Problem 1:

Consider three different processors P1, P2, and P3 executing the same instruction set. P1 has a 3GHz clock rate and a CPI of 1.5. P2 has a 2.5 GHz clock rate and a CPI of 1.0. P3 has a 4.0 GHz clock rate and a CPI of 2.2.

**Given Information:**

P1 Clock rate 3 GHz, CPI 1.5

P2 Clock rate 2.5 GHz, CPI 1

P3 Clock rate 4 GHz, CPI 2.2

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

Instructions per second =

P1 instructions per second = = 2x10^9

P2 instructions per second = = 2.5x10^9 **ANSWER**

P3 instructions per second = = 1.81x10^9

**Answer**: P2 has the highest performance due to p2 having the highest number of instructions per second.

1. If each processor executes a program in 10 seconds, find the number of cycles and the number of instructions.

**Added given information:**

CPU time = 10seconds

Clock cycles =

Number of instructions =

**Cycles**

P1 clock cycles = = 3x10^10 cycles

P2 clock cycles = = 2.5x10^10 cycles

P3 clock cycles = = 4x10^10 cycles

**Number of instructions**

P1 Number of instructions = = 2x10^10 Instructions

P2 Number of instructions = = 2.5x10^10 Instructions

P3 Number of instructions = = 1.81x10^10 Instructions

Problem 2:

Assume a program consists of arithmetic, load/store, and branch instructions. The program requires the execution of 2.56 x109 arithmetic instructions, 1.28 x109 load/store instructions, and 256 x106 branch instructions. Assume that processor P1 has a 2.5 GHz clock rate and CPIs of 2, 2, and 2 for arithmetic, load/store, and branch instructions, and processor P2 has a 2.2 GHz clock rate and CPIs of 1, 3, and 2 for

arithmetic, load/store, and branch instructions.

**Given Information:**

Arithmetic instructions = 2.56x10^9

Load/store instructions = 1.28x10^9

Branch instructions = 256x10^6

P1 Clock rate = 2.5GHz

CPI:

Arithmetic instructions = 2

Load/store instructions = 2

Branch instructions = 2

P2 Clock rate = 2.2GHz

CPI:

Arithmetic instructions = 1

Load/store instructions = 3

Branch instructions = 2

1. What are the weighted average CPIs for P1 and P2 for this program?

|  |  |  |  |
| --- | --- | --- | --- |
| P1 | Arithmetic | Load/save | Branch |
| CPI | 2 | 2 | 2 |
| Seq 1 | 2.56x10^9 | 1.28x10^9 | 256x10^6 |

Seq 1 = = 4.096x10^9

of P1= =

**Answer**:

|  |  |  |  |
| --- | --- | --- | --- |
| P2 | Arithmetic | Load/save | Branch |
| CPI | 1 | 3 | 2 |
| Seq 1 | 2.56x10^9 | 1.28x10^9 | 256x10^6 |

Seq 1 = = 4.096x10^9

of P1= =

**Answer**:

1. Which processor will complete the program faster, and by how much (expressed in percentage)?

CPU Time of P1 = = 3.36 Seconds

CPU Time of P2 = = 3.13 Seconds

Percent difference = = .0735 = 7%

**Answer**: P2 is faster than P1 by 7%.

Problem 3:

Assume a 15 cm diameter wafer has a cost of $12, contains 84 dies, and has 0.02 defects/cm^2. Assume another 20 cm diameter wafer has a cost of $15, contains 100 dies, and has 0.031 defects/cm^2

**Given Information:**

Wafer 1:

Diameter of the wafer = 15cm

Wafer cost = 12$

Number of dies = 84

Defects per cm^2 = .02 defects/cm^2

Wafer 2:

Diameter of the wafer = 20cm

Wafer cost = 15$

Number of dies = 100

Defects per cm^2 = .031 defects/cm^2

1. Find the yield for both wafers.

Yield =

Wafer 1:

Die area = = = 2.103cm^2

Yield = = .959 **ANSWER**(Rounded to 3 decimal places)

**Answer**: The yield of wafer 1 is .959 Working dies per wafer.

Wafer 2:

Die area = = = 3.142cm^2

Yield = = .9093 **ANSWER(**Rounded to 3 decimal places)

**Answer**: The yield of wafer 2 is .959 Working dies per wafer.

1. Find the cost per die for both wafers.

Cost per die =

Wafer 1:

Cost per die = = .15 Cents **ANSWER**(Rounded to nearest 10th)

Wafer 2:  
 Cost per die = = .17 Cents **ANSWER**(Rounded to nearest 10th)