Computer Organization

Assignment 3: Conditional Constructs

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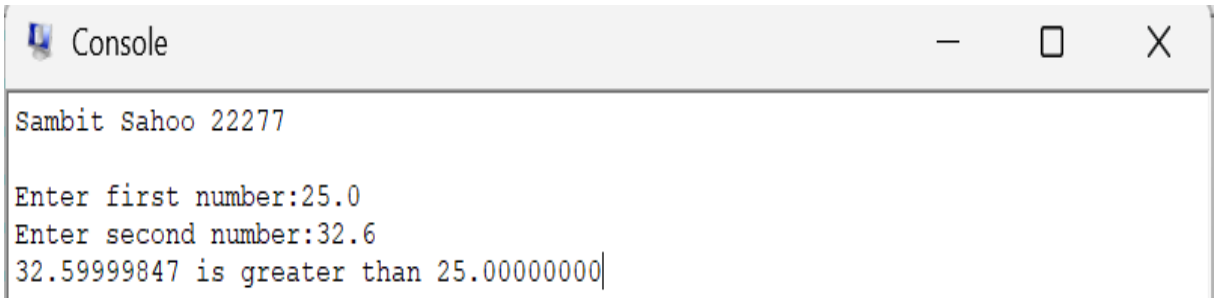
Q1 - MIPS assembly program that takes two number (can be anything floating point or integer) as an input and print maximum between two of them

```
#Sambit Sahoo 22277

.data
        mydetails: .asciiz "Sambit Sahoo 22277 \n\n"
        st1: .asciiz "Enter first number:"
        st2: .asciiz "Enter second number:"
        st3: .asciiz " is greater than "
        st4: .asciiz " is equal to "

.text
.globl main
main:
        li $v0, 4
        la $a0, mydetails
        syscall

        li $v0, 4
        la $a0, st1
        syscall

        li $v0, 6
        syscall
        mov.s $f1, $f0

        li $v0, 4
        la $a0, st2
        syscall
```

```
        li $v0, 6
        syscall
        mov.s $f2, $f0

        c.le.s $f1, $f2
        bc1f first_greater

                c.eq.s $f1, $f2
                bc1t both_equal

                        second_greater:
                                li $v0, 2
                                mov.s $f12, $f2
                                syscall

                                li $v0, 4
                                la $a0, st3
                                syscall

                                li $v0, 2
                                mov.s $f12, $f1
                                syscall

                                beq $0, $0, end_prog

                        both_equal:
                                li $v0, 2
                                mov.s $f12, $f2
                                syscall
```

```
                        li $v0, 4
                        la $a0, st4
                        syscall

                        li $v0, 2
                        mov.s $f12, $f1
                        syscall

                        beq $0, $0, end_prog

first_greater:
        li $v0, 2
        mov.s $f12, $f1
        syscall

        li $v0, 4
        la $a0, st3
        syscall

        li $v0, 2
        mov.s $f12, $f2
        syscall

end_prog:
        li $v0, 10
        syscall
```




```
Double Precision
FP0  = 805306500.018750
FP2  = 0.000000
FP4  = 0.000000
FP6  = 0.000000
FP8  = 0.000000
FP10 = 0.000000
FP12 = 0.000000
FP14 = 0.000000
FP16 = 0.000000
FP18 = 0.000000
FP20 = 0.000000
FP22 = 0.000000
FP24 = 0.000000
FP26 = 0.000000
FP28 = 0.000000
FP30 = 0.000000
```

FP Regs

```
FIR     = 38912
FCSR    = 0


Single Precision
FG0  = 32.599998
FG1  = 25.000000
FG2  = 32.599998
FG3  = 0.000000
FG4  = 0.000000
FG5  = 0.000000
FG6  = 0.000000
FG7  = 0.000000
FG8  = 0.000000
FG9  = 0.000000
FG10 = 0.000000
FG11 = 0.000000
FG12 = 25.000000
FG13 = 0.000000
FG14 = 0.000000
FG15 = 0.000000
FG16 = 0.000000
FG17 = 0.000000
FG18 = 0.000000
FG19 = 0.000000
FG20 = 0.000000
FG21 = 0.000000
FG22 = 0.000000
FG23 = 0.000000
FG24 = 0.000000
FG25 = 0.000000
FG26 = 0.000000
FG27 = 0.000000
FG28 = 0.000000
FG29 = 0.000000
FG30 = 0.000000
FG31 = 0.000000
```

