Department of Information Systems and Technologies

CTIS152 – Algorithms and Data Structures

Spring 2024 - 2025

Lab Guide #16 – Week 11 - 1

OBJECTIVE	: Queue Library and Queue Exercises
Instructor **Assistants**	: Serpil TIN : Berk ÖNDER & Hatice Zehra YILMAZ

Copy the queue_int.h file from Moodle to each of your local project folders and modify it when necessary.

Q1. Write a C program that gets a number from the user until a negative number is entered. Then, it checks whether the number is a multiple of 5. If it is a multiple of 5, insert the number into the queue until a negative number is entered. Then, it displays the queue content.
Write the following function : **`displayQueue`.**

Example Run :

```
Enter a number (or negative to STOP) : 8
Enter a number (or negative to STOP) : 65
Enter a number (or negative to STOP) : 14
Enter a number (or negative to STOP) : 15
Enter a number (or negative to STOP) : 4
Enter a number (or negative to STOP) : 71
Enter a number (or negative to STOP) : 25
Enter a number (or negative to STOP) : -8

Queue Content
--------------------------
65      15      25
```

Project Name: LG16_Q1
File Name: Q1.cpp

Q2. Make the necessary changes in the header file to create a **string** queue.
A group of people has arrived at the bus stop and are lined up. When a bus arrives at the bus stop some of them will get on the bus. Now you will simulate it using the following information;

The names of the passengers are given in the order in the "**students.txt**". Write a C program that will read the names of the passengers from the text file into a queue **with size 20**. Then, display the list of all passengers at the bus stop.
When a bus arrives at the bus stop some of the passengers (***n*** passengers) will get on the bus. The user will give the number of passengers(***n***) and the ***n*** passengers to be removed from the queue. The program displays the passengers' names in which they board the bus and also displays the waiting passengers. Please examine the example run.

Write the following function : **`displayQueue`.**

Project Name: LG16_Q2
File Name: Q2.cpp

Example Run :

```
Waiting students:
Berk
Bengi
Dobi
Bora
Ece
Reyyan
Neva
Batuhan
Leyla
Engin
Efe

The bus arrived to the bus stop!
How many students getting on the bus? 5

The list of students getting on the bus:
Berk
Bengi
Dobi
Bora
Ece

Waiting students:
Reyyan
Neva
Batuhan
Leyla
Engin
Efe
```

students.txt

```
Berk
Bengi
Dobi
Bora
Ece
Reyyan
Neva
Batuhan
Leyla
Engin
Efe
```

Q3. Make the necessary changes in the header file to create a **structure** queue.

In a study center, the names of the classes and the total number of questions solved in a day are kept in the "classes.txt" file.
Write a C program that reads the information from the file and inserts that information into a **structure queue** (**className**, **questions**). The program displays the list of all classes on the screen. Then, it finds and displays "the class of the day" by checking the number of questions solved in a day.
Try to write the following functions; **`fillQueue`, `displayQueue`, `classOfTheDay`.**

Note : displayQueue and classOfTheDay functions will not affect to the original queue.

Project Name: LG16_Q3
File Name: Q3.cpp

Example Run :

```
The list of all classes;

Class Name    # of Questions
****************************
SAY101          5801
EA201           4850
SOZ301          6105
SAY110          1220
SOZ310          4570
EA210           3492
SAY111          1540
SOZ333          3247
EA222           9410

The Class of the day
*********************
EA222      9410
```

classes.txt

```
SAY101 5801
EA201 4850
SOZ301 6105
SAY110 1220
SOZ310 4570
EA210 3492
SAY111 1540
SOZ333 3247
EA222 9410
```

Q4. Write a C program that takes a string input from the user, which the program then pushes into a queue character by character, instead of inserting it as a string. Some characters, however, have special operations bound to them that the program should execute when a special character has been encountered.

Write the following function;

- **`display`**: takes a character queue as a parameter and displays its contents.

