(domande della lezione precedente)

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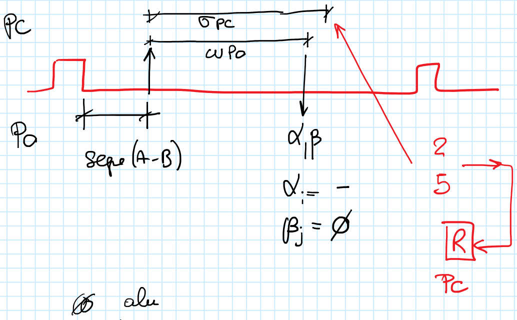
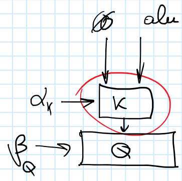
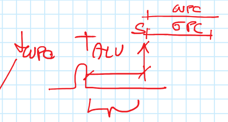
0. $\emptyset \to Q$, 1
1. (segno(A-B) = $\emptyset$) nop, 2
   (= 1) nop, 5
2. Q + 1 → Q, 3
3. A - B → A, 1
5. A → R, $\emptyset$





0. $\emptyset \to Q$, 1
1. (segno(A-B) = 0) Q+1 → Q, 3
   (= 1) A → R, $\emptyset$
3. A - B → A, 1



A - B → TEMP

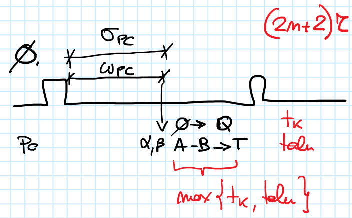
(segno(A-B)) = $TEMP_\emptyset$

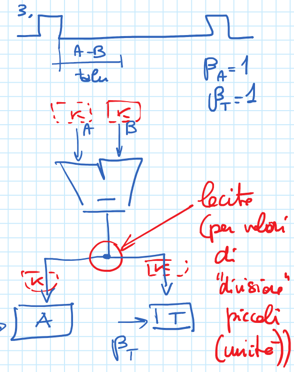
1	0. $\emptyset \to Q$, $\boxed{A-B \to T,}$ 1
n	1. $(T_\emptyset = \emptyset)$ Q+1 → Q, 3
1	(= 1) A → R, $\emptyset$
n	3. A - B → A, 1 $\boxed{A-B \to T}$

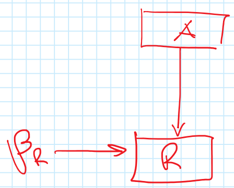
$(2n+2)\tau$

τ

3. A - B → A, A - B → T, 1

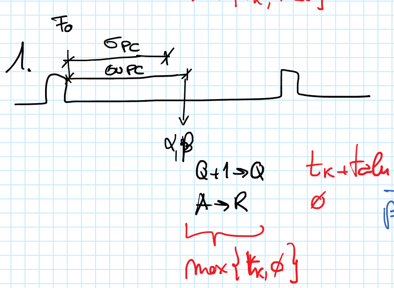






1	0. $\emptyset \to Q$, 1
n	1. A - B → T, 2
n-1	2. $(T_0 = 0)$ Q+1 → Q, T → A, 1
1	$(T_0 = 1)$ A → R, $\emptyset$

$\tau = \tau$



A-B → A

1	0. $\emptyset \to Q$, A - B → T, 1
n	1. $(T_\emptyset = 0)$ Q+1 → Q, A-B → A, A-B → T, 1
1	$(T_\emptyset = 1)$ A → R, $\emptyset$

$(n+1)\tau$

ottimizzazioni
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↳ Condizioni di BERNSTEIN

test per capire se
$$\left.\begin{array}{l} i.\ \mu\text{-}op_A,\ i+1 \\ i+1.\ \mu\text{-}op_B,\ K \end{array}\right\} \overset{?}{\equiv} \underbrace{\left\{ i.\ \mu op_A, \mu op_B, K \right.}$$

$R(\mu op)$ registri letti dalle μop

$W(\mu op)$ registri scritti dalle μop

$R(\mu op_A)$ $R(\mu op_B)$

$W(\mu op_A)$ $W(\mu op_B)$

$R(A-B \to T) = \{A, B\}$ $R(Q+1 \to Q) = \{Q\}$

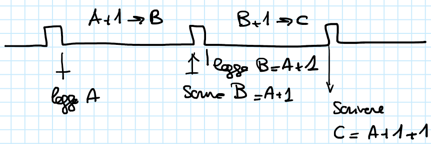
$W(A-B \to T) = \{T\}$ $W(Q+1 \to Q) = \{Q\}$

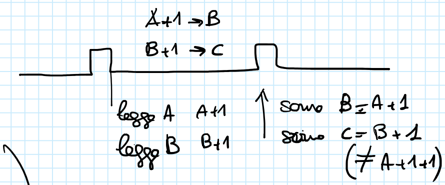
"dipendenza"

1) $W(\mu op_A) \cap R(\mu op_B) = \emptyset$

$\underset{\mu op_A}{A+1 \to B}$ $\underset{\mu op_B}{B+1 \to C}$ $W_A \cap R_B = \{B\}$

non le posso mettere insieme!!

