Bahria University, Islamabad

Department of Software Engineering

Data Structre And Algorithms

(Fall-2024)

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Lab Journal: X

Date:

Task No:	Task Wise Marks		Documentation Marks		Total Marks (20)
	Assigned	Obtained	Assigned	Obtained	
1	3		5		
2	3				
3	3				
4	3				
5	3				

Comments:

Signature

LAB

Lab No: 05

Task 1: Priority Queue Implementation with Role-based Classification

Code:

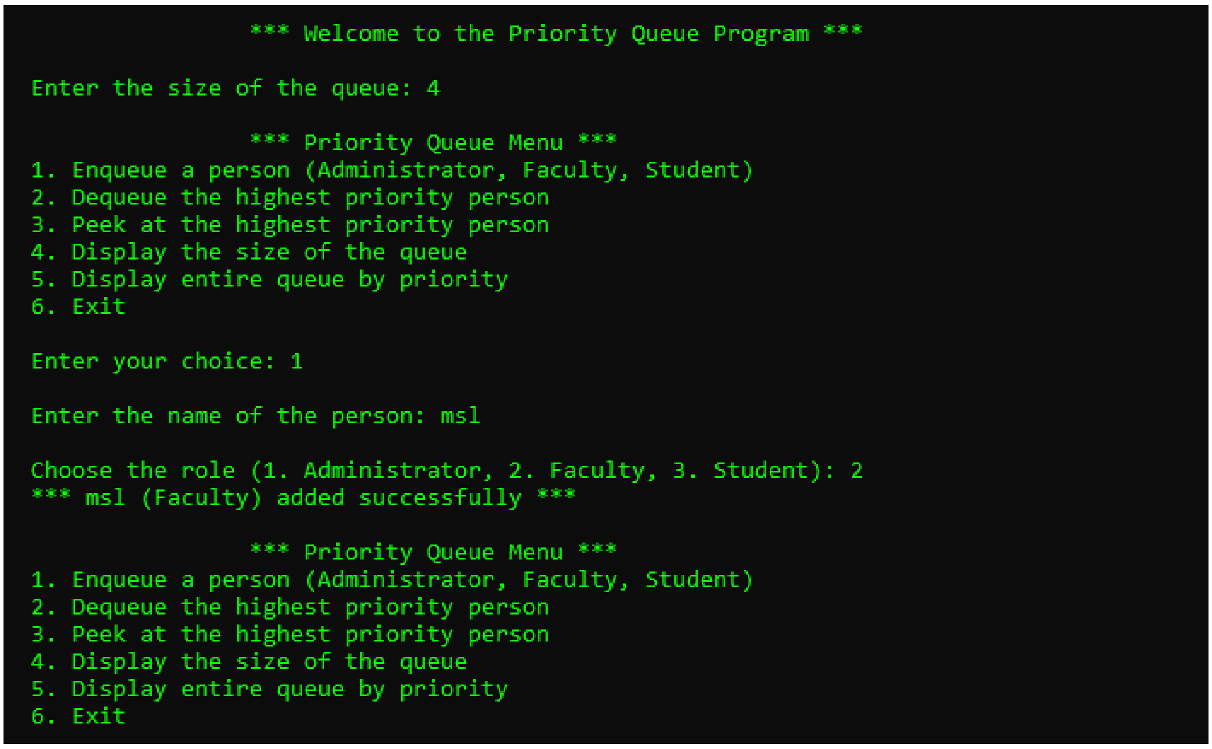
```
#include<iostream>
// this two libraries is used for vilidation
#include<limits>
#include<sstream>

using namespace std;

int arr_size; // store the total size of the queue which is set by the user.

template<class T>
class Queue {
private:
   int front, rear, count; // total element in the queue
   T* array; // declar array to store element in queue
public:
   Queue() {
      front = rear = -1;
      array = new T[arr_size]; // uered chosed size
      count = 0;
   }

   bool isEmpty() {
      return (front == -1 && rear == -1);
   }

   bool isFull() {
      return (rear == arr_size - 1);
   }

   //passing the type and value
   void enQueue(T value) {
      if (!isFull()) {
         if (front == -1) {
            front = 0;
         }
```

```
            rear++;
            array[rear] = value;
            count++;

    }
    else {
        cout << "Queue Overflow!" << endl;
    }
}

// we use T because its class template so it should be that type
T deQueue() {
    T val; // we use this for storing it temporary
    if (!isEmpty()) {
        val = array[front]; //Store the front element in a temporary variable
        front++;
        return val; //returned the removed element
    }
    else {
        cout << "Queue Underflow!" << endl;
    }
    return ""; // return empty string
}

int getSize() {
    return count; // return total element size
}

T peek() {
    if (!isEmpty()) {
        return array[front];
    } else {
        cout << "Queue is empty!" << endl;
        return "";
    }
}

void displayQueue() {
    if (isEmpty()) {
        cout << "Queue is empty!" << endl;
        return;
    }
    cout << "Queue elements: ";
    for (int i = front; i <= rear; i++) {
            cout << array[i] << " ";
        }
        cout << endl;
    }
};

void displayMenu() {
    cout << "\n\t\t\t*** Priority Queue Menu ***" << endl;
    cout << "\t1. Enqueue a person (Administrator, Faculty, Student)" << endl;
    cout << "\t2. Dequeue the highest priority person" << endl;
    cout << "\t3. Peek at the highest priority person" << endl;
    cout << "\t4. Display the size of the queue" << endl;
    cout << "\t5. Display entire queue by priority" << endl;
    cout << "\t6. Exit" << endl;
    cout << "\n\tEnter your choice: ";
}

int getValidatedInput() {
    string input;
    int result;
    while (true) {
        getline(cin, input);
        if (input.empty() || input.find_first_not_of(" \t\n\r") == string::npos) {
            cout << "\n\tEmpty input. Please enter a valid number: ";
            continue;
        }
        //it convert strings to inputA
        stringstream ss(input);
        if (ss >> result) {
            return result; // return an valid int
        }
        else {
            cout << "\n\tInvalid input. Please enter a valid number: ";
        }
    }
}

string getValidatedString() {
    string input;
    while (true) {
        getline(cin, input);
        if (input.empty() || input.find_first_not_of(" \t\n\r") == string::npos) {
            cout << "\n\tEmpty input. Please enter a valid name: ";
            continue;
        }

        return input;
    }
}

int getValidatedRole() {
    int role;
    while (true) {
        cout << "\n\tChoose the role (1. Administrator, 2. Faculty, 3. Student): ";
        role = getValidatedInput();
        if (role == 1 || role == 2 || role == 3) {
            return role;
        } else {
            cout << "\n\tInvalid choice. Please enter 1, 2, or 3.";
        }
    }
}

int main() {
    int choice;
    string value;

    // Input validation for size
    cout << "\n\t\t\t*** Welcome to the Priority Queue Program ***" << endl;
