

CSE2312 Computer Organization & Assembly Language Programming
QUIZ 1 (Chapter 1)

Student Name: _____

Student ID: _____

TRUE OR FALSE (1 pts per)

Q:	1	2	3	4	5	6	7	8	9	10
T/F	T	F	T	T	F	F	F	T	T	F

1. Computer Architecture is to study how to design parts of a computer system that are visible to the programmers. T
2. An interpreter converts programs in one language to another, while a translator carries out a program instruction by instruction. F
3. Hardware and software are functionally equivalent. Any function done by one can, in principle, be done by the other. T
4. Hardware and software are not equivalent in the sense that to make the machine really run, the bottom level must be hardware, not software. They also differ in performance. T
5. L1 language is less convenient for people to use than those in built-in machine instructions. F
6. Clock rate is the only factor that determines the performance of a CPU. F
7. Keep other factors the same, running the same program in a computer with 2 CPUs will get at least 2x acceleration compared to running it on a computer with only 1 CPU. F
8. The response time is defined as the amount of time that a given computer takes to do a specific task. T
9. ISA is the interface between software and hardware. T
10. Amdahl's law predicts the capacity of disk will increase 2x every year. F

Multiple Choices (4 pts per)

1. **Which of following is true for Translation and Interpretation?** [a, b, c]
 - (a) In both of them, the computer carried out instructions in L1 by executing equivalent sequences of instructions in L0
 - (b) In translation, the entire L1 program is converted to a L0 program.
 - (c) In interpretation, after each L1 instruction is examined and decoded, it is carried out immediately.
 - (d) Interpretation is more efficient than Translation

2. **Which of following can be stored in the memory?** [c]
 - (a) Data only
 - (b) Program only
 - (c) Both data and program
 - (d) None of them

3. **Which of following may affect the execution time?** [a, b, c, d]
 - (a) Algorithm: determine the number of operations executed
 - (b) Programming language, compiler, architecture: determine the number of machine instructions executed per operation (IC)
 - (c) Processor and memory system: determine how fast instructions are executed (CPI) and increase it.
 - (d) I/O system (including OS): determines how fast I/O operations are executed

4. **Which of following is true in Multilevel Machines?** [c, d]
 - (a) Instruction Set Architecture Level lay between Digital Logic Level and Microarchitecture Level.
 - (b) Assembly Language Level lay between Instruction Set Architecture Level and Operating System Level
 - (c) Operating System Level lay between Assembly Language Level and Instruction Set Architecture Level
 - (d) Microarchitecture Level lay between Digital Logic Level and Instruction Set Architecture Level

5. **Which of following is true based on Moore Law:** [b]
 - (a) 2X processor speed increment every 8 months.
 - (b) 2X processor speed increment every 18 months.
 - (c) 4X processor speed increment every 8 months.
 - (d) 4X processor speed increment every 18 months.

6. Consider a computer with identical interpreters at levels 1, 2, and 3. It takes an interpreter n instructions to fetch, examine and execute one instruction. A level 1 instruction takes k nanoseconds to execute. How long does it take for an instructions at levels 3 [**c**]

- (a) k nanoseconds.
- (b) kn nanoseconds.
- (c) kn^2 nanoseconds.
- (d) kn^3 nanoseconds.

7. What factors could account for the performance discrepancy of computers: [**a,b,c,d**]

- (a) Cycle time.
- (b) The number of bytes fetched per cycle.
- (c) Memory speed.
- (d) I/O architecture.

8. Which of following is not I/O device? [**d**]

- (a) Keypad.
- (b) Mouse.
- (c) Printer.
- (d) CPU.

9. In computer architecture, which of the following use ISA: [**a, b**]

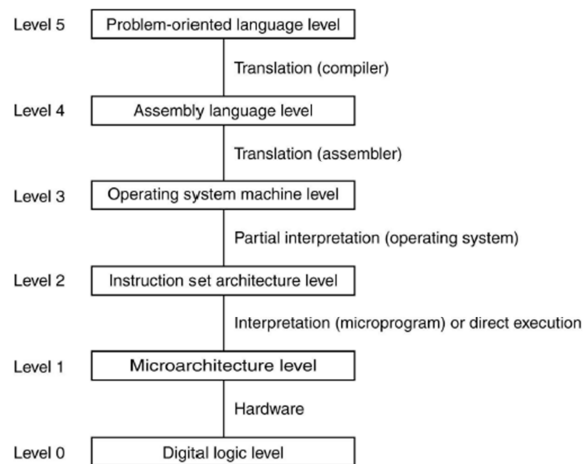
- (a) Operating System.
- (b) Compiler.
- (c) Memory.
- (d) Disk.

