TOGETHER. TOMORROW. EWHA

Computer Architecture Homework #03

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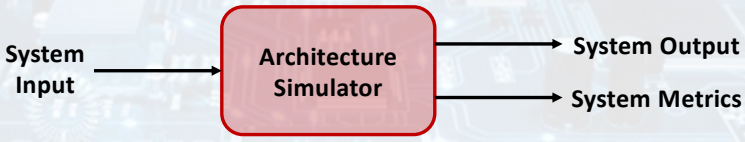
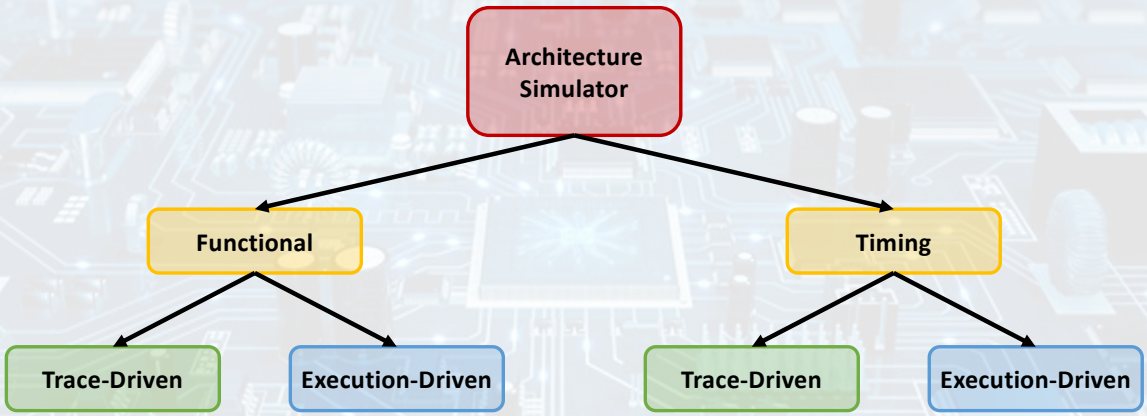
Architecture Simulator

- **What is an architecture (or architectural) simulator?**
  - A tool that reproduces the behavior of a computing device



- **Why use a simulator?**
  - Leverage faster, more flexible software development cycle
    - Permits more design space exploration
    - Facilitates validation before hardware becomes available
    - Level of abstraction can be throttled to design task
    - Possible to increase/improve system instrumentation

A Taxonomy of Simulation Tools

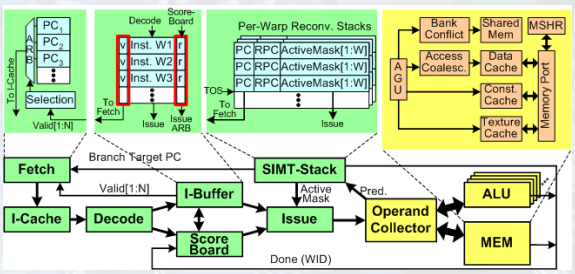


Functional vs. Timing Simulation

- **Functional simulators implement the architecture**
  - The architecture is what programmers see
  - One can collect basic program execution information
    - How many instructions in different classes? (or instruction mix)
    - What is cache hit/miss rate?
- **Timing simulators implement the microarchitecture**
  - Model system internals (microarchitecture)
    - Pipeline, cache, branch predictor, …
  - One can collect many timing-related statistics

Architecture Simulator

- **CPU simulators**
  - GEM5, Multi2Sim, …
- **GPU simulators**
  - Accel-Sim, GPGPU-Sim, …
- **NPU simulators**
  - Scale-Sim, Astra-Sim, …



Guide

- **Grading: 0% ~ 100%**
  - Based on the incorrected number of values (REGISTER + MEMORY)
  - If the program doesn't run, you'll get 0 points (such as Segmentation Fault!!)
- **Due date: 2022-11-16 (11:59 PM)**
  - Late homework is not allowed
  - A compressed file must be uploaded to the cyber campus
  - Folder name must be studentID_YourName (Ex: 1234567_MyungKukYoon)
  - The compressed file name must be studentID_YourName.zip (Ex: 1234567_MyungKukYoon.zip)
- **Q/A**
  - I will be happy to answer your questions about homework #03 until **November 11th**. After November 11th, I will not answer your questions about homework #03
- **Execution time: less than 5 seconds**

Guide

```
/*
* ********** Please read the instructions below carefully **********
* Your name and student ID must be printed when this project is executed
* Do not print anything other than your name and student ID (Delete printf functions used for debugging when submitting this homework)
* - If not, there will be 20% penalty
* Run make clean command before submitting your homework
* Change this project folder name to studentID_yourname (EX: 1234567_myungkukyoon)
* You must compress this project folder (not the files in this folder)
* - If not, there will be 20% penalty
* - Use ZIP compression utility (DO NOT USE TAR COMMAND)
* The name of ZIP file must be studentID_yourname.zip (EX: 1234567_myungkukyoon.zip)
* All the tests must be done in 5 seconds
* - If not, you will get 0%
*/
```

```
/*
* Input instructions
* add, sub, addi, sw, lw
*/
```

No Branch Instruction!!