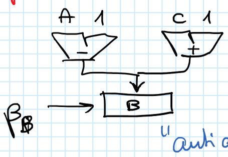




2) $W(\mu op_A) \cap W(\mu op_B) = \emptyset$ "dipendenza di output"

$$\left.\begin{array}{l} i.\ A+1 \to B,\ i+1 \\ i+1.\ C+1 \to B,\ K \end{array}\right\} \quad i.\ A+1 \to B,\ C+1 \to B,\ K$$

non posso metterle nello stesso μ-istruzione



"anti dipendenza"

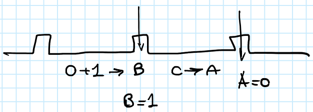
3) $R(\mu op_A) \cap W(\mu op_B) = \emptyset$

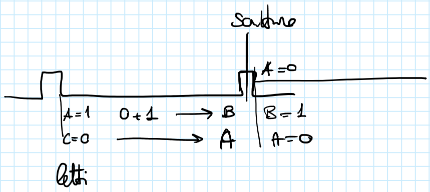
(non è necessario per permettere la trasformazione)

A=1
C=0

$$\left.\begin{array}{l} i.\ A+1 \to B,\ i+1 \\ i+1.\ C \to A,\ K \end{array}\right\} \quad i.\ A+1 \to B,\ C \to A,\ K$$

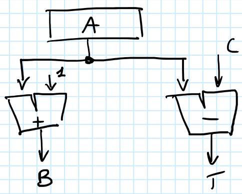
4) $R(\mu op_A) \cap R(\mu op_B) = \emptyset$

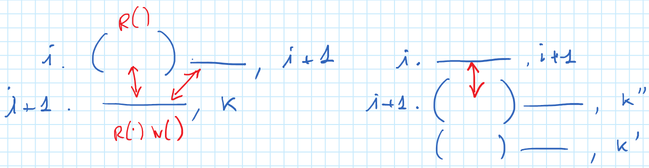




$$\begin{array}{l} i.\ A+1 \to B,\ i+1 \\ i+1.\ A-C \to T,\ K \end{array}$$

$R_A \cap R_B = \{A\}$





Variabili di condizionamento

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Complesse

indicano trasformazioni delle uscite dei Registri (Po) fatte tramite reti combinatorie prive di ingressi di controllo

es Segno(A − B)   OR(A)

(che fa solo ⊖)

(con ingressi che sono solo A, B)

$T_{WPO} = k \cdot t_p$

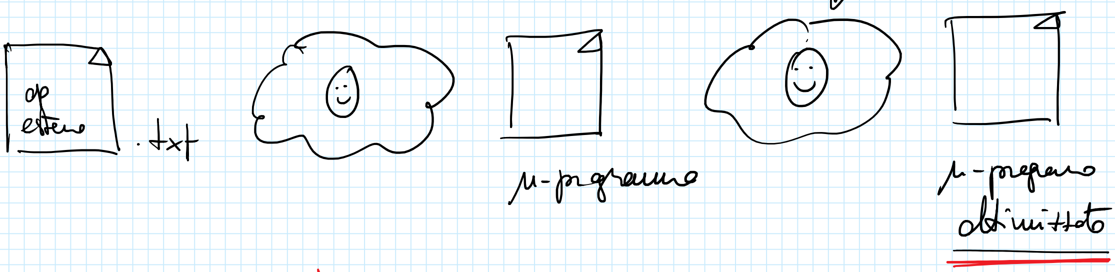
Semplici

indicano uscite di registri (Po) senza trasformazioni

e.g. I_0 $\boxed{S}$ ↓1

$T_{WPO} = \emptyset$

Ottimizzazioni μ-codice



dal μ-programma → Po, PC

$\tau = n \cdot t_p$

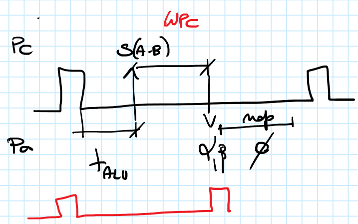
∀ op_i esterna : seguo il flusso logico delle μ-istruzioni eseguite e le conto ⇓ K_i

T tempo medio di elaborazione

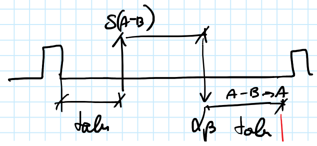
$$T = \sum_{i=0}^{n-1} p_i \cdot K_i \tau = \tau \sum p_i K_i$$

