February 5, 2023

1/10

LAB 04: Flow Control

Saleh AlSaleh salehs@kfupm.edu.sa

King Fahd University of Petroleum and Minerals College of Computing and Mathematics Computer Engineering Department

COE301: Computer Architecture Term 222

S. AlSaleh (KFUPM) LAB 04: Flow Control

Agenda

- **1** Unconditional Jump
- 2 Conditional Jump
- Pseudo Instructions
- **4** Examples
- **5** Tasks

S. AlSaleh (KFUPM) LAB 04: Flow Control

• Code Labels are used to define important locations in code.



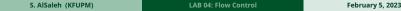
Unconditional Jump

- Code Labels are used to define important locations in code.
- jump instruction is used to jump to another location in code unconditionally.

S. AlSaleh (KFUPM) LAB 04: Flow Control February 5, 2023

Unconditional Jump

- Code Labels are used to define important locations in code.
- jump instruction is used to jump to another location in code unconditionally.
- Syntax: | label



Conditional Jump

 Branch instructions is used to jump to another location in code if a condition is satisfied.



4/10

Conditional Jump

- Branch instructions is used to jump to another location in code if a condition is satisfied.
- Basic Branch Instructions: beg, bne, blez, bgtz, bltz, bgez

S. AlSaleh (KFUPM) LAB 04: Flow Control February 5, 2023 4/10

Conditional Jump

- Branch instructions is used to jump to another location in code if a condition is satisfied.
- Basic Branch Instructions: beq, bne, blez, bgtz, bltz, bgez
- Syntax: beq \$op1, \$op2, label2 if value in \$op1is equal to the value in \$op2, go to label2.
- Used in loops and if statements

S. AlSaleh (KFUPM) LAB 04: Flow Control

Pseudo Instructions

5/10

Branch Pseudo Instructions

- blt, bltu
- ble, bleu
- bgt, bgtu
- bge, bgeu
- e.g. blt \$\$1, \$\$2, label ⇒ \$\$1\$\$at, \$\$1, \$\$2\$
 bne \$\$at, \$\$zero, label

S. AlSaleh (KFUPM) LAB 04: Flow Control

Example #1: if statement

```
if (a==b)
 c = d + e;
else
 c = d - e;
```

Assume a, b, c, d, e are stored in \$s0, \$s1, \$s2, \$s3, \$s4 respectively.

> S. AlSaleh (KFUPM) LAB 04: Flow Control February 5, 2023 6/10

Example #1: if statement

```
if (a==b)
  c = d + e;
else
 c = d - e;
```

```
Assume a, b, c, d, e
are stored in
$s0, $s1, $s2, $s3, $s4
respectively.
```

```
beg $s0, $s1, true
# false cond here
sub $s2, $s3, $s4
exit
true:
add $s2, $s3, $s4
exit:
```

S. AlSaleh (KFUPM)

Example #1: if statement

```
if (a==b)
  c = d + e:
else
 c = d - e;
```

Assume a, b, c, d, e are stored in \$s0, \$s1, \$s2, \$s3, \$s4 respectively.

```
beg $s0, $s1, true
# false cond here
sub $s2, $s3, $s4
exit
true:
add $s2, $s3, $s4
exit:
```

```
bne $s0, $s1, false
# true cond here
add $s2, $s3, $s4
exit
false:
sub $s2, $s3, $s4
exit:
```

Example #2: for loop

```
for (int i=0;i<n;i++)
{
    //loop body
}</pre>
```

Assume i is stored in \$50 and n is stored in \$51.

S. AlSaleh (KFUPM) LAB 04: Flow Control

7/10

...

Example #2: for loop

```
for (int i=0;i<n;i++)</pre>
  //loop body
```

Assume i is stored in \$50 and n is stored in \$s1.

```
li $s0, 0
loop:
bge $s0, $s1, endLoop
# loop body
addi $s0, $s0, 1
loop
endLoop:
```

S. AlSaleh (KFUPM)

```
for (int i=0;i<n;i++)
{
    //loop body
}</pre>
```

Assume i is stored in \$50 and n is stored in \$51.

```
li $50, 0
loop:
bge $50, $51, endLoop
# loop body
addi $50, $50, 1
j loop
endLoop:
```

LAB 04: Flow Control

```
li $s0, 0
loopCheck:
blt $s0, $s1, loop
...
loop:
# loop body
addi $s0, $s0, 1
j loopCheck
```



tonditional Jump Pseudo Instructions Examples Tasks

○ ○ ○ ○ ○ ● ○

Task #1

Write a MIPS program where you ask the user to enter a character. Then, print one of the following messages based on the user's input.

- Uppercase
- Lowercase
- Digit
- Special Character

Sample Run 1

Enter a character: a Lowercase

Sample Run 2

Enter a character: \$
Special Character

9/10

S. AlSaleh (KFUPM)

Conditional Jump Pseudo Instructions

O

Task #2

Write a MIPS assembly program that reads 6 integers and correctly report back their sum.

NOTE: Reading the 6 integers should be done in a loop not by repeating the reading instructions six times.

Sample Run

Enter integer 0: 5

Enter integer 1: 12

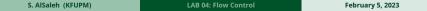
Enter integer 2: 76

Enter integer 3: 43

Enter integer 4: 37

Enter integer 5: 58

Sum = 231



10/10