CISS360: Computer Systems and Assembly Language
Quiz q0404

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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 gets n from the user and stores the first $n + 2$ Fibonacci numbers in the data segment. For instance if the user enters 3, the first 3 + 2 = 5 Fibonacci stored in the numbers are

$$1, 1, 2, 3, 5$$

Test 1
Console

```
3
```

Data segment

```
        DATA
[0x10000000]...[0x10010000]  0x00000000
[0x10010000]                 0x00000001  0x00000001  0x00000002  0x00000003
[0x10010010]                 0x00000005  0x00000000  0x00000000  0x00000000
```

Answer:

```
        .text
        .globl main

main:
        # get n from user
        li    $v0, 5
        syscall

        addiu $a1, $v0, 2   # n + 2

        la    $s0, fibonacci

        # calculate and store Fibonacci numbers

        li    $t0, 2        # initialize loop counter
        # starting from the third Fibonacci number

loop:   beq   $t0, $a1, exit  # EXIT when n + 2 reached
        lw    $t2, 0($s0)    # load the first element in the sequence
```

```
        lw    $t3, 4($s0)    # load the second element in the sequence
        add   $t4, $t2, $t3  # calculate the next element
        sw    $t4, 8($s0)    # store it

        addi   $s0, $s0, 4   # move to the next element
        addi   $t0, $t0, 1   # increment loop counter
        j     loop

exit:
                addi         $a1, $a1, -1   # last element
                add                $a1, $a1, $a1
                add                $a1, $a1, $a1  # n + 2 + 2 * 4 (bytes)
        la      $s0, fibonacci # reset the address
        add     $s0, $s0, $a1  # last element

        li      $v0, 1        # print last element for checking
        lw      $a0, 0($s0)
        syscall

        li     $v0, 10
        syscall

        .data
fibonacci: .word 1 1   # initialize first two
```

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) $1 + 1 = 4$