1.14

TC	FP	INT	L/S	Branch
	$50 \cdot 10^6$	$110 \cdot 10^6$	$80 \cdot 10^6$	$16 \cdot 10^6$
CPI	1	1	4	2

$CR = 2\,GHz$

a) $CPI_{FP_{new}} = ?$, speedup = 2

$$CPU_{time} = \frac{1 \cdot 50 \cdot 10^6 + 1 \cdot 110 \cdot 10^6 + 4 \cdot 80 \cdot 10^6 + 2 \cdot 16 \cdot 10^6}{2 \cdot 10^9} =$$

$$= 10^{-3} \cdot \left(\frac{50 + 110 + 320 + 32}{2}\right) = 10^{-3} \cdot 256 = 0{,}256\,s$$

$$speedup = \frac{CPU_{time}}{CPU_{time_{new}}} \Rightarrow 2 = \frac{0{,}256}{CPU_{time_{new}}} \Rightarrow CPU_{time_{new}} =$$

$$= \frac{0{,}256}{2} \Rightarrow CPU_{time_{new}} = 0{,}128\,s$$

$$CPU_{time_{new}} = \frac{50 \cdot 10^6 \times CPI_{FP_{new}} + 1 \cdot 110 \cdot 10^6 + 4 \cdot 80 \cdot 10^6 + 2 \cdot 16 \cdot 10^6}{2 \cdot 10^9}$$

$$0{,}128 = 10^{-3} \cdot \left(\frac{50 CPI_{FP_{new}} + 110 + 320 + 32}{2}\right)$$

$$128 = 25 CPI_{FP_{new}} + 231$$

$$25 CPI_{FP_{new}} = -103$$

$CPI_{FP_{new}} = -4{,}12 \Rightarrow$ imposibil de ducut viteza modificând CPI_{FP}

c) $CPI_{L/S_{new}} = ?$, speedup = 2

$$\Rightarrow 128 = \frac{1 \cdot 50 + 1 \cdot 110 + CPI_{L/S_{new}} \cdot 80 + 2 \cdot 16}{2}$$

$$128 = 40 CPI_{L/S_{new}} + 96 \Rightarrow CPI_{L/S_{new}} = 0{,}8$$

$\Rightarrow \frac{4}{0,8} = 5 \Rightarrow CPI_{LS}$ se înmulțește de 5 ori

c) $CPU_{Time\ new} = ?$, $CPI_{FP,INT}$ ↓40%, $CPI_{LS,Branch}$ ↓30%

$CPI_{FP\ new} = 0,6 \cdot 1 = 0,6$ $\quad CPI_{LS\ new} = 0,7 \cdot 4 = 2,8$

$CPI_{INT\ new} = 0,6 \cdot 1 = 0,6$ $\quad CPI_{branch\ new} = 0,7 \cdot 2 = 1,4$

$$CPU_{Time\ new} = \frac{0,6 \cdot 50 \cdot 10^6 + 110 \cdot 10^6 + 2,8 \cdot 80 \cdot 10^6 + 1,4 \cdot 16 \cdot 10^6}{2 \cdot 10^9}$$

$$CPU_{Time\ new} = 10^{-3} \cdot \left(\frac{30 + 66 + 224 + 22,4}{2} \right) =$$

$$= 10^{-3} \cdot 171,2 = 0,17125$$

$$speedup = \frac{CPU_{Time\ old}}{CPU_{Time\ new}} = \frac{0,256}{0,1712} = 1,5$$

1,15

$T = 100s$

$T_{multiple} = \frac{T}{p} + 4s$, p - number of processors

$p: 2, 4, 8, 16, 32, 64, 128$

$speedup = \frac{Time}{Time_{new}}$

$speedup\ ideal = \frac{T}{\frac{T}{p}} = p$

$speedup\ real = \frac{T}{\frac{T}{p} + 4}$

$p = 2$; $Si = 2$

$$SR = \frac{100}{\frac{100}{2} + 4} = \frac{100}{54} = 1,85$$

$$ratio = \frac{SR}{Si} = \frac{1,85}{2} = 0,925$$

p=4: Si=4

$$SR = \frac{100}{\frac{100}{4}+4} = \frac{100}{29} = 3,45$$

$$ratio = \frac{SR}{Si} = \frac{3,45}{4} = 0,86$$

p=8: Si=8

$$SR = \frac{100}{\frac{100}{8}+4} = \frac{100}{16,5} = 6,06$$

p=16: Si=16

$$SR = \frac{100}{\frac{100}{16}+4} = \frac{100}{10,25} = 9,75$$

$$ratio = \frac{SR}{Si} = \frac{9,75}{16} = 0,6$$

p=32: Si=32

$$SR = \frac{100}{\frac{100}{32}+4} = \frac{100}{7,125} = 14,03$$

$$ratio = \frac{14,03}{32} = 0,44$$

p=64: Si=64

$$SR = \frac{100}{\frac{100}{64}+4} = \frac{100}{5,56} = 17,98$$

$$ratio = \frac{17,98}{64} = 0,28$$

p=128: Si=128

$$SR = \frac{100}{\frac{100}{128}+4} = \frac{100}{4,78} = 20,9$$

$$ratio = \frac{20,9}{128} = 0,16$$