

**CISS360: Computer Systems and Assembly Language**  
**Quiz q1102**

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Open `main.tex` and enter answers (look for `answercode`, `answerbox`, `answerlong`). Turn the page for detailed instructions. To rebuild and view pdf, in bash shell execute `make`. To build a gzip-tar file, in bash shell execute `make s` and you'll get `submit.tar.gz`.

Q1. Complete the following SPIM program that gets two integers  $x$  and  $y$  from the user and prints the minimum of the absolute values of  $x$  and  $y$ :  $\min(|x|, |y|)$ . You need to write two functions: `min` (the minimum function) and `abs_int` (the absolute value function for integers). Your program must execute in PCSpim (of course). (There's a `*.s` file you can use. But your answer must be inserted into the `main.tex` file.)

ANSWER:

```
.text
.globl main

read_int:
    li      $v0, 5
    syscall
    jal     $ra

abs_int:
    bltz    $a2, is_negative
    jal     $ra

is_negative:
    neg     $a2, $a2
    jal     $ra

min:
    bgt     $a1, $a0, x_is_min
    move    $v0, $a1      # y is min
    jal     $ra

x_is_min:
    move    $v0, $a0      # x is min
    jal     $ra

print_int:
    li      $v0, 1
    syscall
    jal     $ra
```

```
main:  jal    read_int    # Get int x from user
       move   $s0, $v0    # and store in s0

       jal    read_int    # Get int y from user
                               # and store in v0

       move   $a0, $s0    # a0 = s0
       move   $a1, $v0    # a1 = v0

       move   $a2, $a0
       jal    abs_int      # get absolute value of x
       move   $a0, $a2

       move   $a2, $a1
       jal    abs_int      # get absolute value of x
       move   $a1, $a2

       jal    min          # v0 = min(a0, a1)

       move   $a0, $v0    # a0 = v0
       jal    print_int    # print_int(a0)

       li     $v0, 10
       syscall
```

## INSTRUCTIONS

In `main.tex` change the email address in

```
\renewcommand\AUTHOR{jdoe5@cougars.ccis.edu}
```

to yours. In the bash shell, execute “`make`” to recompile `main.pdf`. Execute “`make v`” to view `main.pdf`. Execute “`make s`” to create `submit.tar.gz` for submission.

For each question, you’ll see boxes for you to fill. You write your answers in `main.tex` file. For small boxes, if you see

```
1 + 1 = \answerbox{}
```

you do this:

```
1 + 1 = \answerbox{2}
```

`answerbox` will also appear in “true/false” and “multiple-choice” questions.

For longer answers that needs typewriter font, if you see

```
Write a C++ statement that declares an integer variable name x.
\begin{answercode}
\end{answercode}
```

you do this:

```
Write a C++ statement that declares an integer variable name x.
\begin{answercode}
int x;
\end{answercode}
```

`answercode` will appear in questions asking for code, algorithm, and program output. In this case, indentation and spacing is significant. For program output, I do look at spaces and newlines.

For long answers (not in typewriter font) if you see

```
What is the color of the sky?
\begin{answerlong}
\end{answerlong}
```

you can write

```
What is the color of the sky?
\begin{answerlong}
The color of the sky is blue.
\end{answerlong}
```

For students beyond 245: You can put  $\LaTeX$  commands in `answerbox` and `answerlong`.

A question that begins with “T or F or M” requires you to identify whether it is true or false, or meaningless. “Meaningless” means something’s wrong with the statement and it is not well-defined. Something like “ $1+2$ ” or “ $\{2\}^{\{3\}}$ ” is not well-defined. Therefore a question such as “Is  $42 = 1+2$  true or false?” or “Is  $42 = \{2\}^{\{3\}}$  true or false?” does not make sense. “Is  $P(42) = \{42\}$  true or false?” is meaningless because  $P(X)$  is only defined if  $X$  is a set. For “Is  $1 + 2 + 3$  true or false?”, “ $1 + 2 + 3$ ” is well-defined but as a “numerical expression”, not as a “proposition”, i.e., it cannot be true or false. Therefore “Is  $1 + 2 + 3$  true or false?” is also not a well-defined question.

When writing results of computations, make sure it’s simplified. For instance write 2 instead of  $1 + 1$ . When you write down sets, if the answer is  $\{1\}$ , I do not want to see  $\{1, 1\}$ .

When writing a counterexample, always write the simplest.

Here are some examples (see `instructions.tex` for details):

1. T or F or M:  $1 + 1 = 2$  ..... T

2. T or F or M:  $1 + 1 = 3$  ..... F

3. T or F or M:  $1+^2 =$  ..... M

4.  $1 + 2 =$  3

5. Write a C++ statement to declare an integer variable named **x**.

```
int x;
```

6. Solve  $x^2 - 1 = 0$ .

Since  $x^2 - 1 = (x - 1)(x + 1)$ ,  $x^2 - 1 = 0$  implies  $(x - 1)(x + 1) = 0$ . Therefore  $x - 1 = 0$  or  $x = -1$ . Hence  $x = 1$  or  $x = -1$ .

7. Which is true? ..... C

(A)  $1 + 1 = 0$

(B)  $1 + 1 = 1$

(C)  $1 + 1 = 2$

(D)  $1 + 1 = 3$

(E)  $1 + 1 = 4$