↳ prob dell'op esterna; $\sum p_i = 1$

2. (segno(A − B) = ∅) nop, 2
   (= 1) nop, 5
3. A − B → A, K

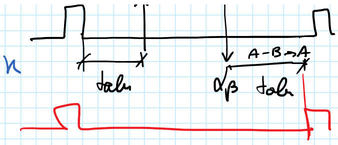


2'. (segno(A − B) = 0) A − B → A, K



2'. $\left(\text{sego}(A-B) = 0\right)$ $A-B \to A$, K

$(=1)$ . . . .



memorie

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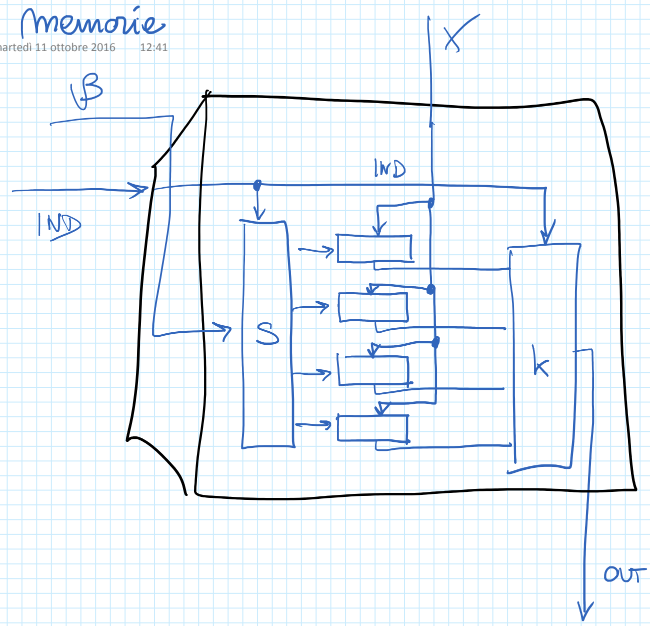
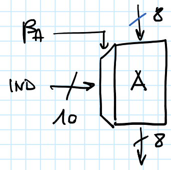


sostituire le occorrenze di X con Y in una memoria A di 1024 posizioni da 8 bit




```
for(i=0 ; i<1024; i++)
  if(A[i]==X)
    A[i] = Y;
```

I da 11 bit
00…0
11…10
11…11 1023
1000…00

① 0. $I = 0$

(m) + ① 1. $(I_0 = 0, \text{zero}(A[I_m] - X) = 01)$ $Y \rightarrow A[I_m]$, $I+1 \rightarrow I$, 1 (0 / 1023)

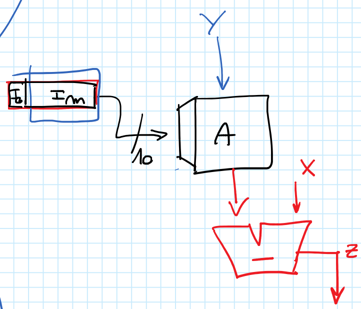
$(= 00)$ $I+1 \rightarrow I$, 1

$(= 1-)$ nop, 0 ← solo I = 1024

$(m+2)\tau$

$T_{OP} = \ldots + t_a$

$\underbrace{}$ tempo di stabilizzazione del selettore di A

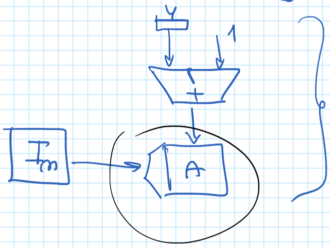


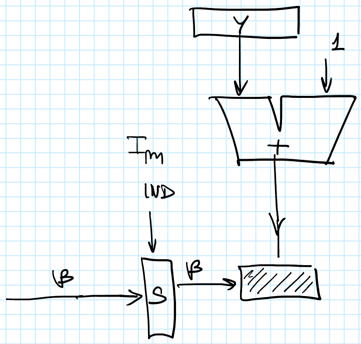
t_a tempo di stabilizzazione del commutatore di A

t_{alu}

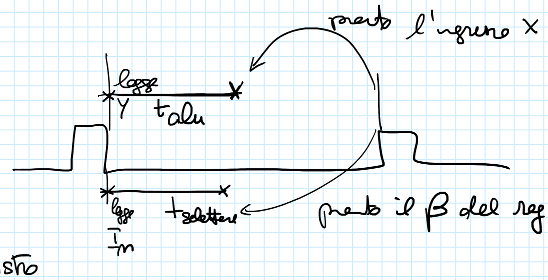
$T_{WPO} = t_a + t_{alu}$

$Y+1 \rightarrow A[I_m]$





registro posizione I_m della memoria A



$T_{OP} = \ldots + \max\{t_a \text{ (selettore)}, t_{preparazione}\}$