CSE 3038 – Computer Organization

Project 1

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Question1:

Looking at the assignment given in this question, we counted the number of occurrences of characters in a particular string and printed it on the screen. With the necessary instructions and the programming logic we thought of, we counted uppercase and lowercase letters as the same character. Finally, as the output of the program, we printed both the number of occurrences and the corresponding letters on the screen.

Firstly, we print a message to the screen which is “Enter the String” and by this way, we informed user and took input string from him/her. We created required arrays, created and implemented required loops to the program.

We added a condition instruction to check the character uppercase and if it is uppercase by substruction operation, we convert this character to it’s lowercase letter format and ascii format respectively. If it is lowercase, we just convert it to the ascii format. Then, by determining index numbers, we continued to the process of placing into arrays respectively(array indices).

We made a comparison with the letters we placed in the array for each letter we looked at in the string, and if the same letter was formed again, we increased the value of our variable that we kept the number of occurrences for this letter. Then we again made a comparison for sort operation, we checked and compared each element of the array and did required swap operations. As a result, we achieved the desired output.

Output:

```
Please select an option: 1
Input: This is Computer Organization course!
Character       Occurence
I               4
O               4
R               3
S               3
T               3
A               2
C               2
E               2
N               2
U               2
G               1
H               1
M               1
P               1
Z               1
```

Question2:

Looking at the assignment given in this question, our aim is to sort the list of input characters, which are separated by spaces, representing single-digit or multi-digit decimal numbers, which is called as the input character list that contains ASCII characters, from small to large, and to print them on the screen in the desired format, and while performing these operations, paying attention to the negative numbers at the same time.

Firstly, we print a informing message to the screen which is “Input” and indicating the form. By this way, we informed user and took input from him/her.

After receiving input from the user and performing the checks on the values in the input, we started to do our work on the array that we created. We checked the negativity by paying attention to the "-" sign at the beginning of the characters. For instance, If negative, we multiplied with -1. After storing all elements in the array, we made comparison operations to sort the list from small to large, we checked and compared each element of the array and did required swap operations. As a result, we achieved the desired output.

Output:

```
Please select an option: 2
Input: 1 6 23 -5 18
-5 1 6 18 23
```

Question3:

Looking at the assignment given in this question, our aim is to calculate the num_prime (N) function, which is the number of prime numbers less than N. As it mentioned in the assignment we used the sieve of Eratosthenes method to generate prime numbers in the interval [2, N]. Firstly, a boolean array is created from 0 to N. At first all the members are 1s and using the formula we check if they are prime and turn the 1s into 0s accordingly. Then we took input from the user and saved it to one of the registers. This input is the N which is the upper limit for the loops. Then we jumped to the num_prime function in order to use sieve of Eratosthenes method. There are two loops and an if clause in this function, that finds the prime numbers in the array and changes the values to zero. First loop starts from 2 and if the value in the array is true(1) it checks the multiples of that value. If the multiples are also prime it changes the values in the array to 0. Lastly a for loop counts the number of primes in the array and saves the value to a register. Result is printed and program terminates.

Output:

```
Please select an option: 3
Enter a number for num_prime(N): 1000000
1000000) is 78498
```

Menu:

Looking at the assignment given, the desired menu implementation is completed by us. Menu gives option opportunities which is runs 1st, 2nd, 3rd, 4th questions programs and exit operation to the user. The all of these which we mentioned in last sentence is defined to the menu and system by this way.

Furthermore, when user press the button 5, the program is terminated and exits. After each running operation is done, the menu screen is displayed again and again because we defined its loop by paying attention to this feature.

Output:

```
Welcome to our MIPS project!

Main Menu:
1. Count Alphabetic Characters
2. Sort Numbers
3. Prime (N)
4. Huffman Coding
5. Exit
Please select an option: 1
```

Exit output:

```
Please select an option: 5
Program ends. Bye :)
-- program is finished running --
```