Computer Architecture and Organization [CSE2003]

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Contents

UNIT – I: Introduction to Computer Architecture

Session – 4:

- Organization of the von Neumann machine and Harvard architecture
- Performance of processor

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Session Objectives

After this session students will be able to:

- Understand the difference between Organization of the Von Neumann machine and Harvard architecture
- Define and Performance of Processor.

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Understanding the Instruction Execution

- Pictorial representation on White Board
  - LOAD A1 TO R1
  - LOAD A2 TO R2
  - R3 = R1 + R2
  - STORE R3 TO A3

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Entry Ticket (**Quiz**)

1. It is a type of memory located inside the CPU. Can hold single piece of data and that Data is useful for both control functions and data processing itself.

- **Answer :** ____________

2. Name Registers of CPU. ___ ___ _____ ____

3. The operations on the data in registers are called ____________

4. The basic operations like add subtract are implemented in computer using ____________

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Entry Ticket

- Understanding Locality of reference

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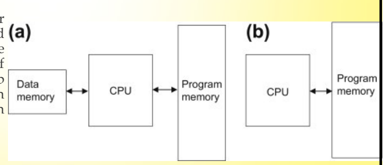
Difference between *Von Neumann and Harvard Architecture*

- In the Harvard architecture(used by most PIC microcontrollers), code and data are on separate busses and this allows the code and data to be fetched simultaneously, resulting in an improved performance.
- it improves the speed of processor operation because data and addresses do not have to share the same bus lines. The reduced size of the instruction set also speeds up decoding and the short data path length in a single chip design reduces data transmission time.
- *In Von Neumann* architecture all memory space is on the same bus and instruction and data use the same bus.



Performance and Speed

- Performance for a program on a particular machine

$$Performance(X) = \frac{1}{Execution(X)}$$

$$\frac{Performance(X)}{Performance(Y)} = \frac{Execution(Y)}{Execution(X)} = n$$

- X is n times faster than Y

Measuring Time

- Execution time is the amount of time it takes the program to execute in seconds.
- Time (computers do several tasks!)
  - elapsed time based on a normal clock;
  - CPU time is time spent executing this program
    - excluding waiting for I/O, or other programs

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- The time to execute a given program can be computed as
- CPU time = CPU clock cycles x clock cycle time
- Since clock cycle time and clock rate are reciprocals
- CPU time = CPU clock cycles / clock rate

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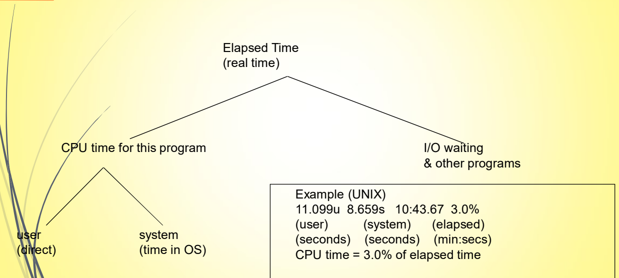
Example: Let assume that a benchmark has 100 instructions:

- 25 instructions are loads/stores (each take 2 cycles)
- 50 instructions are adds (each takes 1 cycle)
- 25 instructions are square root (each takes 50 cycles)
- What is the CPI for this benchmark?
- CPI = ((0.25 * 2) + (0.50 * 1) + (0.25 * 50)) = 13.5

Execution Time



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Performance of Processor

- Pipelines – improve performance
- Programs – must be optimized
- Caches – improve performance
- Benchmarks – measure performance
- Device Fabrication – improves performance
- Various optimizations are possible

Questions

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References