

Control memory $\rightarrow 5.94 \times 2^4 = 2^{12} \times 2^4$

(V-6)

a) 12 bits b) 12 bits c) 12 min 4 to 1

(V-15)

INDR2: DRTAR U JMP NEXT

READ U RET

(V-14) این دستور در صورتی که مقدار مثبت و غیر صفر داشته باشد

به آدرس مورد نظر پرینچ می کند ($PC \leftarrow AR$ Fetch)

SUB: NOP I CALL INDRCT (V-14)

READ U JMP NEXT

SUB U JMP FETCH

SEQ: NOP I CALL INDRCT

READ U JMP NEXT

ACTDR, DRTAC U JMP NEXT

SUB U JMP SEQ 2

ORG 100

SEQ2: DRTAC, ACTDR Z JMP EQL

NOP U JMP FETCH

EQL: INCPC U JMP FETCH

$M[AR] \leftarrow PC, AR \leftarrow AR+1$: BSA, (مسجل) (Valid)
 $PC \leftarrow AR, SC \leftarrow 0$
Fetch

BSA: NOP U CALL INDRCT

PCTDR, ARTPC U JMP NEXT

WRITE, INCPC U JMP FETCH

17 x Reg 17 bit + input \Rightarrow 17 lines (17)

a) $32 \times 32:1$ mux b) d

c) 7×17 decoder \Rightarrow 7 inputs, 17 outputs

d) inputs: 2×32 bits + 1 carry bit

outputs: $32 + 1$ bits

e)

4	5	5	6
seID	seA	seIB	opcode

 \Rightarrow 20 bits

A B C D E + * - /

(A-1)

$$D + E \rightarrow C \times (D + E) \rightarrow B - C \times (D + E) \rightarrow$$

$$A / (B - C \times (D + E))$$

A B C D E F G + * + * + *

$$F + G \rightarrow E \times (F + G) \rightarrow D + E \times (F + G) \rightarrow$$

$$C \times (D + E \times (F + G)) \rightarrow B + C \times (D + E \times (F + G)) \rightarrow$$

$$A \times (B + C \times (D + E \times (F + G)))$$

SUB R_1 A B // $R_1 = A - B$ (a) (1-15)
MUL R_r D E // $R_r = D \times E$
SUB R_r R_r F // $R_r = D \times E - F$
MUL R_r R_r C // $R_r = C \times (D \times E - F)$
ADD R_1 R_1 R_r // $R_1 = A - B + C \times (D \times E - F)$
MUL R_r H K // $R_r = H \times K$
ADD R_r R_r G // $R_r = G + H \times K$
DIV X R_1 R_r //

MOV R_1 A // $R_1 = A$ (b)
SUB R_1 B // $R_1 = R_1 - B$
MOV R_r D // $R_r = D$
MUL R_r E // $R_r = D \times E$
SUB R_r F // $R_r = D \times E - F$
MUL R_r C // $R_r = C \times (D \times E - F)$
ADD R_1 R_r // $R_1 = A - B + C \times (D \times E - F)$
MOV R_r H // $R_r = H$
MUL R_r K // $R_r = H \times K$

$$\frac{A - B + C \times (D \times E - F)}{G + H \times K} \xRightarrow{\text{RPN}} A B - C D E \times F - \times + (d) \\ G H K \times + /$$

PUSH A
 PUSH B
 SUB //TOS = A - B
 PUSH C
 PUSH D
 PUSH E
 MUL //TOS = D x E
 PUSH F
 SUB //TOS = D x E - F
 MUL //TOS = C x (D x E - F)
 ADD //TOS = A - B + C x (D x E - F)
 PUSH G
 PUSH H
 PUSH K
 MUL //TOS = H x K
 ADD //TOS = G + H x K
 DIV //TOS = (A - B + C x (D x E - F)) / (G + H x K)
 POP X

ADD R_r G // $R_r = G + H \times K$
 DIV R_i R_r // $R_i = (A - B + C \times (D \times E - F)) / (G + H \times K)$
 MOV X R_i

LOAD H // AC = H (C)
 MUL K // AC = H × K
 ADD G // AC = G + H × K
 STORE T₁ // T₁ = G + H × K
 LOAD D // AC = D
 MUL E // AC = D × E
 SUB F // AC = D × E - F
 MUL C // AC = C × (D × E - F)
 ADD B // AC = B + C × (D × E - F)
 STORE T₂ // T₂ = B + C × (D × E - F)
 LOAD A // AC = A
 SUB T₂ // AC = A - B + C × (D × E - F)
 DIV T₁ // AC = (A - B + C × (D × E - F)) / (G + H × K)
 STORE X

a) 400

b) 301

c) 702

300	CODE
301	400
302

d) 200

200

R₁

e) 600

$$A \geq B \Rightarrow \underbrace{A - B \geq 0} \Rightarrow (S \oplus V) = 0 \quad (1-1V)$$

Positive with no overflow $\rightarrow S=0 \quad V=0$

negative with overflow $\rightarrow S=1 \quad V=1$

$$A < B \Rightarrow \overline{A \geq B} \Rightarrow (S \oplus V) = 1$$

$$A \leq B \Rightarrow A < B \vee A - B = 0 \Rightarrow (S \oplus V) = 1 \text{ or } Z = 1$$

$$A > B \Rightarrow \overline{A \leq B} \Rightarrow (S \oplus V) = 0 \text{ and } Z = 0$$