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CS251 - Computer Organization and Design

CS251 ARM Simulators

Instructor: Zille Huma Kamal

University of Waterloo

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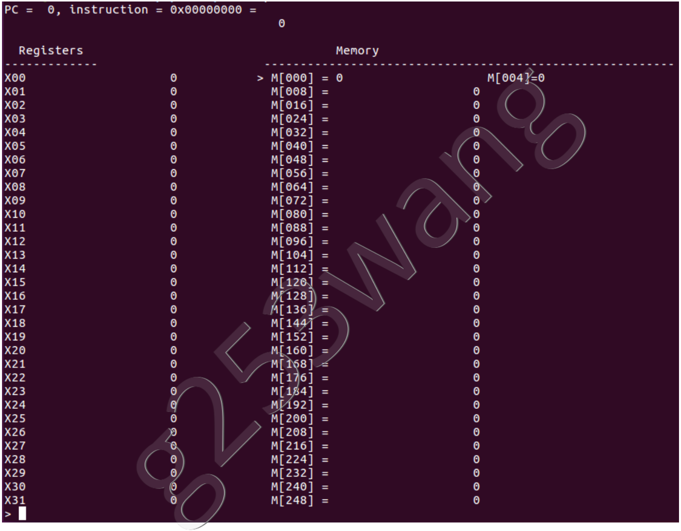
CS251 ARM Simulators

- How to run course simulator
- How to run textbook simulator
- You do not have to use either!

How to Run ARM Simulator in course account

- Login into `student.linux.cs` account.
- Type `/u/cs251/ARM/arm` in any directory you create in your home directory.

ARM Simulator Startup State



```
PC =  0, instruction = 0x00000000 =
                                                    0

  Registers                                         Memory
-------------                                ---------------------------------------------------------
X00                     0                  > M[000] = 0                        M[004]=0
X01                     0                    M[008] =                        0
X02                     0                    M[016] =                        0
X03                     0                    M[024] =                        0
X04                     0                    M[032] =                        0
X05                     0                    M[040] =                        0
X06                     0                    M[048] =                        0
X07                     0                    M[056] =                        0
X08                     0                    M[064] =                        0
X09                     0                    M[072] =                        0
X10                     0                    M[080] =                        0
X11                     0                    M[088] =                        0
X12                     0                    M[096] =                        0
X13                     0                    M[104] =                        0
X14                     0                    M[112] =                        0
X15                     0                    M[120] =                        0
X16                     0                    M[128] =                        0
X17                     0                    M[136] =                        0
X18                     0                    M[144] =                        0
X19                     0                    M[152] =                        0
X20                     0                    M[160] =                        0
X21                     0                    M[168] =                        0
X22                     0                    M[176] =                        0
X23                     0                    M[184] =                        0
X24                     0                    M[192] =                        0
X25                     0                    M[200] =                        0
X26                     0                    M[208] =                        0
X27                     0                    M[216] =                        0
X28                     0                    M[224] =                        0
X29                     0                    M[232] =                        0
X30                     0                    M[240] =                        0
X31                     0                    M[248] =                        0
> █
```

Figure: ARM simulator

ARM Simulator: Observations

- The simulator shows each row of memory as a double word.
- Instructions are 32 bits, half of a row.
- Program counter (PC) is a multiple of 4.
- Registers contain data of size 64 bit.
- Register 31 is always 0.

ARM Simulator: Basic Commands

- To store a value of 6 to register 2, using the command `R[2] = 6` or `x2=6`
- To store a value, e.g. 1000, to memory address 216, type `M[216]=1000`.
- To enter a machine command type the command to the prompt.
- To execute a program, set the pc to the starting line, and press enter to advance. The `run` or `run fast` command will go through all lines of your assembly code.
- The `quit` command exits the simulator.
- The `help` command shows you the commands you can execute.
  - Use `save filename` to save a program you typed. Make sure you have write permission.
  - Use `load filename` to load a program you saved.
  - We can view the memory in hex, decimal, or code: `memory hex`, `memory dec`, `memory code`

ARM Simulator Example

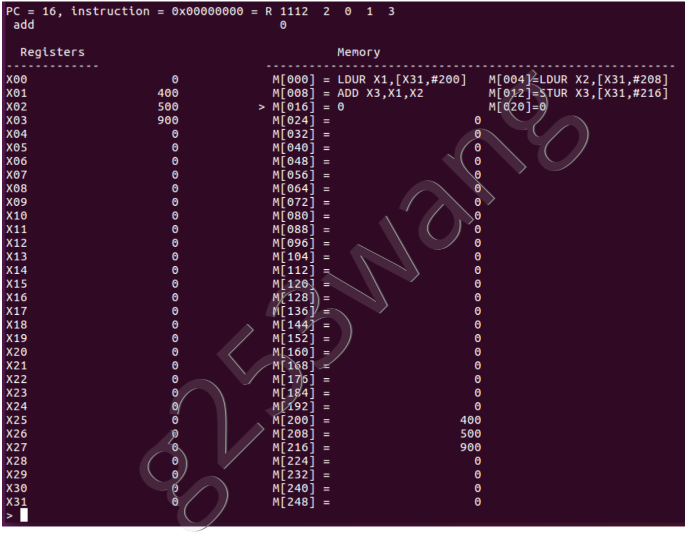
The course note shows three ARM examples for you to try on the simulator.

These examples are in `/u/cs251/ARM` directory:

- `a=b+c.arm`
- `copy.arm`
- `sumarry.arm`

Load these examples or type them yourself as a way to learn.

ARM Simulator Add Example



```
PC = 16, instruction = 0x00000000 = R 1112  2  0  1  3
 add                                    0

  Registers                                            Memory
-------------                                    ------------------------------------------------------
X00                     0                         M[000] = LDUR X1,[X31,#200]    M[004]=LDUR X2,[X31,#208]
X01                   400                         M[008] = ADD X3,X1,X2          M[012]=STUR X3,[X31,#216]
X02                   500                       > M[016] = 0                     M[020]=0
X03                   900                         M[024] =                     0
X04                     0                         M[032] =                     0
X05                     0                         M[040] =                     0
X06                     0                         M[048] =                     0
X07                     0                         M[056] =                     0
X08                     0                         M[064] =                     0
X09                     0                         M[072] =                     0
X10                     0                         M[080] =                     0
X11                     0                         M[088] =                     0
X12                     0                         M[096] =                     0
X13                     0                         M[104] =                     0
X14                     0                         M[112] =                     0
X15                     0                         M[120] =                     0
X16                     0                         M[128] =                     0
X17                     0                         M[136] =                     0
X18                     0                         M[144] =                     0
X19                     0                         M[152] =                     0
X20                     0                         M[160] =                     0
X21                     0                         M[168] =                     0
X22                     0                         M[176] =                     0
X23                     0                         M[184] =                     0
X24                     0                         M[192] =                     0
X25                     0                         M[200] =                   400
X26                     0                         M[208] =                   500
X27                     0                         M[216] =                   900
X28                     0                         M[224] =                     0
X29                     0                         M[232] =                     0
X30                     0                         M[240] =                     0
X31                     0                         M[248] =                     0
> 
```

Figure: ARM simulator add example

Textbook Simulator

- Demo