Input and Output Files

- Input file: input_inst.txt, input_mem.txt, input_reg.txt
- Output file: output.txt
- Your output file: hw03_output.txt

All the values are in hexa-decimal format

# of Instructions

Up to 1000 instructions

Instruction

```
6
0x07852483
0x009a84b3
0x002080b3
0x402080b3
0x00148493
0x06952c23
```

[input_inst.txt]

Word (4-Byte)

Address: 0
Address: 4
Address: 8

```
00000000
00000001
00000002
00000003
00000004
00000005
00000006
00000007
00000008
00000009
0000000a
0000000b
```

Address: Up to 4096 Bytes

[input_mem.txt]

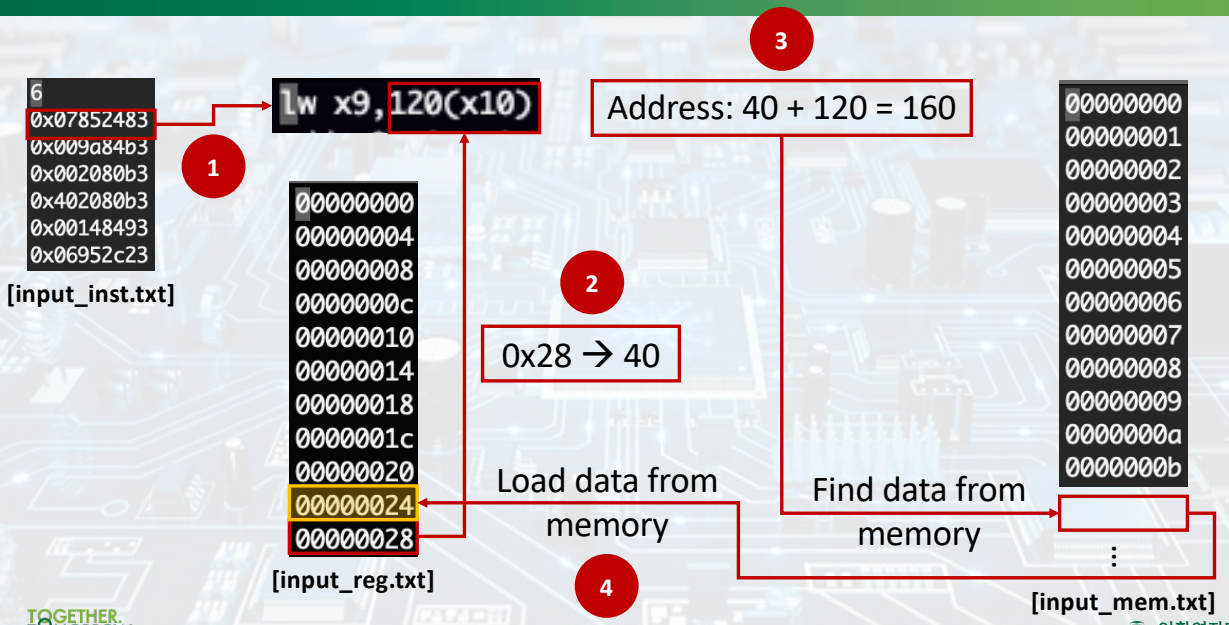
Register #0 (32 bits)

ALWAYS!! Register #0 = 0

```
00000000
00000004
00000008
0000000c
00000010
00000014
00000018
0000001c
00000020
00000024
```

[input_reg.txt]
32 Registers

Simple Functional Simulator



Simple Functional Simulator

```
6
0x07852483
0x009a84b3
0x002080b3
0x402080b3
0x00148493
0x06952c23
```

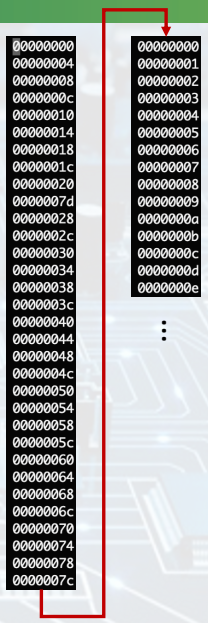
[input_inst.txt]

Print register values and memory values in the order after execution of all instructions

USE ”print_output_to_file” FUNCTION

```
void print_output_to_file(FILE *fp){
    for(unsigned i = 0; i < MAX_REG_SIZE; i++){
        fprintf(fp, "%08x\n", Register[i]);
    }
    for(unsigned i = 0; i < MAX_MEM_SIZE; i++){
        fprintf(fp, "%08x\n", Memory[i]);
    }
}
```

