BRANCHING OPERATIONS

IN ASSEMBLY

LANGUAGE

LAB # 02

Fall 2023

CSE-304L

Computer Organization & Architecture Lab

Submitted by: **AIMAL KHAN**

Registration No.: **21PWCSE1996**

Class Section: **A**

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

Student Signature: _____

Submitted to:

Dr. Bilal Habib

Friday, October 13, 2023

Department of Computer Systems Engineering

University of Engineering and Technology, Peshawar

ASSESSMENT RUBRICS COA LABS

LAB REPORT ASSESSMENT				
Criteria	**Excellent**	**Average**	**Nill**	**Marks Obtained**
1. Objectives of Lab	All objectives of lab are properly covered [Marks 10]	Objectives of lab are partially covered [Marks 5]	Objectives of lab are not shown [Marks 0]	
2. MIPS instructions with Comments and proper indentations.	All the instructions are well written with comments explaining the code and properly indented [Marks 20]	Some instructions are missing are poorly commented code [Marks 10]	The instructions are not properly written [Marks 0]	
3. Simulation run without error and warnings	The code is running in the simulator without any error and warnings [Marks 10]	The code is running but with some warnings or errors. [Marks 5]	The code is written but not running due to errors [Marks 0]	
4. Procedure	All the instructions are written with proper procedure [Marks 20]	Some steps are missing [Marks 10]	steps are totally missing [Marks 0]	
5. OUTPUT	Proper output of the code written in assembly [Marks 20]	Some of the outputs are missing [Marks 10]	No or wrong output [Marks 0]	
6. Conclusion	Conclusion about the lab is shown and written [Marks 20]	Conclusion about the lab is partially shown [Marks 10]	Conclusion about the lab is not shown[Marks0]	
7. Cheating			Any kind of cheating will lead to 0 Marks	
Total Marks Obtained: _____ Instructor Signature: _____				

Branching Operations

Objectives:

- How to create a branch
- How to jump to other branches
- Create reusable branches

Tasks:

Task 1: Enter a number 5432 from user and then display the last digit in the console. (hint: use mfhi).

Code:

```
.text
.globl main

main:
      li $v0, 4 #print string
      la $a0, prompt
      syscall

      li $v0, 5 # enter an int
      syscall
      move $t0, $v0

      li $t1, 10
      div $t0, $t1
      mfhi $t0

      li $v0, 4
      la $a0, result
      syscall

      li $v0, 1
      move $a0, $t0
      syscall

      li $v0, 10  # Exit the program
      syscall


.data
      prompt: .asciiz "Enter 4 digit number? "
      result: .asciiz "The last digit of entered number is: "
```

Output:

```
Console
Enter 4 digit number? 5432
The last digit of entered number is: 2
```

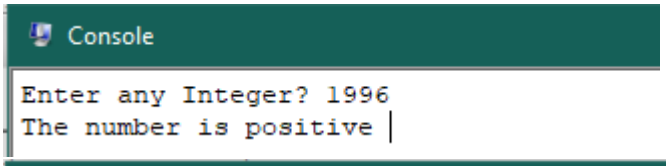
Task 2: Check whether a number input by user is negative or equal to zero or greater then zero using branching (Use bgt or ble).

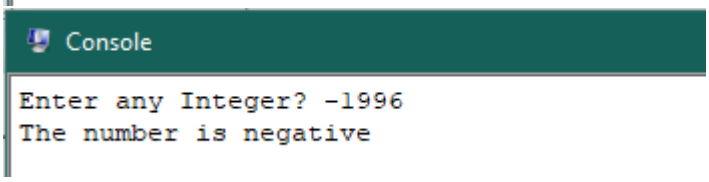
Code:

```
.text
.globl main

main:
      li $v0, 4 #print string
      la $a0, prompt
      syscall

      li $v0, 5 # enter an int
      syscall
      move $t0, $v0

      li $t1, 0 # store a zero in t1

      # if a number is positive
      bgt $t0,$t1, isPositive

      # if a number is zero
      beq $t0, $t1, isZero

      # if a number is negative
      blt $t0, $t1, isNegative


  # Some branchings
      isPositive:
            li $v0, 4 #print string
            la $a0, positive
            syscall
            j end # Jump to end

      isZero:
            li $v0, 4 #print string
            la $a0, zero
            syscall
            j end

      isNegative:
            li $v0, 4 #print string
            la $a0, negative
            syscall
```

```
            j end

      end:
            li $v0, 10  # Exit the program
            syscall


.data
      prompt: .asciiz "Enter any Integer? "
      positive: .asciiz "The number is positive "
      zero: .asciiz "The number is zero "
      negative: .asciiz "The number is negative "
```

Output:





Task 3: Check using branch whether the number input by user are equal or not (Use beq).

