Slide-8

`if(((x >> n) & 0x1) == 1)`

$\equiv$

`if((x & mask) != 0)` where mask has a 1 at $(n+1)^{th}$ bit position and 0 at all other positions.

Slide-11

Let baseline cycle time be τ.

$$\text{Time}_{base} = (500 \times 1 + \underset{\substack{\uparrow \\ \text{Largest fraction}}}{300 \times 10} + 100 \times 3)\,\tau = 3800\,\tau$$

By Amdahl's Law one should focus on the common case i.e., load/store instructions.

$$\text{Time}_{opt} = (375 \times 1 + 300 \times 10 + 100 \times 3)\, 1.1\,\tau = 4042.5\,\tau$$

Not better

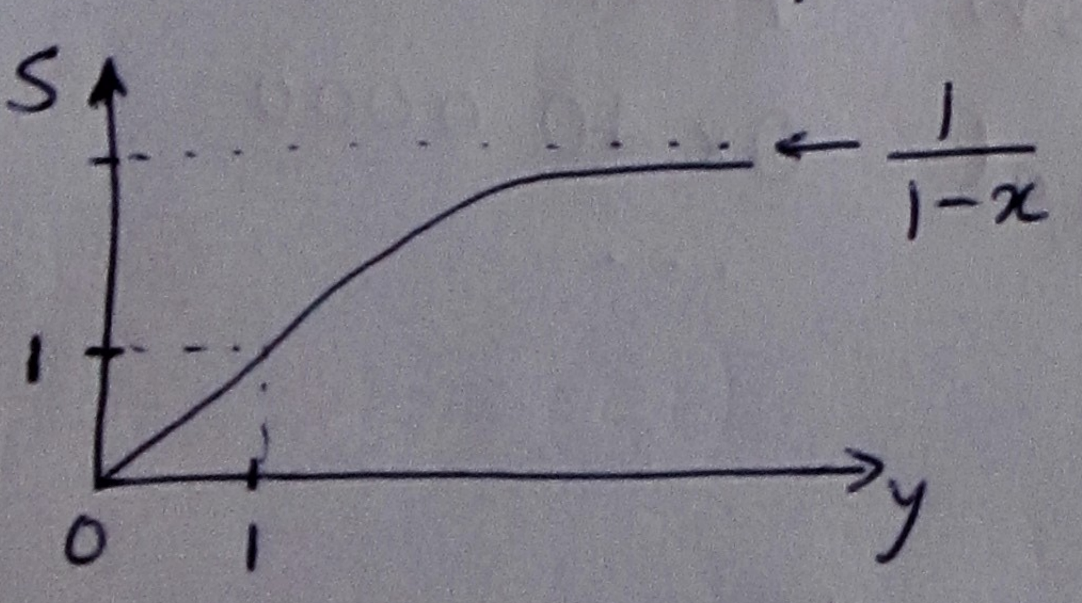
In the limit, if the CPI of arithmetic instructions is made 0, Time $= 3300\,\tau \Rightarrow$ speedup $= \dfrac{3800}{3300} = 1.15$

only 15%.

Optimizing load/store instructions can bring more benefits.

Slides 13-14

$$\text{speedup} = S = \frac{1}{1 - x + x/y}$$



For a given y,

$S = 1$ if $x = 0$

$S = y$ if $x = 1$

max. speedup

We want both x and y large for good speedup.

Slide-14

$$S = \frac{1}{1 - x + x/y}$$

Speedup on improving sqrt by 10 times

$= S_1$ (say)

$$= \frac{1}{1 - 0.2 + \frac{0.2}{10}}$$

$$= \frac{1}{0.82}$$

Speedup on improving all FP instructions by 2 times

$= S_2$ (say)

$$= \frac{1}{1 - 0.5 + \frac{0.5}{2}}$$

$$= \frac{1}{0.75}$$

$S_2 > S_1 \Rightarrow$ second choice is better.

Slide-20

$$\text{SPECratio}(C1) = \sqrt[n]{\frac{t_{rA_1}}{t_{C1A_1}} \cdot \frac{t_{rA_2}}{t_{C1A_2}} \cdots \frac{t_{rA_n}}{t_{C1A_n}}}$$

$$\text{SPECratio}(C2) = \sqrt[n]{\frac{t_{rA_1}}{t_{C2A_1}} \cdot \frac{t_{rA_2}}{t_{C2A_2}} \cdots \frac{t_{rA_n}}{t_{C2A_n}}}$$

$$\frac{\text{SPECratio}(C1)}{\text{SPECratio}(C2)} = \sqrt[n]{\frac{t_{C2A_1}}{t_{C1A_1}} \cdot \frac{t_{C2A_2}}{t_{C1A_2}} \cdots \frac{t_{C2A_n}}{t_{C1A_n}}}$$