CS 590: Topics in Computer Science
Assignment 09: MIPS Debugging and more MIPS GCC

MIPS programming

Exercise 1: Debugging a MIPS program

Debug the loop in the program in `lab09s.s`. It is meant to copy integers from memory address $a0 to memory address $a1, until it reads a zero value. The number of integers copied (up to, but not including the zero value), should be stored in $v0.

Exercise 2: Compiling from C to MIPS

The file `lab09c.c` is a C version of the program in Exercise 1 above. Compile this program into MIPS code using the (cross-compiler) command:

```
mips-linux-gnu-gcc -S -O2 -fno-delayed-branch lab09c.c -o lab09c_nodelay.s
```

```
mips-linux-gnu-gcc -S -O2 lab09c.c -o lab09c_delay.s
```

The `-O2` option turns on optimization. The `-S` option generates assembly code.

The above command should generate assembly language output (`lab09c_nodelay.s`) for the C code. Find the assembly code for the loop that copies source values to destination values. Then, for the registers `$a0`, `$a1`, `$v0`, and `$v1` from part 2, determine what registers gcc used to store the corresponding value. (For example, `$a0` was used to store the source address of integers to be copied. What register is used for this purpose in the mips-gcc output?) Compare the programs `lab09c_nodelay.s` and `lab09c_delay.s`, explain what is different and why.

Questions/Tasks:

1. Explain what a side-channel attack is.
2. Explain how an operating system process separation helps in hardware security.
3. Explain how return-oriented programming works to read memory from the victim's process.
4. Explain about the cache timing attack and countermeasures against it.

SUBMISSION

Write your report including screenshots of your program running and explaining how it works. Include comments in your code too and submit your program source code files (.c and .asm).

Submit your report as a DOCX or PDF document through Western Online. Include in the report the answers to the questions writing the corresponding numbers and questions (or at least the numbers) in **bold** and in the proper order before every answer. At the end include a conclusion (properly labeled as that) explaining the importance of all this.

Name your report using the following format:
`YourLastName_YourFirstName_CS590_Lab09.pdf`

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