.
9. Show All Students Details.
10. Exit.
------------------------------------
Please Enter Your Choice To Perform The Task: 8
------------------------------------
Enter Student Roll Number To Update : 4
------------------------
1. First Name.
2. Second Name.
3. Roll Number.
4. GPA Number.
5. Courses ID.
Choose option to update : 4
------------------------------------
Enter New GPA Number : 3.4
------------------------------------
[INFO]  UPDATED SUCCESSFULLY!
------------------------------------
```

```
------------------------------------
Enter Student Roll Number To Update : 4
------------------------
1. First Name.
2. Second Name.
3. Roll Number.
4. GPA Number.
5. Courses ID.
Choose option to update : 4
------------------------------------
Enter New GPA Number : 3.4
------------------------------------
[INFO]  UPDATED SUCCESSFULLY!
------------------------------------
Choose The Task You Want To Perform
------------------------------------
1. Add Student Details Manually.
2. Add Student Details From Text File.
3. Find Student Details By Roll Number.
4. Find Student Details By First Name.
5. Find Student Details By Course ID.
6. Find Total Number Of Student.
7. Delete Student Details By Roll Number.
8. Update Student Details By Roll Number.
9. Show All Students Details.
10. Exit.
------------------------------------
Please Enter Your Choice To Perform The Task: 3
------------------------------------
Enter Student Roll Number : 4
------------------------------------
Student Roll Number 4 Details :-
------------------------------------
        | --------------------------
        | Student First Name  : Mina
        | Student Second Name : Emad
        | Student Roll Number : 4
        | Student GPA Number  : 3.40
          | Student Course 1 ID 2
          | Student Course 2 ID 5
          | Student Course 3 ID 8
          | Student Course 4 ID 4
          | Student Course 5 ID 6
```

2.9. Show All Students Data:

2.9.1. Implementation:

```c
                                        /** Print All Students Details **/
Buffer_STATUS Print_All_Details(FIFO_Buf_t* FIFO_Buf)
{
    Element_Type* temp_ptr;
    unsigned int temp_Count = 0;

    if(List_Status(FIFO_Buf) != FIFO_No_Error && List_Status(FIFO_Buf) != FIFO_Is_Full)
    {
        return List_Status(FIFO_Buf);
    }
    else
    {
        printf("---------------------------------- \n");
        temp_ptr = FIFO_Buf->base;
        while (temp_Count != FIFO_Buf->count)
        {
            printf("\t| ------------------------ \n");
            printf("\t| Student First Name  is %s\n", temp_ptr->fName);
            printf("\t| Student Second Name is %s\n", temp_ptr->sName);
            printf("\t| Student Roll Number is %d\n", temp_ptr->rollNumber);
            printf("\t| Student GPA Number  is %.2f\n", temp_ptr->GPA);
            for (i = 0; i < 5; i++)
            {
                printf("\t  | Student Course %d ID is %d \n", i + 1, temp_ptr->course_ID[i]);
            }
            temp_Count++;
            temp_ptr++;
        }
        printf("---------------------------------- \n");
        return FIFO_No_Error;
    }
}
```

2.9.2. Run Code:

```
-----------------------------------
Choose The Task You Want To Perform
-----------------------------------
1. Add Student Details Manually.
2. Add Student Details From Text File.
3. Find Student Details By Roll Number.
4. Find Student Details By First Name.
5. Find Student Details By Course ID.
6. Find Total Number Of Student.
7. Delete Student Details By Roll Number.
8. Update Student Details By Roll Number.
9. Show All Students Details.
10. Exit.
-----------------------------------
Please Enter Your Choice To Perform The Task: 9
-----------------------------------
        | ------------------------
        | Student First Name  is Mina
        | Student Second Name is Gamil
        | Student Roll Number is 1
        | Student GPA Number  is 3.50
          | Student Course 1 ID is 1
          | Student Course 2 ID is 2
          | Student Course 3 ID is 3
          | Student Course 4 ID is 4
          | Student Course 5 ID is 5
        | ------------------------
        | Student First Name  is Moudi
        | Student Second Name is Gamil
        | Student Roll Number is 2
        | Student GPA Number  is 3.80
          | Student Course 1 ID is 2
          | Student Course 2 ID is 3
          | Student Course 3 ID is 4
          | Student Course 4 ID is 5
          | Student Course 5 ID is 6
        | ------------------------
        | Student First Name  is Marcello
        | Student Second Name is Gamil
        | Student Roll Number is 3
        | Student GPA Number  is 3.70
          | Student Course 1 ID is 5
          | Student Course 2 ID is 6
          | Student Course 3 ID is 7
          | Student Course 4 ID is 8
          | Student Course 5 ID is 9
        | ------------------------
        | Student First Name  is Mina
        | Student Second Name is Emad
        | Student Roll Number is 4
        | Student GPA Number  is 3.40
          | Student Course 1 ID is 2
          | Student Course 2 ID is 5
          | Student Course 3 ID is 8
          | Student Course 4 ID is 4
          | Student Course 5 ID is 6
-----------------------------------
```

2.10. Exit Code:

2.10.1. Implementation:

