Computer Architecture
Assignment 2.

3.3. ①预测分支失败

②预测分支成功

③.延迟分支.

共同点：对分支的处理方法在程序执行过程中始终不变.

是静态的.

3.6. (1) $T_k = (50+80+100+200) + 200 \times 9 = 2200\ ns$.

$\therefore TP = \frac{10}{2200\ ns} \approx 0.0045\ ns^{-1}$

$\because e_i = \frac{T_i}{T_k} = \frac{nt_i}{T_k}$

$\therefore E = \frac{\sum e_i}{4} = \frac{10\times(50+80+100+200)}{4T_k} = \frac{10\times 400}{4\times 2200} = \frac{5}{11}$.

(2) 瓶颈在第4段.

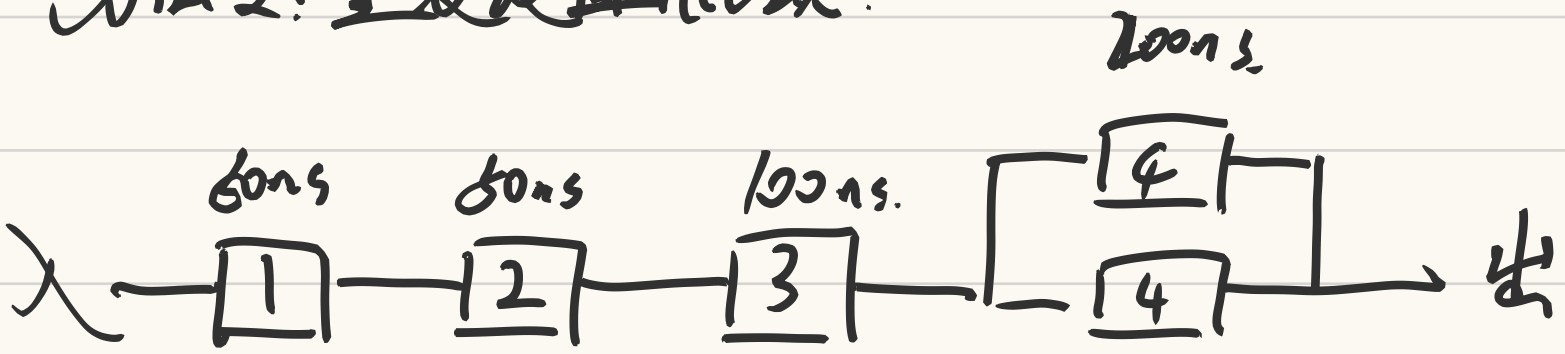
方法1：细分瓶颈段，将200ns拆分为两个100ns.

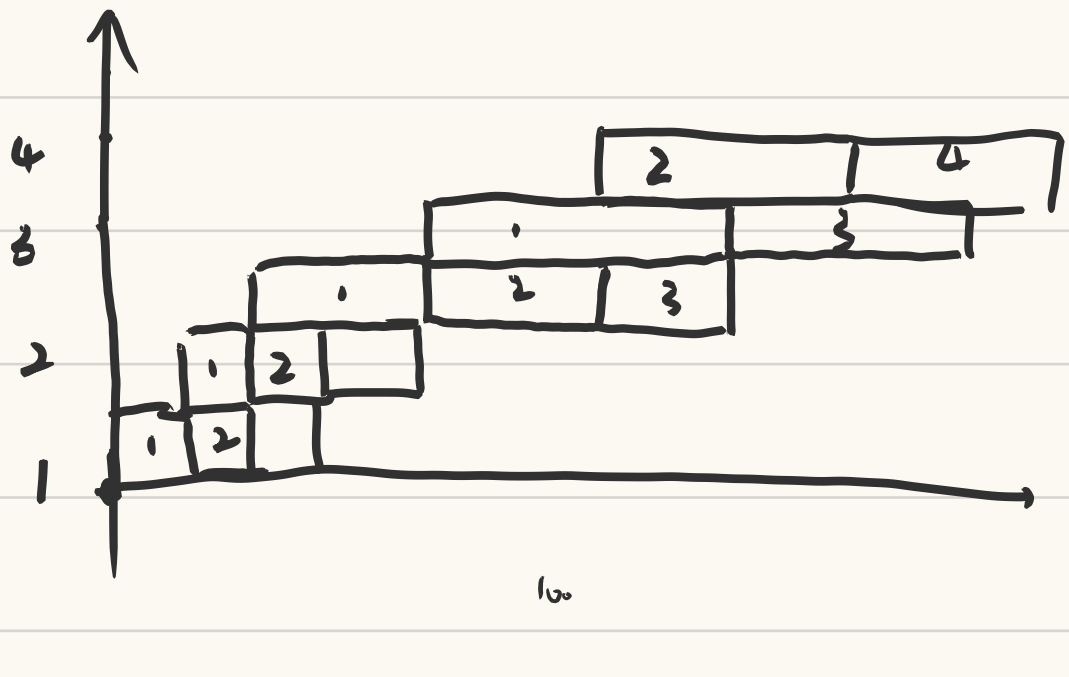
$\therefore T_k = (60+60+100+100+100+100)\times 9 = 1300\ ns$.