Int Regs [10]

```
PC        = 4194556
EPC       = 0
Cause     = 0
BadVAddr  = 0
Status    = 805371664

HI        = 0
LO        = 0

R0  [r0] = 0
R1  [at] = 268500992
R2  [v0] = 10
R3  [v1] = 0
R4  [a0] = 268501055
R5  [a1] = 2147480504
R6  [a2] = 2147480512
R7  [a3] = 0
R8  [t0] = 0
R9  [t1] = 0
R10 [t2] = 0
R11 [t3] = 0
R12 [t4] = 0
R13 [t5] = 0
R14 [t6] = 0
R15 [t7] = 0
R16 [s0] = 0
R17 [s1] = 0
R18 [s2] = 0
R19 [s3] = 0
R20 [s4] = 0
R21 [s5] = 0
R22 [s6] = 0
R23 [s7] = 0
R24 [t8] = 0
R25 [t9] = 0
R26 [k0] = 0
R27 [k1] = 0
R28 [gp] = 268468224
R29 [sp] = 2147480500
R30 [s8] = 0
R31 [ra] = 4194328
```

Q2 - An assembly program that takes year as an input from the user and check whether the input year is leap year or not. If it is leap year prompt the message "Input year is a leap year" Otherwise, prompt the message "Input year is not a leap year".

```
#Sambit Sahoo 22277

.data
        mydetails: .asciiz "Sambit Sahoo 22277 \n\n"
        st1: .asciiz "Enter the year:"
        st2: .asciiz " is a leap year"
        st3: .asciiz " is not a leap year"


.text
.globl main
main:
        li $v0, 4
        la $a0, mydetails
        syscall

        li $v0, 4
        la $a0, st1
        syscall

        li $v0, 5
        syscall
        move $t0, $v0           #t0 = year

        li $t1, 400
        div $t0, $t1
        mfhi $t2
```

```
        li $t3, 100
        div $t0, $t3
        mfhi $t4

        li $t5, 4
        div $t0, $t5
        mfhi $t6

        beq $t2, $0, div_by_400

                beq $t4, $0, div_by_100

                        beq $t6, $0, div_by_4

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

                                li $v0, 4
                                la $a0, st3
                                syscall

                                beq $0, $0, end_prog


                                div_by_4:
                                        li $v0, 1
                                        move $a0, $t0
                                        syscall
```

```
                                li $v0, 4
                                la $a0, st2
                                syscall

                                beq $0, $0, end_prog

                div_by_100:
                                li $v0, 1
                                move $a0, $t0
                                syscall

                                li $v0, 4
                                la $a0, st3
                                syscall

                                beq $0, $0, end_prog

        div_by_400:
                li $v0, 1
                move $a0, $t0
                syscall

                li $v0, 4
                la $a0, st2
                syscall

        end_prog:
                li $v0, 10
                syscall
```

Console

```
Sambit Sahoo 22277

Enter the year:2500
2500 is not a leap year
```

```
Double Precision
FP0  = 0.000000
FP2  = 0.000000
FP4  = 0.000000
FP6  = 0.000000
FP8  = 0.000000
FP10 = 0.000000
FP12 = 0.000000
FP14 = 0.000000
FP16 = 0.000000
FP18 = 0.000000
FP20 = 0.000000
FP22 = 0.000000
FP24 = 0.000000
FP26 = 0.000000
FP28 = 0.000000
FP30 = 0.000000
```

FP Regs

```
FIR      = 38912
FCSR     = 0


Single Precision
FG0  = 0.000000
FG1  = 0.000000
FG2  = 0.000000
FG3  = 0.000000
FG4  = 0.000000
FG5  = 0.000000
FG6  = 0.000000
FG7  = 0.000000
FG8  = 0.000000
FG9  = 0.000000
FG10 = 0.000000
FG11 = 0.000000
FG12 = 0.000000
FG13 = 0.000000
FG14 = 0.000000
FG15 = 0.000000
FG16 = 0.000000
FG17 = 0.000000
FG18 = 0.000000
FG19 = 0.000000
FG20 = 0.000000
FG21 = 0.000000
FG22 = 0.000000
FG23 = 0.000000
FG24 = 0.000000
FG25 = 0.000000
FG26 = 0.000000
FG27 = 0.000000
FG28 = 0.000000
FG29 = 0.000000
FG30 = 0.000000
FG31 = 0.000000
```