```
case 10:
    exit(0);
    break;
```

2.10.2. Run Code:

```
-----------------------------------
Choose The Task You Want To Perform
-----------------------------------
1. Add Student Details Manually.
2. Add Student Details From Text File.
3. Find Student Details By Roll Number.
4. Find Student Details By First Name.
5. Find Student Details By Course ID.
6. Find Total Number Of Student.
7. Delete Student Details By Roll Number.
8. Update Student Details By Roll Number.
9. Show All Students Details.
10. Exit.
-----------------------------------
Please Enter Your Choice To Perform The Task: 10
PS D:\Mastering_embedded_systems\GitHub_Repo\Embedded_Systems_Online_Diploma\First_Term\Second_Project_Student_DataStructure>
```

3. Some Useful Functions:

3.1. Print Student Data:

```c
/** print Student API **/
void print_One_Student(Element_Type* Current_Head)
{
    Element_Type* temp_ptr = Current_Head;

    printf("\t| ------------------------ \n");
    printf("\t| Student First Name  : %s\n", temp_ptr->fName);
    printf("\t| Student Second Name : %s\n", temp_ptr->sName);
    printf("\t| Student Roll Number : %d\n", temp_ptr->rollNumber);
    printf("\t| Student GPA Number  : %.2f\n", temp_ptr->GPA);
    for (i = 0; i < 5; i++)
    {
        printf("\t  | Student Course %d ID %d \n", i + 1, temp_ptr->course_ID[i]);
    }
}
```

3.2. Check Roll Number:

```c
/** Check Student Roll Numbr API **/
Element_Type* Check_Roll_Number(FIFO_Buf_t* FIFO_Buf, int rollNumber)
{
    Element_Type* Temp_pointer = FIFO_Buf->base;
    for (i = 0; i < (int)FIFO_Buf->count; i++)
    {
        if (rollNumber == Temp_pointer->rollNumber)
        {
            return Temp_pointer;
        }
        Temp_pointer++;
    }
    return NULL;
}
```

3.3. Check Course ID:

```c
/** Check Student Course ID API **/
int Check_Course_ID(FIFO_Buf_t* FIFO_Buf, int ID)
{
    for(j = 0; j < 5; j++)
    {
        if (FIFO_Buf->head->course_ID[j] == ID)
        {
            return 1;
        }
    }
    return 0;
}
```

3.4. List Status:

```c
/** Check Student List Status   API **/
Buffer_STATUS List_Status(FIFO_Buf_t* FIFO_Buf)
{
    if(!FIFO_Buf->base || !FIFO_Buf->head || !FIFO_Buf->tail)
    {
        return FIFO_Is_Null;
    }
    else if (FIFO_Buf->count == FIFO_Buf->length)
    {
        return FIFO_Is_Full;
    }
    else if (FIFO_Buf->count == 0)
    {
        return FIFO_Is_Empty;
    }
    else
    {
        return FIFO_No_Error;
    }
}
```

4. Header file:

```c
#ifndef STUDENT_MANAGEMENT_SYSTEM_H_
#define STUDENT_MANAGEMENT_SYSTEM_H_

/** Include All Needed Libraries**/
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include <ctype.h>

/** Define Used Macros **/
#define Element_Type struct sinfo

#define Error(...)      printf("---------------------------------- \n");\
                        printf("| [ERROR] "__VA_ARGS__");\
                        printf("---------------------------------- \n")

#define Info(...)       printf("[INFO] "__VA_ARGS__)

#define Message(...)    printf("---------------------------------- \n");\
                        printf("%s \n",#__VA_ARGS__);\
                        printf("---------------------------------- \n")

struct sinfo
{
    char fName[30];
    char sName[30];
    int rollNumber;
    float GPA;
    int course_ID[5];
};