Code:

```
.text
.globl main

main:
      li $v0, 4 #print string
      la $a0, prompt1
      syscall

      li $v0, 5 # enter an int
      syscall
      move $t0, $v0

      li $v0, 4 #print string
      la $a0, prompt2
      syscall

      li $v0, 5 # enter an int
      syscall
      move $t1, $v0


      # if a both number are equal
```

```
        beq $t0,$t1, isEqual

        # if both number are not equal
        bne $t0, $t1, isNotEqual


        # ------------ Some branchings: -----------------------
        isEqual:
                li $v0, 4 #print string
                la $a0, equal
                syscall
                j end # Jump to end

        isNotEqual:
                li $v0, 4 #print string
                la $a0, notEqual
                syscall
                j end


        end:
                li $v0, 10  # Exit the program
                syscall


.data
        prompt1: .asciiz "Enter an Integer? "
        prompt2: .asciiz "Enter another Integer? "
        equal: .asciiz "Both The numbers are Equall."
        notEqual: .asciiz "Both the number are different/not-Equal."
```

Output:

```
Console
Enter an Integer? 34
Enter another Integer? 15
Both the number are different/not-Equal.
```

```
Console
Enter an Integer? 1996
Enter another Integer? 1996
Both The numbers are Equall.
```

Task 4: Write the assembly of the below C++ code.

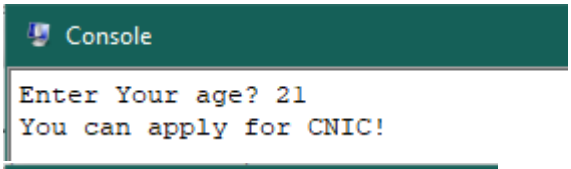
Int age; …..

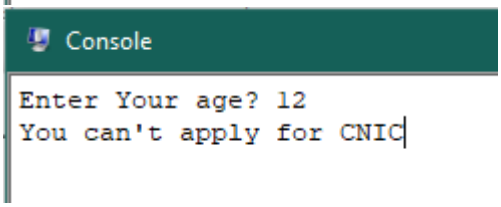
Code:

```
.text
.globl main
```

```
main:
      li $v0, 4 #print string
      la $a0, prompt
      syscall

      li $v0, 5 # enter an int
      syscall
      move $t0, $v0

      li $t1, 18 # load 18 to a register

      # if user >= 18
      bge $t0, $t1, isEighteen

      # if user is not 18
      blt $t0, $t1, isNotEighteen


      # -------------- Some branchings -----------------
      isEighteen:
            li $v0, 4 #print a string
            la $a0, msg1
            syscall
            j end

      isNotEighteen:
            li $v0, 4 #print a string
            la $a0, msg2
            syscall
            j end


      end:
            li $v0, 10  # Exit the program
            syscall

.data
      prompt: .asciiz "Enter Your age? "
      msg1: .asciiz "You can apply for CNIC!"
      msg2: .asciiz "You can't apply for CNIC"
```

Output:





Task 5: Write a program which take a limit from user and compute the sum of numbers from 0 to the limit (Use bqe, add, addi, and J (jump)).

Code:

```
.text
.globl main

main:
      li $v0, 4 #print string
      la $a0, prompt
      syscall

      li $v0, 5 # enter an int num
      syscall
      move $t0, $v0


      li $t1, 1 # store 1
      li $t2, 2 # store 2

      # if num > 0
      bgt $t0, $zero, countSum

      # else num <= 0
      ble $t0, $zero, noSum


      # -------------- Some branchings -----------------
      countSum:   # n(n+1)/2
            add $t3, $t0, $t1 # n+1
            mul $t4, $t0, $t3 # n(n+1)
            div $t4, $t2      # n(n+1)/2
            mflo $t5    # save qoutient

            li $v0, 1
            move $a0, $t5
            syscall

            j end

      noSum:
            li $v0, 4
            la $a0, errorMessage
            syscall

            j end

      end:
            li $v0, 10  # Exit the program
            syscall

.data
```

```
      prompt: .asciiz "Enter a number? "
      errorMessage: .asciiz "Cannot count sum of zero or negative
numbers!"
```

Output:

```
Console
Enter a number? 1996
1993006
```

```
Console
Enter a number? -1996
Cannot count sum of zero or negative numbers!
```

Reference:

To view my codes, please refer to my GitHub Account.

Conclusion:

In this lab I have learnt how to create branches and use them in code. Mostly these branches are like If Else in high level languages. This lab give me insight of how to create a branch jump to another branch exit a program and much more.

The End.