$\therefore TP = \frac{10}{1300\ ns} = \frac{1}{130}\ ns^{-1}$

$\therefore E = \frac{10\times(60+60+300)}{1300\times5} : \frac{4200}{1300\times5} : \frac{8}{13}$.

方法2：重复设置瓶颈.



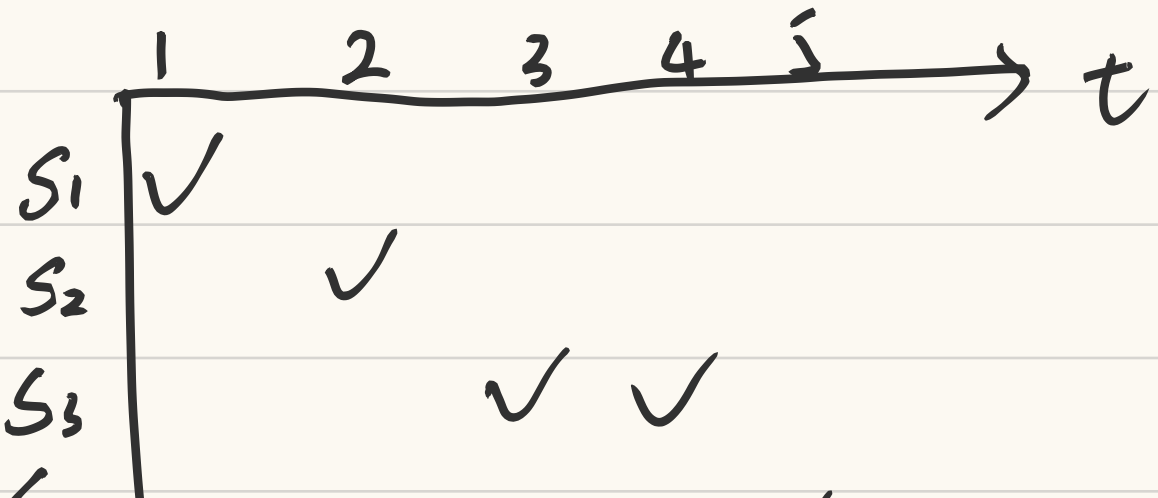


$\therefore Tk = 60+60+100+2001+100\times9 = 1300ns$.

$\therefore E = \frac{10\times400}{1300\times5} = \frac{8}{13}$.

4 or 5 ?

3.



S4↓

删除段

(1) 会出现. 多用流水段.

(2).

禁止表: $F=\{1\}$

初始冲突向量 $C_0=10001$

$$\therefore TP_{max}=\frac{n}{5\Delta t+2(n-1)\Delta t}=\frac{n}{2n\Delta t+3\Delta t}\approx\frac{1}{2\Delta t}$$

$$TP=\frac{10}{5\Delta t+18\Delta t}=\frac{10}{23\Delta t}$$

$$n=\frac{5\times10\times5\Delta t}{23\times23\Delta t}=\frac{25}{46}$$

(3). 新增一个流水线第三段功能器件.

$$\therefore TP=\frac{10}{5\Delta t+9\Delta t}=\frac{10}{14\Delta t}$$

$$n=\frac{10\times5\Delta t}{5\times14\Delta t}=\frac{5}{7}$$

3.10.

(1). ① 禁止表: {6, 3, 1}

初始冲突向量: 100101

允许间隔: 5, 4, 2

② 当 $\Delta t = 5$ 时.

