# Lab Report-1

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Changing the CPU frequency:

CPU Type: ATOMIC
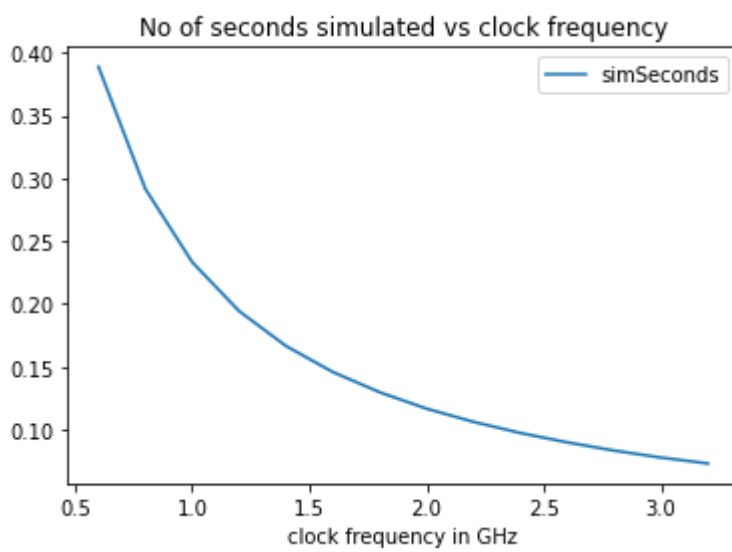


| | clock frequency | simSeconds |
|---|---|---|
| 0 | 0.6 | 0.388892 |
| 1 | 0.8 | 0.291611 |
| 2 | 1.0 | 0.233288 |
| 3 | 1.2 | 0.194329 |
| 4 | 1.4 | 0.166568 |
| 5 | 1.6 | 0.145805 |
| 6 | 1.8 | 0.129708 |
| 7 | 2.0 | 0.116644 |
| 8 | 2.2 | 0.106146 |
| 9 | 2.4 | 0.097281 |
| 10 | 2.6 | 0.089816 |
| 11 | 2.8 | 0.083284 |
| 12 | 3.0 | 0.077685 |
| 13 | 3.2 | 0.073019 |

As expected, the increase in clock frequency leads to faster simulation. The seconds taken by simulation decrease as the clock frequency increases.

## Changing CPU Type:

$$\text{CPU Execution Time} = \frac{\text{No of instructions} \times cpi}{\text{clock frequency}}$$

Clock Frequency: 3.2 GHz

| | CPU Type | Execution Time in s |
|---|---|---|
| 0 | Atomic | 0.072903 |
| 1 | Minor | 2.323170 |
| 2 | O3 | 0.801723 |
| 3 | Timing | 8.313445 |

Execution Time vs CPU Type
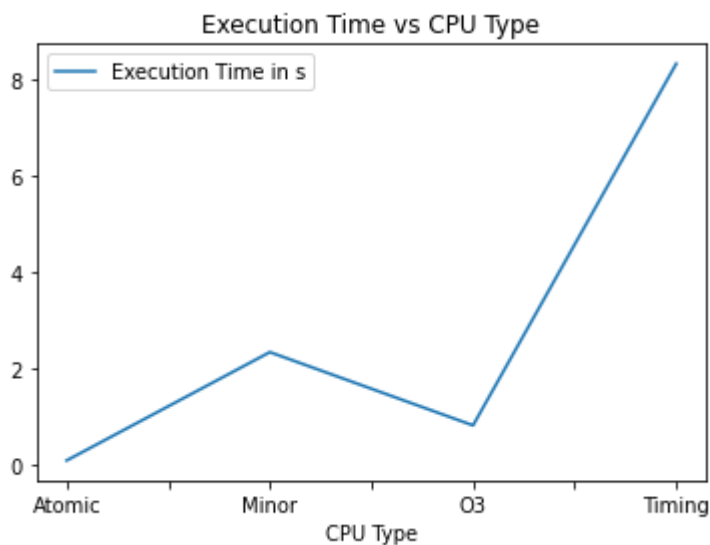


Performance is inversely connected to execution time. Timing CPU takes up the longest time to execute, while Atomic CPU takes the least time among the four types of CPU.

## Adding L1 Cache:

The introduction of a cache makes the simulation faster.

| | Configuration | simSeconds |
|---|---|---|
| 0 | 1GHz+Timing+NoCache | 9.790468 |
| 1 | 1GHz+Timing | 0.226030 |

It can be observed that cache inclusion brings down the simulation time from 9.79s to 0.226s.

## Changing Memory Type from DDR3 to DDR4:

CPU Type: ATOMIC

| | Configuration | hostInstRate |
|---|---|---|
| 0 | 1GHz+Atomic+DDR3 | 1103946.0 |
| 1 | 1GHz+Atomic+DDR4 | 1154578.0 |

"hostInstRate" denotes Simulator Instruction Rate and, therefore, gives an estimate of the simulator performance. It can be seen that by changing the memory type from DDR to DDR4, the performance becomes better.