MIPS

One alternative way to measure CPU performance is MIPS or Million Instructions per second.

$$MIPS = \frac{\text{Instruction Count}}{\text{Execution Time} \times 10^6} \quad (1)$$

Since

$$\text{Execution Time} = \frac{\text{Instruction Count} \times CPI}{\text{Clock Rate}} \quad (2)$$

So Equation (1) becomes

$$MIPS = \frac{\text{Clock Rate}}{CPI \times 10^6} \quad (3)$$

Since MIPS is a rate of operations per unit time, CPU Performance Can be specified as the inverse of execution time, with faster Machines having a higher MIPS rating.

Example:- Two Machine A and B

With Clock Rate of 200MHz

Instruction Category	Percentage of Occurrence		No. of Cycles Per Instruction		No. of inst. in Millions	
	(A)	(B)	(A)	(B)	(A)	(B)
ALU	38	35	1	1	8	10
Load & Store	15	30	3	2	4	8
Branch	42	15	4	3	2	2
Others	5	20	5	5	4	4
					18	24

$$CPI_A = \frac{\sum_{i=1}^{n} CPI_i \times I_i}{\text{Instruction Count}} = \frac{(38\times1)+(15\times3)+(42\times4)+(5\times5)}{100} = 2.76$$

$$MIPS_A = \frac{\text{Clock Rate}}{CPI_A \times 10^6} = \frac{200\times10^6}{2.76\times10^6} = 70.24$$

$$CPI_B = \frac{\sum_{i=1}^{n} CPI_i \times I_i}{\text{Instruction Count}} = \frac{(35\times1)+(30\times2)+(20\times5)+(15\times3)}{100} = 2.4$$

$$MIPS_B = \frac{\text{Clock Rate}}{CPI_B \times 10^6} = \frac{200\times10^6}{2.4\times10^6} = 83.67$$

Thus $MIPS_B > MIPS_A$

Performance in terms of CPU Execution time

$$CPU_A = \frac{\text{Instruction Count} \times CPI_A}{\text{Clock Rate}} = \frac{18\times10^6 \times 2.76}{200\times10^6} = 0.24$$

$$CPU_B = \frac{24\times10^6 \times 2.4}{200\times10^6} = 0.28$$

$CPU_B > CPU_A$ & $MIPS_B > MIPS_A$

"So it Requires longer CPU time to execute the same set of benchmark program."