1 1) Control hazard detection: We should get branch signal from Control and the output of extra ALU comparing rs and rt from register, if branch==1 and output==1 (zero) (means rs==rt). then control hazard is detected and we need to make IF.Flush==1 to stall a nop.

2) $lw \overset{nop}{\rightarrow} beq \rightarrow lw \overset{nop}{\rightarrow} beq \rightarrow beq \rightarrow sw.$

original: $6+1+1+3+3+4 = 18$ cycles. 原未放 EX/MEM后 要3nop.

ID stage: $6+\underset{nop}{2}+\underset{nop}{2}+1+\underset{penal}{1}+4 = 16$ cycles 现在在 ID stage.
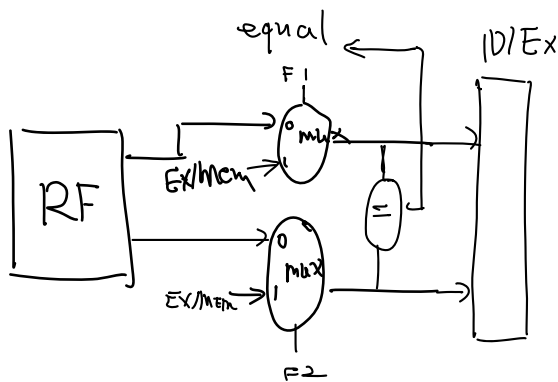
speed up $= 18/16 = 1.125$

3) R_2 : $lw\ R_2, 0(R_1)$ and $beq\ R_2, R_0, Label\ 2$

R_3 : $lw\ R_3, 0(R_2)$ and $beq\ R_3, R_0, Label\ 1$

4)

$lw\ R_2, 0(R_1)$
$L_1: beq\ R_2, R_0, L_2$

mux Forwarding 1 : 1 , Forwarding 2 : 0
stall 2 nop.

2. 1) Branch outcomes determine in EX stage, 2 extra cycles needed
   Extra CPI $= (1-45\%) \cdot 30\% \cdot 2 = 0.33$

2) Assum "j" is determined in ID stage, 1 extra cycle needed.
   Extra CPI $= (1-55\%) \cdot 30\% \cdot 2 + 5\% \cdot 1$
   $= 0.32$

3.

T	N	N	T	T	T	T	N
0	1	1	0	0	1	1	0
SN	WN	SN	SN	WN	WT	ST	ST
↓	↓	↓	↓	↓	↓	↓	↓
WN	SN	SN	WN	WT	ST	ST	WT

T	N	N	T	T	T	T	N
1	0	0	0	1	1	1	0
WT	ST	WT	WN	WT	ST	ST	ST
↓	↓	↓	↓	↓	↓	↓	↓
ST	WT	WN	WT	ST	ST	ST	WT

and loop forever.

for these two condition, accuracy is always 0.5

Thus, accuracy is 0.5