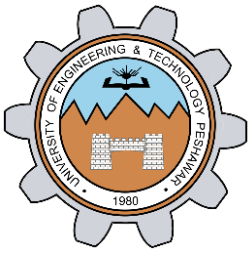
COA Lab

LAB #08



Fall 2020

CSE304L Computer Organization and Architecture Lab

Submitted by: **Shah Raza**

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Class Section: **B**

"On my honor, as a student of University of Engineering and Technology, I have neither given nor received unauthorized assistance on this academic work."

Student Signature: _____

Submitted to:

Engr. Amaad Khalil

17th February, 2021

Department of Computer Systems Engineering

University of Engineering and Technology, Peshawar

Task 1:

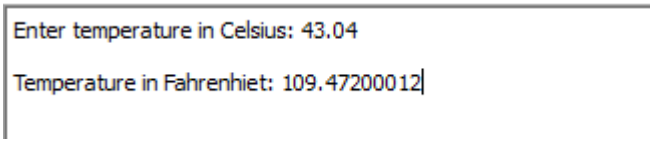
Write a program to convert Fahrenheit to Celsius using the formula below: Fahrenheit = Celsius * 9.0 / 5.0 + 32.0; Write a function for this temperature conversion. Celsius value is to be passed into the function as single-precision data and Fahrenheit value is returned also in single-precision. Remember to follow all the floating-point function conventions.

Source code:

```
.data
    str: .asciiz"Enter temperature in Celsius: "
    str1: .asciiz"\nTemperature in Fahrenhiet: "
.text


main:
    la $a0,str  #Load str to a0
    li $v0,4    #Print str
    syscall     #syscall

    li $v0,6    #Take floating point input
    syscall     #syscall
    mov.s $f2,$f0   #move input to f2

    li.s $f4,9.0    #f4 = 9.0
    li.s $f6,5.0    #f6 = 5.0
    li.s $f8,32.0   #f8 = 32.0

    mul.s $f10,$f2,$f4      #f10 = Celsius*9.0
    div.s $f10,$f10,$f6     #f10 = (Celsius*9.0)/5.0
    add.s $f10,$f10,$f8     #f10 = Celsius*9.0/5.0 +32.0

    mov.s $f12,$f10        #f12 = f10

    la $a0,str1 #Load str1 to a0
    li $v0,4    #Print str
    syscall     #syscall
```

```
    li $v0,2    #Print the result
    syscall     #syscall

    li $v0,10   #Terminate the Program
    syscall     #syscall
```

Output:



Task 2:

This exercise will familiarize you with floating point multiplication and division instructions. In this part you have to write a complete 'UET Peshawar GPA calculator" program. The program should calculate GPA for a quarter only. When your program starts it should ask the unit and GPA in each of the four courses taken in the quarter. It should store all this information in memory. It should then compute the quarter GPA for the person and display it to the user. You should have a separate Compute GPA function which loads all necessary info from memory and computes the GPA. Note that you will need syscalls to input and output floats to the user. For this purpose, you will have to refer to the old handout for the service code of these system calls. A more detailed instruction set is given at the end of this handout and may be useful for this exercise.

Source code:

```
.data
   str: .asciiz"----------  GPA Calculator ----------"
   str1: .asciiz"\nEnter your GPA in suject 1: "
   str2: .asciiz"\nCredit Hours: "
   str3: .asciiz"\nEnter your GPA in suject 2: "
   str4: .asciiz"\nEnter your GPA in suject 3: "
   str5: .asciiz"\nEnter your GPA in suject 4: "
   str6: .asciiz"\nYour GPA is: "
.text
```