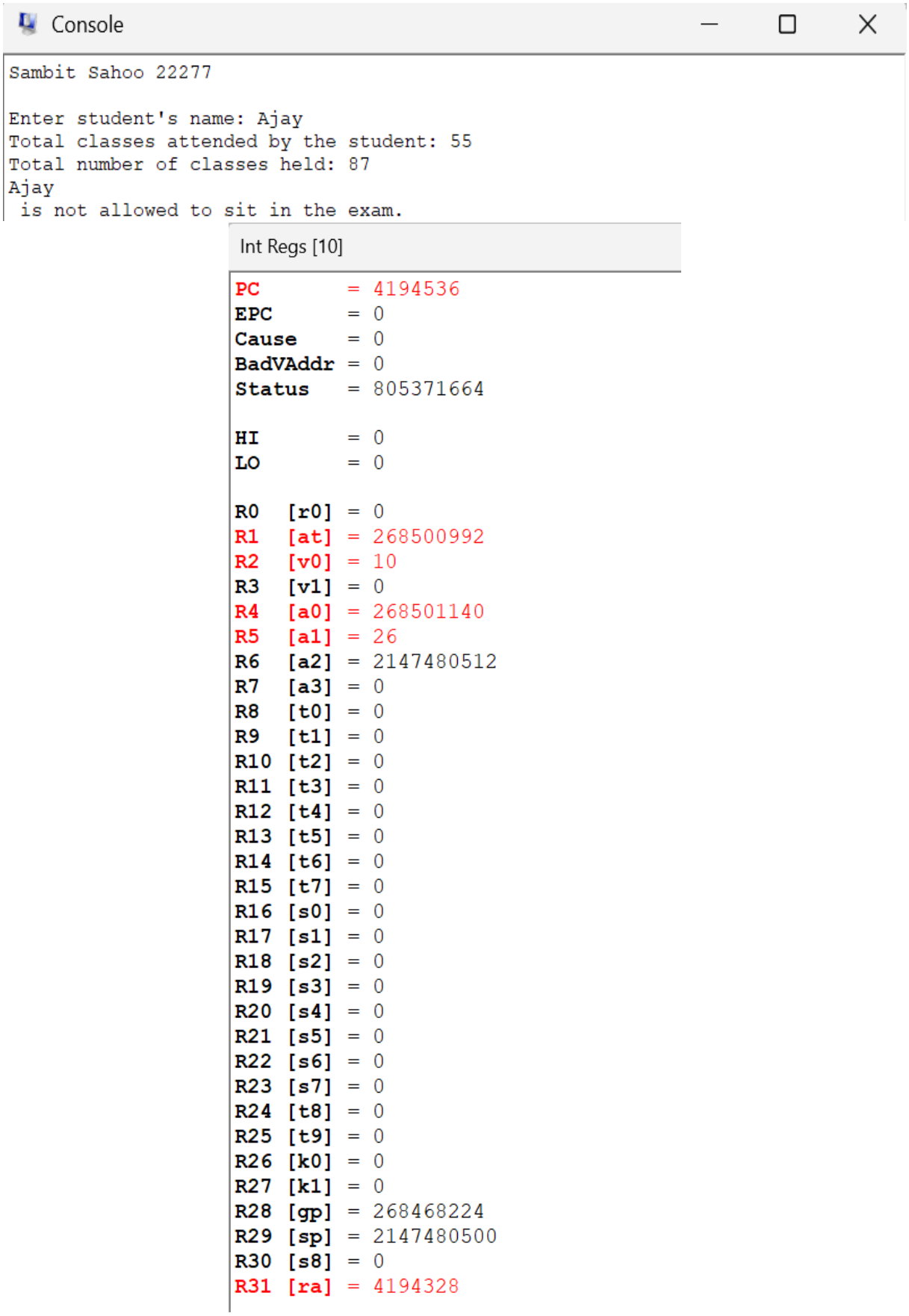
Int Regs [10]

```
PC        = 4194556
EPC       = 0
Cause     = 0
BadVAddr  = 0
Status    = 805371664

HI        = 0
LO        = 625

R0  [r0] = 0
R1  [at] = 268500992
R2  [v0] = 10
R3  [v1] = 0
R4  [a0] = 268501046
R5  [a1] = 2147480504
R6  [a2] = 2147480512
R7  [a3] = 0
R8  [t0] = 2500
R9  [t1] = 400
R10 [t2] = 100
R11 [t3] = 100
R12 [t4] = 0
R13 [t5] = 4
R14 [t6] = 0
R15 [t7] = 0
R16 [s0] = 0
R17 [s1] = 0
R18 [s2] = 0
R19 [s3] = 0
R20 [s4] = 0
R21 [s5] = 0
R22 [s6] = 0
R23 [s7] = 0
R24 [t8] = 0
R25 [t9] = 0
R26 [k0] = 0
R27 [k1] = 0
R28 [gp] = 268468224
R29 [sp] = 2147480500
R30 [s8] = 0
R31 [ra] = 4194328
```