10. Which of following is not a computer of Von Neumann Architecture: [**d**]

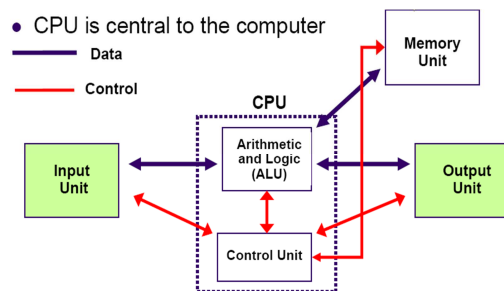
- (a) iPhone.
- (b) iPad.
- (c) Dell Desktop PC.
- (d) Babbage's difference engine.

Fill in the Blanks and Short Answer (5 pts per)

1. Please draw a diagram for the Contemporary 6-level Machines



2. Please draw a diagram for the Von Neumann Machine



3. What factors affect the execution time? How to reduce the execution time correspondingly?

Solution:

Algorithm, programming language, compiler and architecture, processor and memory system, I/O system.

- Algorithm

- Reduce number of operations executed

- Programming language, compiler, architecture

- Reduce number of machine instructions executed per operation (IC)

- Processor and memory system

- Determine how fast instructions are executed (CPI) and increase it.

- I/O system (including OS)

- Determines how fast I/O operations are executed

4. If computer A and Computer B are 8Mhz and 3Ghz respectively, what is their clock times respectively?

Solution:

A: $1/8 * 10^{-6}$ sec.

B: $1/3 * 10^{-9}$ sec.

5. What is the key gap in computer design? How to bridge this gap?

Key Gap: *Human prefers natural language while it's easy to use machine (binary) language for computers.*

Bridging the Gap: *Designing a high level language (L1) including a new set of instructions that is more convenient for people to use than those in built-in machine instructions (L0 language).*

Computation and Short Answer (15 pts per)

1. There are 4 classes of instructions, A, B, C, D. Suppose compiler has two choices: Sequence 1 and Sequence 2, as described below:

Class	A	B	C	D
CPI for class	1	2	1	3
IC in sequence 1	3	1	5	1
IC in sequence 2	2	4	1	3

Which choice will be better? Why?

Solution:

Sequence 1: $IC = 3 + 1 + 5 + 1 = 10$.

Clock cycle = $3 * 1 + 1 * 2 + 5 * 1 + 1 * 3 = 13$.

Avg CPI = $13 / 10 = 1.3$

Sequence 2: $IC = 2 + 4 + 1 + 3 = 10$.

Clock cycle = $2 * 1 + 4 * 2 + 1 * 1 + 3 * 3 = 20$.

Avg CPI = $20 / 10 = 2$.

Sequence 1 has lower avg CPI, so it is better.

2. Computer A has 5GHz clock. It takes 100s CPU time to finish one given task.

We want to design Computer B to finish the same task within 20s CPU time. The clock cycle number for computer B is 2 times as that of Computer A.

So, what clock rate should be designed for Computer B?

Solution:

Clock rate (CR) = Clock Cycle/CPU Time

$$\text{Clock Cycle}_A = \text{CR}_A * \text{CPU}_A = 5 * 10^9 * 100\text{s} = 500 * 10^9$$

$$\text{Clock Cycle}_B = 2 \text{ Clock Cycle}_A = 2 * 500 * 10^9 = 1000 * 10^9$$

$$\text{CPU}_B = 20\text{s}$$

$$\text{So Clock Rate}_B = \text{Clock Cycle}_B / \text{CPU}_B = (1000/20) * 10^9 = 50 \text{ GHz}$$

3. There are two computers: A and B.

- Computer A: Cycle Time = 500ps, CPI = 4.0
- Computer B: Cycle Time = 200ps, CPI = 5.0

If they have the same ISA, which computer is faster? How many times it is faster than another?

Solution:

$$\text{CPU} = \text{IC} * \text{CPI} * \text{Cycle time}$$

So

$$\text{CPU}_A = \text{IC} * 4 * 500 = 2000 * \text{IC}$$

$$\text{CPU}_B = \text{IC} * 5 * 200 = 1000 * \text{IC}$$

So B is $(2000/1000) = 2$ times faster.