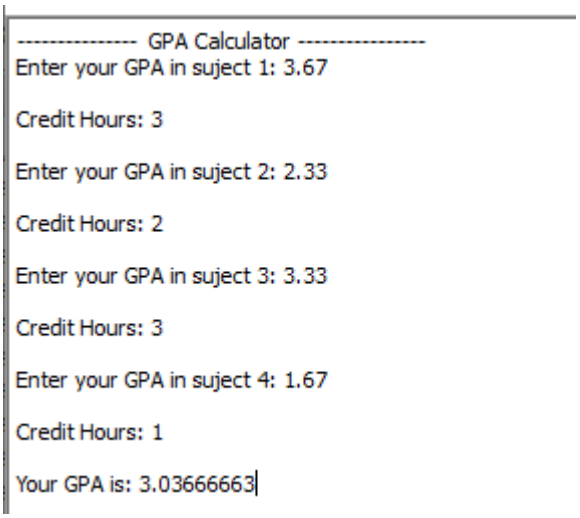
```
main:
    la $a0,str  #Load str to a0
    li $v0,4    #Print str
    syscall     #syscall

    la $a0,str1 #Load str1 to a0
    li $v0,4    #Print str
    syscall     #syscall

    li $v0,6    #Take floating point input
    syscall     #syscall
    mov.s $f2,$f0   #GPA of sub1

    la $a0,str2 #Load str2 to a0
    li $v0,4    #Print str
    syscall     #syscall

    li $v0,6    #Take floating point input
    syscall     #syscall
    mov.s           $f1, $f0 # CH of sub1

    la $a0,str3 #Load str3 to a0
    li $v0,4    #Print str
    syscall     #syscall

    li $v0,6    #Take floating point input
    syscall     #syscall
    mov.s $f4,$f0   #GPA of sub2
```

```
la $a0,str2 #Load str2 to a0
li $v0,4    #Print str
syscall     #syscall

li $v0,6    #Take floating point input
syscall     #syscall
mov.s           $f3, $f0 # CH of sub2

la $a0,str4 #Load str4 to a0
li $v0,4    #Print str
syscall     #syscall

li $v0,6    #Take floating point input
syscall     #syscall
mov.s $f6,$f0   #GPA of sub3

la $a0,str2 #Load str2 to a0
li $v0,4    #Print str
syscall     #syscall

li $v0,6    #Take floating point input
syscall     #syscall
mov.s           $f5, $f0 # CH of sub3

la $a0,str5 #Load str5 to a0
li $v0,4    #Print str
syscall     #syscall
```

```
li $v0,6    #Take floating point input
syscall     #syscall
mov.s $f8,$f0   #GPA of sub4

la $a0,str2 #Load str2 to a0
li $v0,4    #Print str
syscall     #syscall

li $v0,6    #Take floating point input
syscall     #syscall
mov.s           $f7, $f0 # CH of sub4

add.s $f9,$f1,$f3
add.s $f9,$f9,$f5
add.s $f9,$f9,$f7     #Total Credit hours (denom)

mul.s $f12,$f2,$f1
li.s $f10,0.0
add.s $f10,$f10,$f12    #f10=GPA1*CH1

mul.s $f12,$f4,$f3
add.s $f10,$f10,$f12

mul.s $f12,$f6,$f5
add.s $f10,$f10,$f12

mul.s $f12,$f8,$f7
add.s $f10,$f10,$f12    #Nom
```

```
div.s $f12,$f10,$f9     #Result

la $a0,str6 #Load str6 to a0
li $v0,4    #Print str
syscall     #syscall

li $v0,2    #Print the result
syscall     #syscall

li $v0,10   #Terminate the Program
syscall     #syscall
```

Output:



Task 3:

Design a calculator that can perform addition, subtraction, multiplication and division using double floating point numbers.