    cout << "\n\tEnter the size of the queue: ";
    arr_size = getValidatedInput();

    //defrent queues for each user
    Queue<string> Admin;
    Queue<string> Faculty;
    Queue<string> Student;
    Queue<string> priorityQueue;

    do {
        displayMenu();
        choice = getValidatedInput();
        switch (choice) {
            case 1: {
                cout << "\n\tEnter the name of the person: ";
                string name = getValidatedString();
                int roleChoice = getValidatedRole();

                // after chosing the person we chose the person job
                if (roleChoice == 1) {
                   Admin.enQueue(name);
                   cout << "\t*** " << name << " (Administrator) added successfully ***" << endl;
                } else if (roleChoice == 2) {
                   Faculty.enQueue(name);
                   cout << "\t*** " << name << " (Faculty) added successfully ***" << endl;
                } else if (roleChoice == 3) {
                   Student.enQueue(name);
                   cout << "\t*** " << name << " (Student) added successfully ***" << endl;
                }
                break;
            }
            case 2: {
                //  dequeu by sequence

                if (!Admin.isEmpty()) {
                   cout << "\t*** " << Admin.deQueue() << " (Administrator) dequeued successfully
***" << endl;
                } else if (!Faculty.isEmpty()) {
                   cout << "\t*** " << Faculty.deQueue() << " (Faculty) dequeued successfully ***"
<< endl;
                } else if (!Student.isEmpty()) {
                   cout << "\t*** " << Student.deQueue() << " (Student) dequeued successfully
***" << endl;
                } else {
                   cout << "\t*** Queue is empty ***" << endl;
                }
                break;
            }
            case 3: {
                // printing the front person
                if (!Admin.isEmpty()) {
                   cout << "\t*** Front Person: " << Admin.peek() << " (Administrator) ***" <<
endl;
                } else if (!Faculty.isEmpty()) {
                   cout << "\t*** Front Person: " << Faculty.peek() << " (Faculty) ***" << endl;
                } else if (!Student.isEmpty()) {
                   cout << "\t*** Front Person: " << Student.peek() << " (Student) ***" << endl;
                } else {
                   cout << "\t*** Queue is empty, nothing to peek ***" << endl;
                }
                break;
            }
```

```
        case 4: {
          //printing the fromt person
          int totalSize = Admin.getSize() + Faculty.getSize() + Student.getSize();
          cout << "\t*** Current size of the queue: " << totalSize << " ***" << endl;
          break;
        }
        case 5: {
          cout << "\n\t*** Displaying the Queue by Priority ***" << endl;
          Admin.displayQueue();
          Faculty.displayQueue();
          Student.displayQueue();
          break;
        }
        case 6:
          cout << "\n\t*** Exiting the program... ***" << endl;
          break;
        default:
          cout << "\n\tInvalid choice, please try again." << endl;
      }
    } while (choice != 6);

    return 0;
}
```

GitHub-Link: https://github.com/lotfullahmsl/DSA-Lab-FA2024

Screenshot:



```
                *** Welcome to the Priority Queue Program ***

Enter the size of the queue: 4

                *** Priority Queue Menu ***
1. Enqueue a person (Administrator, Faculty, Student)
2. Dequeue the highest priority person
3. Peek at the highest priority person
4. Display the size of the queue
5. Display entire queue by priority
6. Exit

Enter your choice: 1

Enter the name of the person: msl

Choose the role (1. Administrator, 2. Faculty, 3. Student): 2
*** msl (Faculty) added successfully ***

                *** Priority Queue Menu ***
1. Enqueue a person (Administrator, Faculty, Student)
2. Dequeue the highest priority person
3. Peek at the highest priority person
4. Display the size of the queue
5. Display entire queue by priority
6. Exit
```