Project Name: LG16_Q4
File Name: Q4.cpp

*****	Erase the first character (remove it from the queue)
+	Kill the entire line (Empty the queue)
: or !	Display the queue content
Enter	Terminate the string entry and display the queue content

Example Run:

```
*      Erase the first character (remove it from the queue)
+      Kill the entire line (Empty the queue)
: or ! Display the queue content
Enter  Terminate the string entry and display the queue content

Enter characters to be inserted to the queue (press enter to stop)..:
Tarantula:*insizeof*human!+facediscovered!in+SriLanka

The content of the queue is: T a r a n t u l a
The character <T> is removed from the queue
The character <a> is removed from the queue

The content of the queue is: r a n t u l a i n s i z e o f h u m a n
All the characters are removed from the queue

The content of the queue is: f a c e d i s c o v e r e d
All the characters are removed from the queue

The content of the queue is: S r i L a n k a
```

Additional Questions

AQ. Arya is a bright student and she will take an exam for the university. She already knows all of the topics. However, she should solve questions for math to be quicker. She cannot decide which topic she should solve.

Write a C program that reads the file named **"math.txt"** into an array of structure queues (topic and level) according to their levels. To exemplify, if the question level is "Easy", its topic should be stored in a queue and other levels should be stored in other queues. Then, the program displays the content of the queues and asks the user "Do you want to add any topic?". If the answer is 'Y', it gets the information and adds it to the correct queue. Then, it asks the same question again until 'N' is entered. If the answer is 'N', it gets the level of the question to select a topic and it will display a topic from the queue according to the answer as in the example run. Write the **`displayQueue`** function to display the content of the queue.

Example Run #1:

```
Easy Topics;
            Topic        Level
*******************************
    Rational Number      Easy
    Rate Proportion      Easy
           Clusters      Easy
           Problems      Easy
            Numbers      Easy

Medium Topics;
            Topic        Level
*******************************
         Inequality    Medium
     Absolute Value    Medium
          Functions    Medium
         Statistics    Medium
        Permutation    Medium

Hard Topics;
            Topic        Level
*******************************
Exponential Numbers      Hard
          Equations      Hard
        Combination      Hard
        Possibility      Hard
           Parabola      Hard

Do you want to add any topic ? ( Y/N ) : Y

Enter the topic : Logic

  Enter the level of the question : Medium
              Topic        Level
  *******************************
           Inequality    Medium
       Absolute Value    Medium
            Functions    Medium
           Statistics    Medium
          Permutation    Medium
                Logic    Medium

  Do you want to add any topic ? ( Y/N ) : Y

  Enter the topic : Algebra

  Enter the level of the question : Hard
              Topic        Level
  *******************************
  Exponential Numbers      Hard
            Equations      Hard
          Combination      Hard
          Possibility      Hard
             Parabola      Hard
               Algebra     Hard

  Do you want to add any topic ? ( Y/N ) : N

  Which   level   do   you   prefer   to   solve
  questions ? :  Medium
You  should  solve  the  Inequality  question.
Good Luck :)
```

Example Run #2:

```
Easy Topics;
            Topic        Level
*******************************
    Rational Number      Easy
    Rate Proportion      Easy
           Clusters      Easy
           Problems      Easy
            Numbers      Easy

Medium Topics;
            Topic        Level
*******************************
         Inequality    Medium
     Absolute Value    Medium
          Functions    Medium
           Statistics    Medium
          Permutation    Medium

  Hard Topics;
              Topic        Level
  *******************************
  Exponential Numbers      Hard
            Equations      Hard
          Combination      Hard
          Possibility      Hard
             Parabola      Hard

  Do you want to add any topic ? ( Y/N ) : n

  Which   level   do   you   prefer   to   solve
  questions ? :  Easy
  You   should   solve   the   Rational   Number
  question. Good Luck :)
```

Project Name: LG16_AQ
File Name: AQ.cpp