**BPDC, Dubai - First Semester, 2023-2024**

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| **Course No: CS F342**  **Week: #02** | **TUTORIAL 2**  **Solution** | **Course Title: Computer Architecture** |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 1 |  |  |  |  |  |  |  |
|  | Sl.No | Instr Class | No of Instr(ICi) | CPIi | CPIi \* ICi | %Time (S) | (us) |
|  | 1 | Arith | 500 | 1 | 500 | 0.00000025 | 0.25 |
|  | 2 | Load | 150 | 4 | 600 | 0.0000003 | 0.3 |
|  | 3 | Store | 100 | 4 | 400 | 0.0000002 | 0.2 |
|  | 4 | Branch | 250 | 2 | 500 | 0.00000025 | 0.25 |
|  |  |  | 1000 |  | 2000 | 0.000001 | 1 |
|  |  |  |  |  |  |  |  |
|  |  | CPU Clock = |  |  | 2GHz |  |  |
|  |  | CPU Clock Cycles = | A | 2000 |  |  |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
|  |  | Total Instruction Count(B) = | B |  | 1000 |  |  |
|  |  |  |  |  |  |  |  |
|  | i) | Avg CPI (C) = | C | A/B | 2 |  |  |
|  |  |  |  |  |  |  |  |
|  | ii) | Total Exec Time (Sec)= |  | 2000/2GHz | 0.000001 |  |  |
|  |  |  |  |  | 1us |  |  |
|  |  |  |  |  |  |  |  |
|  | iii) | %Time (us) |  |  | (us) |  |  |
|  |  | Arith |  |  | 0.25 |  |  |
|  |  | Load |  |  | 0.3 |  |  |
|  |  | Store |  |  | 0.2 |  |  |
|  |  | Branch |  |  | 0.25 |  |  |
|  |  |  |  |  |  |  |  |

2. We have the instruction count: 109 instructions. The clock time can be computed quickly from the clock rate to be 0.5×10-9 seconds. So we only need to to compute clocks per instruction as an effective value:

Value Frequency Product

3 0.5 1.5

4 0.3 1.2

5 0.2 1.0

CPI = 3.7

Then we have

Execution time = 1.0×109 × 3.7 × 0.5×10-9 sec = 1.85 sec.

3.

1. Which processor has the highest performance expressed in Instructions per second?

P2: 2.5GHz / 1.0 = 2.5 \* 10^9 instructions per second

P3: 4GHz / 2.2 = 1.82 \* 10^9 instructions per second

So P2 has the highest performance among the three

1. If the processor executes a program in 10 sec, find the no of cycles and no of instructions executed.

Cycles:

P2: 2.5GHz \* 10 = 2.5 \* 10^10 cycles

P3: 4GHz \* 10 = 4 \* 10^10 cycles

No. of instructions

P2: 2.5GHz \* 10 / 1.0 = 2.5 \* 10^10 instructions

P3: 4GHz \* 10 / 2.2 = 1.82 \* 10^10 instructions

1. For each of the processors, what should be the clock rate, if the execution time reduced by 30%, but leads to an increase in CPI by 20%.

P2: 2.5GHz \* 1.71 = 4.27 GHz; P3: 4GHz \* 1.71 = 6.84 GHz

Percent increase = [(new value - original value)/original value] \* 100

Percent decrease = [(original value - new value)/original value] \* 100