Source code:

```
.data
    str: .asciiz"Enter the first double floating point number: "
    str1: .asciiz"\nEnter the second double floating point number: "
    str2: .asciiz"\n1. Addition"
    str3: .asciiz"\n2. Subtraction"
    str4: .asciiz"\n3. Multiplication"
    str5: .asciiz"\n4. Division"
    str6: .asciiz"\nEnter your Choice: "
    str7: .asciiz"\nResult: "
    str8: .asciiz"\nInvalid Choice"
.text

main:
    la $a0,str  #Load str to a0
    li $v0,4    #Print str
    syscall     #syscall

    li $v0,7    #Take double floating point input
    syscall     #syscall
    mov.d $f2,$f0   #move input to f2

    la $a0,str1 #Load str1 to a0
    li $v0,4    #Print str
    syscall     #syscall

    li $v0,7    #Take double floating point input
    syscall     #syscall
    mov.d $f4,$f0   #move input to f4

    la $a0,str2 #Load str2 to a0
    li $v0,4    #Print str
    syscall     #syscall
```

```
    la $a0,str3 #Load str3 to a0
    li $v0,4    #Print str
    syscall     #syscall

    la $a0,str4 #Load str4 to a0
    li $v0,4    #Print str
    syscall     #syscall

    la $a0,str5 #Load str5 to a0
    li $v0,4    #Print str
    syscall     #syscall

    la $a0,str6 #Load str6 to a0
    li $v0,4    #Print str
    syscall     #syscall

    li $v0,5    #Take integer input
    syscall     #syscall
    move            $t0, $v0                    # Choice

    li $t1,1    #t1 = 1
    li $t2,2    #t2 = 2
    li $t3,3    #t3 = 3
    li $t4,4    #t4 = 4

    beq   $t0, $t1, Add   #Branch to Add if t0 == t1
    beq $t0, $t2, Sub   #Branch to Sub if t0 == t2
    beq $t0, $t3, Mul   #Branch to Mul if t0 == t3
    beq $t0, $t4, Div   #Branch to Div if t0 == t4
    j Invalid           #Jump to Invalid

Add:
    la $a0,str7 #Load str7 to a0
    li $v0,4    #Print str
```

```
    syscall     #syscall

    add.d $f12,$f2,$f4  #Add the two numbers
    li $v0,3    #Print the result
    syscall     #syscall

    j exit  #Jump to exit
Sub:
    la $a0,str7 #Load str7 to a0
    li $v0,4    #Print str
    syscall     #syscall

    sub.d $f12,$f2,$f4  #Subtract the two numbers
    li $v0,3    #Print the result
    syscall     #syscall

    j exit  #Jump to exit
Mul:
    la $a0,str7 #Load str7 to a0
    li $v0,4    #Print str
    syscall     #syscall

    mul.d $f12,$f2,$f4  #Multiply the two numbers
    li $v0,3    #Print the result
    syscall     #syscall

    j exit  #Jump to exit
Div:
    la $a0,str7 #Load str7 to a0
    li $v0,4    #Print str
    syscall     #syscall

    div.d $f12,$f2,$f4  #Divide the two numbers
    li $v0,3    #Print the result
```

```
    syscall     #syscall

    j exit  #Jump to exit
Invalid:
    la $a0,str8 #Load str8 to a0
    li $v0,4    #Print str
    syscall     #syscall
exit:
    li $v0,10   #Terminate the Program
    syscall     #syscall
```

Output:

```
Enter the first double floating point number: 8.33

Enter the second double floating point number: 4.21

1. Addition
2. Subtraction
3. Multiplication
4. Division
Enter your Choice: 1

Result: 12.539999999999999
```

```
Enter the first double floating point number: 8.33

Enter the second double floating point number: 4.21

1. Addition
2. Subtraction
3. Multiplication
4. Division
Enter your Choice: 2

Result: 4.1200000000000001
```

```
Enter the first double floating point number: 8.33

Enter the second double floating point number: 4.21

1. Addition
2. Subtraction
3. Multiplication
4. Division
Enter your Choice: 3

Result: 35.069299999999998
```

```
Enter the first double floating point number: 8.33

Enter the second double floating point number: 4.21

1. Addition
2. Subtraction
3. Multiplication
4. Division
Enter your Choice: 4

Result: 1.9786223277909738
```