Macchina a Registri (A.A. 2012/2013)

Set di Istruzioni

HLT
00000
$\Phi; \mu_{-1}$

FETCH
00000
$Pc \rightarrow MAR, Pc + 1 \rightarrow Pc; \mu_0$
$M[MAR] \rightarrow MBR; \mu_1$
$MBR \rightarrow IR; \mu_2$

LD R$_i$, #X $<X \rightarrow R_i>$
00001
$'0...0', IRx \rightarrow R_i, 0 \rightarrow IR; \mu_3$

LD R$_i$, X $<M[X] \rightarrow R_i>$
00010
$IRx \rightarrow MAR; \mu_4$
$M[MAR] \rightarrow MBR; \mu_1$
$MBR \rightarrow R_i, 0 \rightarrow IR; \mu_5$

LD R$_i$, @X $<M[M[X]] \rightarrow R_i>$
00011
$IRx \rightarrow MAR; \mu_4$
$M[MAR] \rightarrow MBR; \mu_1$
$MBR_{13-18} \rightarrow MAR; \mu_6$
$M[MAR] \rightarrow MBR; \mu_1$
$MBR \rightarrow R_i, 0 \rightarrow IR; \mu_5$

LD R$_i$ $<M[Pc+1] \rightarrow R_i>$
00100
$Pc \rightarrow MAR, Pc+1 \rightarrow Pc; \mu_0$
$M[MAR] \rightarrow MBR; \mu_1$
$MBR \rightarrow R_i, 0 \rightarrow IR; \mu_5$

ST R$_i$, X $<R_i \rightarrow M[X]>$
00101
$IRx \rightarrow MAR, R_i \rightarrow MBR; \mu_7$
$MBR \rightarrow M[MAR], 0 \rightarrow IR; \mu_8$

ST R$_i$, @X $<R_i \rightarrow M[M[X]]>$
00110
$IRx \rightarrow MAR; \mu_4$
$M[MAR] \rightarrow MBR; \mu_1$
$MBR_{13-18} \rightarrow MAR, R_i \rightarrow MBR; \mu_9$
$MBR \rightarrow M[MAR], 0 \rightarrow IR; \mu_8$

ADD R$_i$, X $<M[X] + R_i \rightarrow R_i>$
00111
$IRx \rightarrow MAR, R_i \rightarrow A; \mu_{10}$
$M[MAR] \rightarrow MBR; \mu_1$
$MBR \rightarrow B; \mu_{11}$
$A + B \rightarrow R_i, 0 \rightarrow IR; \mu_{12}$

ADD R$_i$, R$_j$ $<R_i + R_j \rightarrow R_i>$
01000
$R_i \rightarrow A; \mu_{13}$
$R_j \rightarrow B; \mu_{14}$
$A+B \rightarrow R_i, 0 \rightarrow IR; \mu_{12}$

ADD R$_i$, @R$_j$ $<R_i + M[R_j] \rightarrow R_i>$
01001
$R_i \rightarrow A; \mu_{13}$
$R_{j13-18} \rightarrow MAR; \mu_{15}$
$M[MAR] \rightarrow MBR; \mu_1$
$MBR \rightarrow B; \mu_{11}$
$A+B \rightarrow R_k, 0 \rightarrow IR; \mu_{16}$

SUB R$_i$, R$_j$, R$_k$ $<R_i - R_j \rightarrow R_k>$
01010
$R_i \rightarrow A; \mu_{13}$
$R_j \rightarrow B; \mu_{14}$
$A-B \rightarrow R_k, 0 \rightarrow IR; \mu_{17}$

MUL R$_i$, R$_j$, R$_k$ $<R_i * R_j \rightarrow R_k>$
01011
$R_i \rightarrow R'_D, 0 \rightarrow A; \mu_{18}$
1: $\underline{if}$ OR $(R'_D) = 1$ $\underline{then}$ β_1
       $R_j \rightarrow B, R'_D -1 \rightarrow R'_D; \mu_{19}$
       $A+B \rightarrow A, \underline{goto} \ 1; \mu_{20}$
$\underline{else}$ $A \rightarrow R_k, 0 \rightarrow IR; \mu_{21}$

DIV R$_i$, R$_j$, R$_k$ $<R_i / R_j \rightarrow R_k>$
01100
$R_i \rightarrow A, 0 \rightarrow R_D; \mu_{22}$
$R_j \rightarrow B; \mu_{14}$
1: $A-B \rightarrow A; \mu_{23}$
$A-B \rightarrow R'_D; \mu_{24}$
$\underline{if}$ $(R'_{D0}=0)$ $\underline{then}$ β_2
       $R_D +1 \rightarrow R_D, \underline{goto} \ 1; \mu_{25}$
$\underline{else}$ $R_D \rightarrow R_k, 0 \rightarrow IR; \mu_{26}$

JMP X $<salta \ ad \ X>$
01101
$IRx \rightarrow Pc, 0 \rightarrow IR; \mu_{27}$

JZ R$_i$, X $<se \ (R_i=0) \ salta \ ad \ X>$
01110
$R_i \rightarrow R'_D; \mu_{28}$
$\underline{if}$ OR$(R'_D) = 0$ $\underline{then}$ β_3
       $IRx \rightarrow Pc, 0 \rightarrow IR; \mu_{27}$
$\underline{else}$ $0 \rightarrow IR; \mu_{29}$

JG R$_i$, X $<se \ (R_i>0) \ salta \ ad \ X>$
01111
$R_i \rightarrow R'_D; \mu_{28}$
$\underline{if}$ $(OR(R'_D) = 1)$ AND $(R'_{D0}=0))$ $\underline{then}$ β_4
       $IRx \rightarrow Pc, 0 \rightarrow IR; \mu_{27}$
$\underline{else}$ $0 \rightarrow IR; \mu_{29}$

MOV R$_i$, R$_j$ $<R_j \rightarrow R_i>$
10000
$R_j \rightarrow R_i, 0 \rightarrow IR; \mu_{30}$

INC R$_i$ $<R_i + 1 \rightarrow R_i>$
10001
$R_i \rightarrow R_D; \mu_{31}$
$R_D + 1 \rightarrow R_D, 0 \rightarrow IR; \mu_{32}$
$R_D \rightarrow R_j; \mu_{33}$