Q3- An assembly program that determines whether the student is allowed to sit the examination provided his/her attendance is 75%.

```
#Sambit Sahoo 22277

.data
        mydetails: .asciiz "Sambit Sahoo 22277 \n\n"
        st1: .asciiz "Enter student's name: "
        st2: .asciiz "Total classes attended by the student: "
        st3: .asciiz "Total number of classes held: "
        msg1:.asciiz " is allowed to sit in the exam."
        msg2:.asciiz " is not allowed to sit in the exam."
        name: .space 26

.text
.globl main
main:
        li $v0, 4
        la $a0, mydetails
        syscall

        li $v0, 4
        la $a0, st1
        syscall

        li $v0, 8
        la $a0, name
        li $a1, 26
        syscall

        li $v0, 4
        la $a0, st2
        syscall

        li $v0, 6
        syscall
        mov.s $f1, $f0
```

```
        li $v0, 4
        la $a0, st3
        syscall

        li $v0, 6
        syscall
        mov.s $f2, $f0

        div.s $f3, $f1, $f2
        li.s $f0, 0.75

        c.lt.s $f3, $f0
        bc1f allowed

                not_allowed:
                        li $v0, 4
                        la $a0, name
                        syscall

                        li $v0, 4
                        la $a0, msg2
                        syscall
                        beq $0, $0, end_prog

                allowed:
                        li $v0, 4
                        la $a0, name
                        syscall

                        li $v0, 4
                        la $a0, msg1
                        syscall

                end_prog:
                        li $v0, 10
                        syscall
```


Console
Sambit Sahoo 22277
Enter student's name: Ajay
Total classes attended by the student: 55
Total number of classes held: 87
Ajay
is not allowed to sit in the exam.
Int Regs [10]
PC = 4194536
EPC = 0
Cause = 0
BadVAddr = 0
Status = 805371664
HI = 0
LO = 0
R0 [r0] = 0
R1 [at] = 268500992
R2 [v0] = 10
R3 [v1] = 0
R4 [a0] = 268501140
R5 [a1] = 26
R6 [a2] = 2147480512
R7 [a3] = 0
R8 [t0] = 0
R9 [t1] = 0
R10 [t2] = 0
R11 [t3] = 0
R12 [t4] = 0
R13 [t5] = 0
R14 [t6] = 0
R15 [t7] = 0
R16 [s0] = 0
R17 [s1] = 0
R18 [s2] = 0
R19 [s3] = 0
R20 [s4] = 0
R21 [s5] = 0
R22 [s6] = 0
R23 [s7] = 0
R24 [t8] = 0
R25 [t9] = 0
R26 [k0] = 0
R27 [k1] = 0
R28 [gp] = 268468224
R29 [sp] = 2147480500
R30 [s8] = 0
R31 [ra] = 4194328

FP Regs

```
FIR      = 38912
FCSR     = 8388608


Single Precision
FG0  = 0.750000
FG1  = 55.000000
FG2  = 87.000000
FG3  = 0.632184
FG4  = 0.000000
FG5  = 0.000000
FG6  = 0.000000
FG7  = 0.000000
FG8  = 0.000000
FG9  = 0.000000
FG10 = 0.000000
FG11 = 0.000000
FG12 = 0.000000
FG13 = 0.000000
FG14 = 0.000000
FG15 = 0.000000
FG16 = 0.000000
FG17 = 0.000000
FG18 = 0.000000
FG19 = 0.000000
FG20 = 0.000000
FG21 = 0.000000
FG22 = 0.000000
FG23 = 0.000000
FG24 = 0.000000
FG25 = 0.000000
FG26 = 0.000000
FG27 = 0.000000
FG28 = 0.000000
FG29 = 0.000000
FG30 = 0.000000
FG31 = 0.000000
```

```
Double Precision
FP0  = 481036401920.000000
FP2  = 0.000136
FP4  = 0.000000
FP6  = 0.000000
FP8  = 0.000000
FP10 = 0.000000
FP12 = 0.000000
FP14 = 0.000000
FP16 = 0.000000
FP18 = 0.000000
FP20 = 0.000000
FP22 = 0.000000
FP24 = 0.000000
FP26 = 0.000000
FP28 = 0.000000
FP30 = 0.000000
```

