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Chapter 1 Homework

CSE 401

**1.12.1**

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| --- | --- | --- |
| **Process** | P1 | P2 |
| Clock Rate: | 4 GHz | 3GHz |
| Average CPI | 0.9 | 0.75 |
| Instruction Execution | 5.0E^9 | 1.0E^9 |

Performance = (Clock Rate/CPI) x Instruction Execution

P1: (4/0.9) x 5.0E^9 = 4.44 x 5.0E^9

P2: (3/0.75) x 1.0E^9 = 4E^9

In this scenario the process of P1 is faster than P2. Making this case the process with the faster clock rate does allow for greater performance.

**1.12.2**

# of Instructions = CPI \* Executing Sequence Instruction/Clock Rate

P1 has an ESI of 0.9 x 10 ^9 cc due to the CPI being 0.9 and the total instructions of 1.0E^9

So P1 has a CPU Time instruction of = 0.9 x 10^9 / 4 x10^9 = 0.225 seconds

P2 has ESI of 0.75 x 10^9 following the same logic from solving for P1

So P2 has a CPU time of 0.75 x 10^9 / 3 x 10^9 = 0.225

Since both Processes have the same amount of time, we have to analyze which process has the greater number of instructions. Since P2 has the greater number then it will need more time for completion

**1.12.3**

MIPS = (Clock Rate/ Average CPI \* 10^6)

P1: (4 x 10^9)/(0.9 x 10^6) = 4.444 x 10^3

P2: (3 x 10^9)/(0.75 x 10^6) = 4.00 x 10^3

According to those calculations the MIPS of process P1 is greater than P2, allowing P1 to have the greater performance.

**1.12.4**

Number of floating point operation = Instruction Execution x clock rate x CPI

P1: 5.0E^9 x 4 x 0.9 = 1.8 x 10^9

P2: 1.0E^9 x 3 x 0.75 = 2.25 x 10^9

Execution time = (CPI x Instruction Execution) / Clock Rate

P1: ( 0.9 x 5x10^9) / ( 4 x 10^9) = 1.125 seconds

P2: ( 0.75 x 1x10^9 ) / 3x10^9 = 0.25 seconds

MFLOPS = # of Floating Point Operations / (execution time x 1E6)

P1: ( 1.8 x 10^9 ) / ( 1.125 x 10^6 ) = 1.6 x 10^3

P2: ( 2.25 x 10^9 ) / ( 0.25 x 10^6 ) = 9 x 10^3

**1.15**

O = Overhead = 4s

P = number of processor – Initial 100

Execution Time = (t / p) + 4s

Ex: For 2 processors = (100 / 2) + 4s = 54s

Total Time = Execution time / # of Processors

Ex: For 2 Processors = 54s / 2 = 27s

Relative Speed Up – Initial process count (100) / execution time

Ex: For 2 processors = 100 / 54 = 1.86

Actual Speed Ratio = Relative Speed Up / # of Processors

Ex: For 2 Processors = 1.86 / 2 = 0.925

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Number of Processors | Execution Time (seconds) | Total Time (seconds) | Relative Speed Up | Actual Speed : Ideal Speed Up |
| 1 | 100 | 100 |  |  |
| 2 | 54 | 27 | 1.86 | 0.925 |
| 4 | 29 | 7.25 | 3.45 | 0.8625 |
| 8 | 16.5 | 2.0625 | 6.06 | 0.7575 |
| 16 | 10.25 | 0.64 | 9.76 | 0.61 |
| 32 | 7.125 | 0.223 | 14.04 | 0.4375 |
| 64 | 5.5625 | 0.087 | 17.98 | 0.28 |
| 128 | 4.78 | 0.037 | 20.92 | 0.1634 |