

**CISS360: Computer Systems and Assembly Language**  
**Quiz q0303**

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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. Write a MIPS program that obtains one integer  $x$  from the user and stores  $x$ ,  $2x$ ,  $4x$ ,  $8x$ ,  $16x$ ,  $32x$  in the data segment (at the beginning of the data segment of course). Do NOT use `mul` or `mult`. Next get an integer  $y$  from the user, load  $8x$  from the data segment, compute and print  $8x + y$  and store this value at the word after  $32x$ .

Use `a`- and `v`-registers only for input/output. For instance for input, once the input is performed, move the input to an `s`-register. For output, move the value from an `s`-register to an `a`-register.

Do not use `t`-registers. For your computation, use only `s`-registers. Use the *least* number of `s`-registers. In fact, you only need `$s0` and `$s1`.

Do *not* hardcode addresses but use *one* label instead.

ANSWER:

```
.text
.globl main

main:    li    $v0, 5          # get x from user
         syscall
         move $s0, $v0        # move x to s0

         la    $v0, x          # v0 holds address of x
         sw    $s0, 0($v0)     # store x

         # calculate and store 2x, 4x, 8x, 16x, 32x
         add   $s1, $s0, $s0    # 2x
         sw    $s1, 4($v0)     # store 2x into x + 4
         add   $s1, $s1, $s1    # 4x
         sw    $s1, 8($v0)     # store 4x into x + 8

         add   $s1, $s1, $s1    # 8x
         sw    $s1, 12($v0)    # store 4x into x + 12
```

```
add $s1, $s1, $s1    # 16x
sw  $s1, 16($v0)     # store 16x in x + 16

add $s1, $s1, $s1    # 32x
sw  $s1, 20($v0)     # store 32x in x + 20

la  $s0, 0($v0)      # store the &x in s0

# get integer y from user
li  $v0, 5
syscall

# compute 8x + y and store in s1
lw  $s1, 12($s0)     # 8x is in s1
add $s1, $s1, $v0    # 8x + y
sw  $s1, 24($s0)     # store 8x + y in x + 24

# output the result
move $a0, $s1        # move the result to a0
li  $v0, 1
syscall

# exit the program
li  $v0, 10
syscall

.data
x:  .word 0 # store x, 2x, 4x, 8x, 32x, 8x + y
```

## 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)  $1 + 1 = 4$