X is n% faster than y	$\frac{Exe_{t_y}}{Exe_{t_x}} = 1 + \frac{n}{100}$
Overall speedup	$\frac{1}{(1-f)+\frac{f}{s}}$, f = Fraction of program affected, s = times faster
CPI: Avg # of instr	tot tot $¿cc \frac{¿}{¿} instr ¿ = \frac{CPU_{exe} * CR}{Instr\,Count} = op_1 * cc_1 + op_n * cc$
$CPU_{executiontime}$	$num\,instrs \frac{.*CPI*1}{CR} = \frac{num\,instrs.}{MIPS*10^6}$
MIPS: Millions of instructions per second	$\frac{¿instrs.}{CPU_{exe.t}*10^6} = \frac{CR}{CPI*10^6}$
MFLOPS	$\frac{¿floating\,pt\,ops}{CPU_{exe.t}*10^6}$

When dealing with a "new" operation	
Step 1	Complete old CPI
Step 2	Make some change. Replace pairs "Load and ALU op" with new. Determine % of such replacements "x% of ALU ops are paired with a load".
Step 3	Make changes to the table where needed
Step 4	Compute the new CPI. $IC_n = y * IC_o$
Step 5	Determine a relationship between $CCT_o \wedge CCT_n$
Step 6	Compute expressions for $CPU_{exe.t_{old}} = IC_o * CPI_o * CCT_o$, $CPU_{exe.t_n} = IC_n * CPI_n * n * CCT_o$

4. Consider a program P with the following mix of operations: 20% Floating point multiplications, 15% Floating point adds, 5% Floating point divides, and 60% integer instructions. This program is executed on two machines – one with floating point hardware (MFP) and one with no floating point hardware (MNFP). Both machines have a clock rate of 600 MHz. On the MNFP machine, the floating point instructions are emulated using integer instructions, each integer instruction taking 2 clock cycles. On MFP, the floating point operations require the following number of cycles:

Floating point Multiply	8 cycles
Floating point Add	4 cycles
Floating point Divide	25 cycles
Integer instructions	2 cycles

On MNFP, the number of integer instructions needed to implement each of the floating point operations is as follows:

Floating point Multiply	30 integer instructions
Floating point Add	15 integer instructions
Floating point Divide	50 integer instructions

(a) Find the CPI and the MIPS rating for both MFP and MNFP.

(b) If the MFP machine needs 300 million instructions for the program P, how many integer instructions are needed on the MNFP machine for the same program P?

(c) What is the execution time in seconds for program P on MFP and MNFP, assuming the instruction count from part (b)?

$MIPS_{MNFP} * 10^6 \quad 300 * 10^6$

2 ~~3~~

4. (a)

$$CPI_{MFP} = \underbrace{0.2*8}_{Flt.Pt.*} + \underbrace{0.15*4}_{Flt.Pt.+} + \underbrace{0.05*25}_{Flt.Pt.\div} + \underbrace{0.6*2}_{Integer} = \boxed{4.65}$$

$$MIPS_{MFP} = \frac{\text{Clock Rate}}{CPI * 10^6} = \frac{600 * 10^6}{4.65 * 10^6} = \boxed{129}$$

MNFP has only integer instructions. Each integer instruction takes 2 clock cycles.

So $CPI_{MNFP} = \boxed{2}$

$$MIPS_{MNFP} = \frac{600 * 10^6}{2 * 10^6} = \boxed{300}$$

(b) Program P has 300 million instrs. on MFP.

			# of Instrs. on MFP
Flt.Pt. *	20%	0.2 * 300 mil =	60 mil
Flt.Pt. +	15%	0.15 * 300 mil =	45 mil
Flt.Pt. ÷	5%	0.05 * 300 mil =	15 mil
Integer	60%	0.6 * 300 mil =	180 mil

On MNFP, the floating-point instructions need to be emulated by integer instructions.

		# of Instrs. on MNFP
Flt.Pt. *	60 mil * 30 =	1800 mil
Flt.Pt. +	45 mil * 15 =	675 mil
Flt.Pt. ÷	15 mil * 50 =	750 mil