Intro to MIPS

COMP1521 Week 2

What is MIPS?

- An assembly language. But what's that?
  - A low-level language that runs on a particular architecture (i.e. a particular kind of CPU). Examples include MIPS, x86, and ARM.
  - Compilers turn our C code into assembly language (which can then be turned into .o files by the assembler, and into ELF files by the linker — beyond the scope of this course).
- Why do we need assembly?
  - Computers don't understand C code. However, assembly languages are much closer to the actual machine code that CPUs do understand. A MIPS CPU, for example, can actually execute an "add" instruction.
- What are registers, by the way?
  - Tiny regions of memory in the CPU that are extremely fast to access (much faster than RAM; much, much faster than disk). MIPS is a 32-bit architecture, so each register holds 32 bits.

Meme

This was too big for the previous slide :(

What is mipsy (and mipsy_web), and what do we use them for in COMP1521?

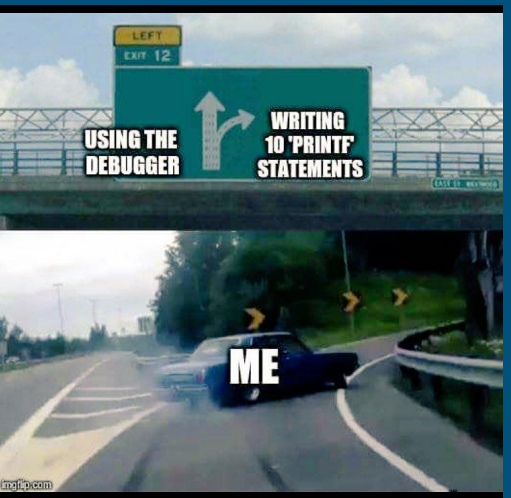
- Mipsy is a MIPS emulator which simulates the execution of a MIPS CPU and lets you run MIPS assembler on any computer (regardless of native architecture).
- Mipsy-web is a web version of mipsy that allows you to view your program state more easily.

A helpful extension

If you use VSCode, may want to install ‘Mipsy Editor Features’, which provides autocomplete, syntax highlighting, and more. I would highly recommend doing so.

Let’s discuss debugging!

- A short demonstration? Or discussion?
- But first, some things not to do:



Registers and their “types”

- Different registers have different purposes. A lot of them are simply convention, but it is important to adhere to convention so that others can read and use our code.
- Broadly, there are three types:
  - General use registers
  - Function call registers
  - Other registers

Some MIPS conventions

General use registers

- $8-$15, $24, $25
  - Temporary registers. But they can be referred to in other ways. How do we do that?
  - Yep, $t0-$t9.
- $16-$23
  - Saved registers, generally referred to as $s0-$s7.
  - These are no different from temporary registers until we get to MIPS functions.

Function call registers

- $a0-$a3
  - First four arguments to a function call (including syscalls, though these are a bit different from a normal function call).
  - Arguments that don't fit into 32-bits are placed on the stack (not commonly seen in this course, but worth noting)
- $v0, $v1
  - Return value(s) from a function. We will generally only use $v0 in this course.
  - Also note that the return of syscall 5 (scanning in an integer), will be placed in $v0.
- $ra
  - Return address of the most recent function caller.
- $sp, $fp
  - Stack pointer, points to the top of the stack/frame pointer, points to bottom of stack frame.

Other registers

- $zero
  - Always gives 0 upon read (ignores writes)
- $at
  - Assembler temporary register. You can’t use this register. Often used for pseudo-instructions.
- $k0, $k1
  - Reserved for kernel (i.e. operating system) use. You can’t use these.