Chapter 1

1. List all classes of contemporary computers
   Personal computers, server computers, supercomputers, embedded computers.

2. Which parameters will affect to performance of an application?
   Algorithms, Programming languages, Compiler, ISA

3. To which time of an application will Operating system contribute?
   Elapsed time

4. Why are frequencies of Intel processors reduced in 2004?
   Power wall/ reducing power consumption

5. What is a correct order in level of abstractions from high to low of the following languages?
   Programming Languages, Binary Languages, and Assembly Languages
   Programming Languages, Assembly Languages, Binary Languages

6. A clock signal becomes logic 1 in total $2x10^9$ times per second, what is the cycle time of the clock?
   0.5 ns /0.5×10^{-9} s

Assume that a program consists of:

- $200x10^6$ FP instructions
- $100x10^6$ integer instructions
- $80x10^6$ data transfer instructions
- $40x10^6$ branch instructions

CPI for these instruction groups are 2, 1, 4, and 2, respectively

7. What is average CPI of the above program?
   ~2.143/2.14/2.1

8. By how much must we improve the CPI of FP instructions so that the program runs 1.5x faster?
   New CPI of FP = 0.5/reduced by 4 times/reduced by 75%

9. If we reduce CPI of integer and FP instructions by 40% and of branch and data transfer by 30%; what is the speed-up?
   Speed-up = 1.55x /1.55 times

Chapter 2:

1. Which instructions below are legal?/which instructions will cause a compile error?
   A-add $s0, $s0, 5
   B- sll $t0, $t1, 34
   C- sw $t1, 0x07($t0) *
   D- andi $t0, $t1, $t2

2. Write two independent standard instructions that can invert all bits of $s1
   nor $s1, $s1, $s1
   nor $s1, $zero, $s1

3. Write three independent standard instructions that can assign 0 to $t0
   addi $t0, $zero, 0

ori $t0, $zero, 0
sub $t0, $zero, $zero

4. To assign the value of 0x12345678 to $t0, which standard MIPS instructions should we use?
   lui $t0, 0x1234
   ori $t0, $t0, 0x5678/addi $t0, $t0, 0x5678

Assume that $s0 and $s1 store values of 0x12345678 and 0xCAFEFACE, respectively.

5. What is the value of $s2 after executing the following instruction?
   andi $s2, $s0, 2020
   s2 = 0x00000660

6. What is the value of $s2 after executing the following instructions?
   sll $s2, $s0, 4
   nor $s2, $s1, $s2
   $s2 = 0x14000031

7. Which is machine instruction of add $t0, $s1, $s2?
   0|17|18|8|0|32
   000000_10001_10010_01000_00000_100000
8. What is the MIPS instruction of the following machine instruction?
   0000_0000_0001_0000_0101_0000_1000_0000$_2$
   sll $t2, $s0, 2

   Assume that we execute the following sequence of instructions on a MIPS processor

```
--
#declare data in memory
.data
      myArray: .word 2020, -20, 20
#instructions
.text
      la $t0, myArray #psuedo instruction that will assign base address of an
array to a register
      lbu $s0, 2($t0)
      lbu $s1, 7($t0)
      add $s3, $s1, $s0 #$s3 = 0x000000F3
      sw $s3, 8($t0)
      lb $s4, 11($t0)
---
```

9. What is the value of $s0?
   $s0 = 0x00000007

10. What is the value of $s1?
    $s1 = 0x000000EC

11. What is the value of $s4?
    $s4 = 0xFFFFFFF3

Assume that, we have following MIPS instructions. The first instruction is stored at address of 8

```
label: bne $t0, $t1, exit #x
```

```
     addi $t0, $t0, -1#x+4
     addi $t1, $t1, 1 #x + 8
     j label #x + 12
exit #x + 16 = target = PC + address*4 = x+4 + address*4
```

12. What is the value of the offset/address field in bne

    Address = 3

13. What is the value of the address field in j

    Address = 2

Target address = 8 = {PC[31:28],address,00} = {0000,address,00}