If you find a bug in the input and output files, please send me an email. Anyone who finds a bug and reports it for the first time will receive an additional 10% of this homework (1% of your total grade)



Additional information

- **Changing directory**
  - $cd FOLDER_NAME
  - $cd ..
- **Printing the path of the working directory**
  - $pwd
- **Listing files or directoris**
  - $ls

Additional information

- **Build/Clean/Run**
  - $make
  - $make clean
  - $./hw03
- **Diff (this command will be used to check your answer)**
  - $diff hw03_output.txt output.txt
- **ZIP & UNZIP**
  - $zip FILE_NAME.zip FOLDER_NAME/*
  - $unzip FILE_NAME.zip

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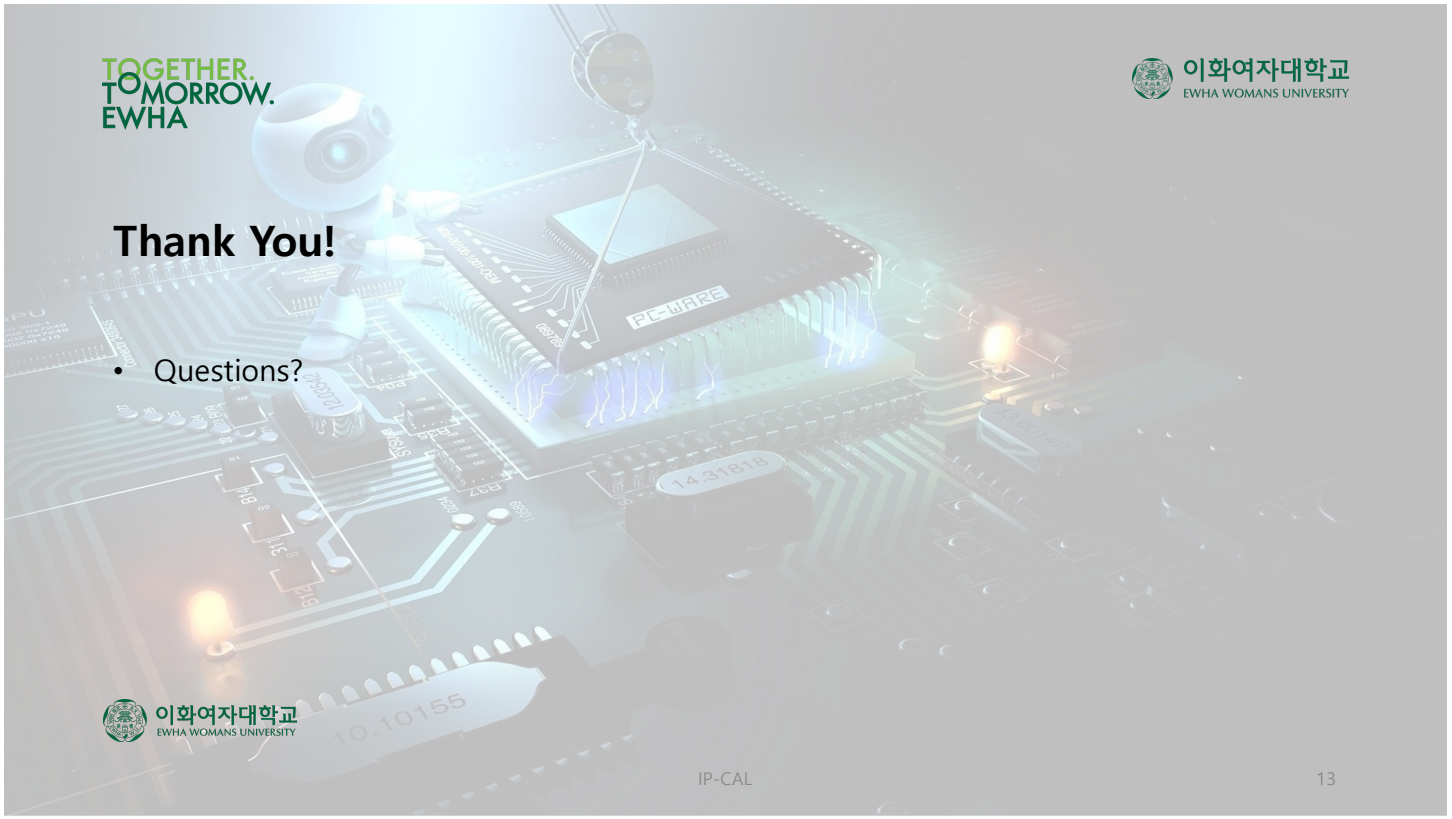
Thank You!

- Questions?



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