Q4. Write a MIPS assembly program that takes the marks of a student as an input (in the range of 1–100) and assigns a grade according to the following grading policy:

Grade: A if marks ≥ 80
Grade: B if $60 \leq$ marks < 80
Grade: C if $40 \leq$ marks < 60
Grade: F otherwise

```
#Sambit Sahoo 22277

.data
        mydetails: .asciiz "Sambit Sahoo 22277 \n\n"
        a_grade: .asciiz "Grade: A"
        b_grade: .asciiz "Grade: B"
        c_grade: .asciiz "Grade: C"
        f_grade: .asciiz "Grade: F"

        st1: .asciiz "Enter the marks of student: "

.text
.globl main
main:
        li $v0, 4
        la $a0, mydetails
        syscall

        li $v0, 4
        la $a0, st1
        syscall

        li $v0, 5
        syscall
        move $t0, $v0      #t0 = entered marks

        li $t1, 40
        li $t2, 60
        li $t3, 80
```

```
        blt $t0, $t1, F

                blt $t0, $t2, C

                        blt $t0, $t3, B

                                A:
                                        li $v0, 4
                                        la $a0, a_grade
                                        syscall
                                        beq $0, $0, end_prog

                        B:
                                li $v0, 4
                                la $a0, b_grade
                                syscall
                                beq $0, $0, end_prog

                C:
                        li $v0, 4
                        la $a0, c_grade
                        syscall
                        beq $0, $0, end_prog

        F:
                li $v0, 4
                la $a0, f_grade
                syscall

        end_prog:
                li $v0, 10
                syscall
```

Console

```
Sambit Sahoo 22277

Enter the marks of student: 80
Grade: A
```

```
Double Precision
FP0  = 0.000000
FP2  = 0.000000
FP4  = 0.000000
FP6  = 0.000000
FP8  = 0.000000
FP10 = 0.000000
FP12 = 0.000000
FP14 = 0.000000
FP16 = 0.000000
FP18 = 0.000000
FP20 = 0.000000
FP22 = 0.000000
FP24 = 0.000000
FP26 = 0.000000
FP28 = 0.000000
FP30 = 0.000000
```

FP Regs

```
FIR      = 38912
FCSR     = 0


Single Precision
FG0  = 0.000000
FG1  = 0.000000
FG2  = 0.000000
FG3  = 0.000000
FG4  = 0.000000
FG5  = 0.000000
FG6  = 0.000000
FG7  = 0.000000
FG8  = 0.000000
FG9  = 0.000000
FG10 = 0.000000
FG11 = 0.000000
FG12 = 0.000000
FG13 = 0.000000
FG14 = 0.000000
FG15 = 0.000000
FG16 = 0.000000
FG17 = 0.000000
FG18 = 0.000000
FG19 = 0.000000
FG20 = 0.000000
FG21 = 0.000000
FG22 = 0.000000
FG23 = 0.000000
FG24 = 0.000000
FG25 = 0.000000
FG26 = 0.000000
FG27 = 0.000000
FG28 = 0.000000
FG29 = 0.000000
FG30 = 0.000000
FG31 = 0.000000
```

Int Regs [10]

```
PC        = 4194496
EPC       = 0
Cause     = 0
BadVAddr  = 0
Status    = 805371664

HI        = 0
LO        = 0

R0  [r0] = 0
R1  [at] = 268500992
R2  [v0] = 10
R3  [v1] = 0
R4  [a0] = 268501014
R5  [a1] = 2147480504
R6  [a2] = 2147480512
R7  [a3] = 0
R8  [t0] = 80
R9  [t1] = 40
R10 [t2] = 60
R11 [t3] = 80
R12 [t4] = 0
R13 [t5] = 0
R14 [t6] = 0
R15 [t7] = 0
R16 [s0] = 0
R17 [s1] = 0
R18 [s2] = 0
R19 [s3] = 0
R20 [s4] = 0
R21 [s5] = 0
R22 [s6] = 0
R23 [s7] = 0
R24 [t8] = 0
R25 [t9] = 0
R26 [k0] = 0
R27 [k1] = 0
R28 [gp] = 268468224
R29 [sp] = 2147480500
R30 [s8] = 0
R31 [ra] = 4194328
```