

Computer Architecture

Assignment 3

Due: Next weak section. (one day before if you submit by email)

Notes: This assignment is individual assignment, every student should complete by himself.

1. (10 points) Indicate whether the following belongs to ISA or the Microarchitecture layer and describe each statement in no more than 2 lines.

- a. Pipelining
- b. In-order versus out-of-order instruction execution
- c. Memory Address space ,and Alignment
- d. Memory access scheduling policy
- e. Opcodes, Addressing Modes, Data Types
- f. Speculative execution
- g. Superscalar processing (multiple instruction issue)
- h. Prefetching
- i. Voltage/frequency scaling
- j. Task/thread Management

2. Complete the following tutorial then answer question 3. This tutorial to review a simple Factorial program on 8086 and ARM ISA follow the next steps to complete the tutorial correctly:

Part 1: 8086 ISA

1. [Download MASM](#) (Microsoft assembler)
2. [Download 8086 Factorial](#) program
3. Start assemble the program with MASM and check the results
Hint: for further help review this [online lecture](#), or review [8086 instruction set](#)

Part 2: ARM ISA

1. [Download ARMSim](#) (Arm simulator and assembler)
2. [Download ARM Factorial](#) program
3. Start assemble the program with ARMSim and check the results
Hint: for further help review this [online lecture](#), or review [ARM instruction set](#)

3. (10 points) Trace the following 8086 program and test with [MASM](#) and the [Debug](#) tool then answer the questions.

```
Data Segment
    num db 00000010B
Data Ends

Code Segment
    Assume cs:code, ds:data

Begin:
    mov ax, data
    mov ds, ax
    mov es, ax
    mov ah, 0000h
    mov al, num
    NOT al
    mov bl, al
    adc al, 00000001B
    mov bl, al

Exit:
    mov ax, 4c00h
    int 21h
Code Ends
End Begin
```

- a. **What does this program do?**
- b. **Convert the program into ARM assembly and test your program with ARMSim.**