/** Define Typedef struct FIFO buffer**/
typedef struct
{
    unsigned int length;              // Buffer Length got from user
    unsigned int count;               // items counter init. to Zero
    Element_Type* base;               // pointer indicate to base address and never change
    Element_Type* head;               // pointer indicate to head where the data enqueue
    Element_Type* tail;               // pointer indicate to tail where the data dequeue
}FIFO_Buf_t;

typedef enum
{
    FIFO_No_Error,
    FIFO_Is_Full,
    FIFO_Is_Null,
    FIFO_Is_Empty,
    Student_Added,
    Student_Not_Found,
    Student_Found,
    Student_Removed,
    error
}Buffer_STATUS;

/** Students Queue API's **/
Buffer_STATUS FIFO_Init(FIFO_Buf_t* Fifo_Buf, Element_Type* Buf, unsigned int len);
Buffer_STATUS Add_Student_Manually(FIFO_Buf_t* FIFO_Buf);
Buffer_STATUS Add_Student_From_File(FIFO_Buf_t* FIFO_Buf);
Buffer_STATUS Find_Student_By_RollNumber(FIFO_Buf_t* FIFO_Buf);
Buffer_STATUS Find_Student_By_FirstName(FIFO_Buf_t* FIFO_Buf);
Buffer_STATUS Find_Student_By_CourseID(FIFO_Buf_t* FIFO_Buf);
Buffer_STATUS Count_Student(FIFO_Buf_t* FIFO_Buf);
Buffer_STATUS Remove_Student_By_RollNumber(FIFO_Buf_t* FIFO_Buf);
Buffer_STATUS Update_Student_By_RollNumber(FIFO_Buf_t* FIFO_Buf);
Buffer_STATUS Print_All_Details(FIFO_Buf_t* FIFO_Buf);

/** Common API's **/
void print_One_Student(Element_Type* Current_Head);
Element_Type* Check_Roll_Number(FIFO_Buf_t* FIFO_Buf, int rollNumber);
int Check_Course_ID(FIFO_Buf_t* FIFO_Buf, int ID);
Buffer_STATUS List_Status(FIFO_Buf_t* FIFO_Buf);

#endif /*STUDENT_MANAGEMENT_SYSTEM_H_*/
```

5. main.c:

```c
/**
 ************************************************************
 @file           : main.c
 @date           : Feb 9, 2025
 @author         : Mina Gamil
 @brief          : main program for student data structure
 ************************************************************
 */

#include <stdio.h>
#include "Student_Queue_Function.h"

FIFO_Buf_t Students_Buf;
Element_Type Students[60];
Buffer_STATUS state;

int main(void)
{
    FIFO_Init(&Students_Buf, Students, 50);
    int choice;
    printf("\n\t *** Welcome To Student Management System *** \n");
    printf("\t     ------------------------------------     \n");

    while (1)
    {
        printf("Choose The Task You Want To Perform \n");
        printf("----------------------------------- \n");
        printf("1. Add Student Details Manually. \n");
        printf("2. Add Student Details From Text File. \n");
        printf("3. Find Student Details By Roll Number. \n");
        printf("4. Find Student Details By First Name. \n");
        printf("5. Find Student Details By Course ID. \n");
        printf("6. Find Total Number Of Student. \n");
        printf("7. Delete Student Details By Roll Number. \n");
        printf("8. Update Student Details By Roll Number. \n");
        printf("9. Show All Students Details. \n");
        printf("10. Exit. \n");
        printf("----------------------------------- \n");
        printf("Please Enter Your Choice To Perform The Task: ");

        scanf("%d", &choice);

        switch (choice)
        {
        case 1:
            state = Add_Student_Manually(&Students_Buf);
            break;

        case 2:
            state = Add_Student_From_File(&Students_Buf);
            break;

        case 3:
            state = Find_Student_By_RollNumber(&Students_Buf);
            break;

        case 4:
            state = Find_Student_By_FirstName(&Students_Buf);
            break;

        case 5:
            state = Find_Student_By_CourseID(&Students_Buf);
            break;

        case 6:
            printf("----------------------------------- \n");
            state = Count_Student(&Students_Buf);
            break;

        case 7:
            state = Remove_Student_By_RollNumber(&Students_Buf);
            break;

        case 8:
            state = Update_Student_By_RollNumber(&Students_Buf);
            break;

        case 9:
            state = Print_All_Details(&Students_Buf);
            break;

        case 10:
            exit(0);
            break;

        default:
            break;
        }

        if (state == FIFO_Is_Null)
        {
            Message(Student list not exist);
        }
        else if (state == FIFO_Is_Full)
        {
            Message(Student list is Full);
        }
        else if (state == FIFO_Is_Empty)
        {
            Message(Student list is Empty);
        }
    }
    return 0;
}
```