

## 第七周作业

1. (1) 时钟周期  $T_{\text{pipe}} = 2\text{ns} + 0.1\text{ns} = 2.1\text{ns}$

(2) 设指令数为  $N$ , 流水级为  $k$

$$S = \frac{T_{\text{old}}}{T_{\text{new}}} = \frac{T_{\text{cycle}}}{T_{\text{pipe}}} \times \frac{\text{CPI}_{\text{cycle}}}{\text{CPI}_{\text{pipe}}} = \frac{7\text{ns}}{2.1\text{ns}} \times \frac{N}{N+k-1} = \frac{10N}{3(N+k-1)} = \frac{10N}{3(N+4)}$$

(3) 设  $N=k \rightarrow \infty$

$N \rightarrow \infty$  时  $S = 3.33$

$$S_{\text{max}} = \frac{T_{\text{old}}}{T_{\text{new}}} = \lim_{\substack{N \rightarrow \infty \\ k \rightarrow \infty}} \frac{\cancel{7\text{ns}}}{\cancel{2.1\text{ns}}} \times \frac{T_{\text{cycle}}}{T_{\text{pipe}'}} \times \frac{\text{CPI}_{\text{cycle}}}{\text{CPI}_{\text{pipe}'}}$$

$$= \lim_{\substack{N \rightarrow \infty \\ k \rightarrow \infty}} \frac{7}{(\frac{7}{k} + 0.1)} \times \frac{N}{N+k-1} = \lim_{\substack{N \rightarrow \infty \\ k \rightarrow \infty}} \frac{\cancel{7N}}{\cancel{\frac{7N-7}{k} + 0.1(N+k) + 6.9}}$$

$$= \frac{7\text{ns}}{0.1\text{ns}} = 70$$

~~$= 3.33$~~

$\therefore$  加速比极限是 70.