$(100101)_{SR5} \vee 100101 = 100101$

$\Delta t = 4$ 时.

$(100101)_{SR4} \vee 100101 = 100111$ 允许: 5. 4.

$\Delta t = 2$ 时.

$(100101)_{SR2} \vee 100101 = 101101$ 允许 5. 2.

③ $\Delta t = 4$ 时.

$(100111)_{SR5} + 100101 = 100101$

$(100111)_{SR4} + 100101 = 100111$

$\Delta t = 2$ 时

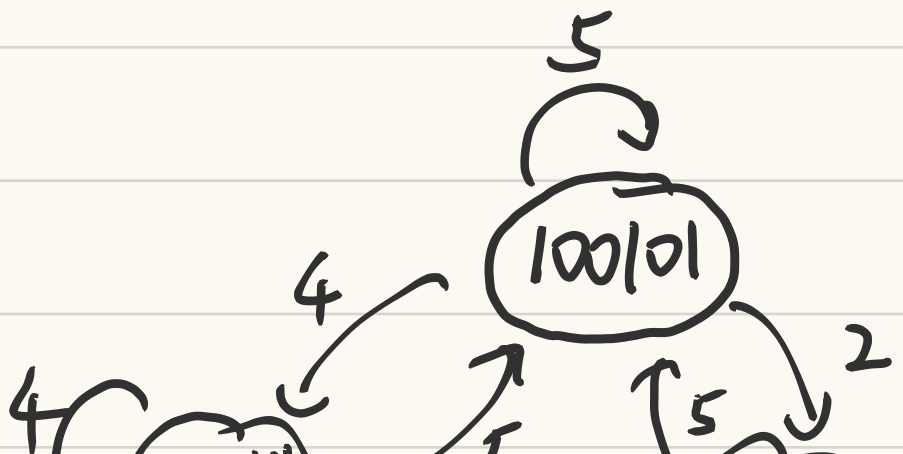
$(101101)_{SR2} + 100101 = 101111$ 允许5.

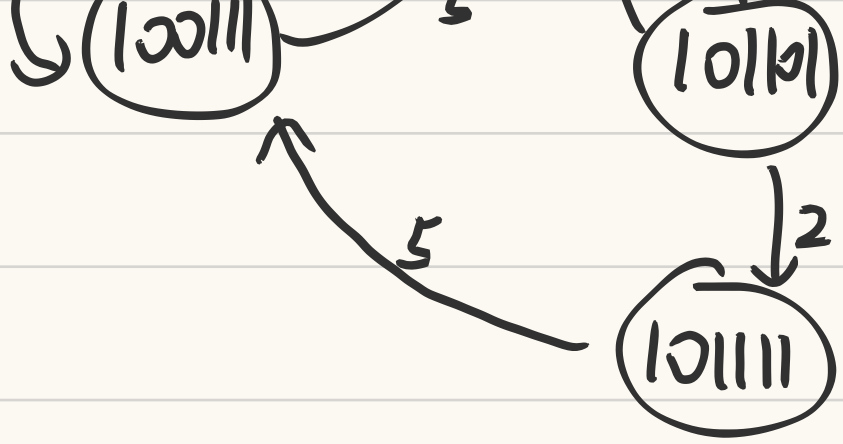
$(101101)_{SR5} + 100101 = 100101$

$\therefore (101111)_{SR6} + 100101 = 100111$

3. 5

2. 2. 5. 5





(2). ∴不等时间间隔最优：{2,5}

等时间最优：{4}

$$\therefore TP_{max1} = \frac{n}{7+(2+5)\cdot\frac{n}{2}} \approx \frac{2}{7}$$

$$TP_{max2} = \frac{n}{7+4n} \approx \frac{1}{4}$$

(3). $TP_1 = \frac{10}{7+2+5+2+5+2+5+2+5+2} = \frac{10}{37}$.

加速比 $S_1 = \frac{7\times10}{37} = \frac{70}{37}$.

$$TP_2 = \frac{10}{7+4\times9} = \frac{10}{43}$$

$$S_2 = \frac{70}{43}$$

3.12 解：

$$S = \frac{n\times4}{4+(n-1)+n\times5\%+n\times20\%\times60\%\times2}$$

$$= \frac{4n}{n+3+0.29n}$$