Instrução DIV

Especificado por: Fluxo geral, fluxo detalhado e máquina de estado em Verilog.

1. Fluxo Geral

MAH <- M[PC]

PC <- PC + 1

MAL <- M[PC]

PC <- PC + 1

MD <- M[MA]

AC <- MD

M[SP] <- RFLAGS

Push

Acumulador

SP <- SP - 1

M[SP] <- AC

SP <- SP - 1

AC <- SHR(AC)

AC <- SHR(AC)

AC <- AC + MD

AC <- SHR(AC)

SP <- SP + 1

AC <- M[SP]

SP <- SP + 1

RFLAGS <- M[SP]

MD <- AC

MD <- AC

AC <- SHR(AC)

MD <- MDL

Pop

Acumulador

AC <- MDH

MD < 1

ERROR

AC < MD

1

AC <- ACC

0

AC <- AC - MD

M[SP] <- RFLAGS

SP <- SP - 1

M[SP] <- AC

SP <- SP - 1

Push

Acumulador

AC <- ACC

M[SP] <- RFLAGS

SP <- SP - 1

M[SP] <- AC

SP <- SP - 1

AC <- SHR(AC)

AC <- SHR(AC)

ACC <- MD

SP <- SP + 1

AC <- M[SP]

SP <- SP + 1

RFLAGS <- M[SP]

Push

Acumulador

Pop

Acumulador

SP <- SP + 1

AC <- M[SP]

SP <- SP + 1

RFLAGS <- M[SP]

MD<- 1

AC <- AC + MD

MD<- ACC

ACC<- AC

INC

Pop

Acumulador

OBS.: DIV2, DIV3, DIV4, DIV5 e V são apenas “labels”.

1. Fluxo Detalhado

**T4**

ENPCA

**T5**

ENPCA

MR

1

ENPCA

MR

(LMAH)

**T6**

2

**T7**

(INCPC)

**T8**

ENPCA

ENPCA

MR

(LMAL)

ENPCA

MR

**T9**

3

**T10**

**T11**

(INCPC)

ENMAA

**T12**

4

ENMAA

MR

ENMAA

MR

(LMD)

**T13**

ENDES

(LAC)

5

**T14**

ENSPA

ENFLD

ENSPA

ENFLD

MW

(DECSP)

ENSPA

ENDES

ENSPA

ENDES

MW

(DECSP)

(LRESET)

(LINT)

**T15**

**T16**

**T17**

6 - push

**T18**

**T19**

**T20**

ENDES

(LMD)

ENDES

OP2

(LAC)

(LRESET)

(LINT)

ENDES

(LMD)

ENDES

OP2

(LAC)

(LRESET)

(LINT)

**T21**

7 - 1° SHL

**T22**

**T23**

7 - 2° SHL

**T24**

ENDES

(LMD)

ENDES

OP2

(LAC)

(LRESET)

(LINT)

ENDES

(LMD)

ENDES

OP2

(LAC)

(LRESET)

(LINT)

**T25**

7 - 3° SHL

**T26**

**T27**

7 - 4° SHL

**T28**

ENDES

SD0

(LAC)

(LRESET)

(LINT)

ENDES

SD0

(LAC)

(LRESET)

(LINT)

ENDES

SD0

(LAC)

(LRESET)

(LINT)

**T29**

8 - 1° SHR

**T30**

8 - 2° SHR

**T31**

8 - 3° SHR

ENDES

SD0

(LAC)

(LRESET)

(LINT)

ENDES

(LMD)

**T32**

8 - 4° SHR

9

**T33**

**T34**

(INCSP)

**T35**

ENSPA

ENSPA

MR

(LAC)

ENSPA

MR

**T35**

**T36**

10 - Pop

**T38**

ENSPA

MR

ENSPA

(INCSP)

**T39**

**T40**

ENSPA

MR

(LINTE)

(LCARRY)

(LZERO)

(LRESET)

(LINT)

ENDES

SD0

(LAC)

(LRESET)

(LINT)

ENDES

SD0

(LAC)

(LRESET)

(LINT)

10 – Pop (cont.)

**T41**

**T42**

11 - 1° SHR

**T43**

11 - 2° SHR

ENDES

SD0

(LAC)

(LRESET)

(LINT)

**T44**

11 - 3° SHR

ENDES

SD0

(LAC)

(LRESET)

(LINT)

11 - 4° SHR

**T45**

MD <1

ERROR

T0

AC < MD

1

0

ENDES

LAC

ENDES

OP2

OP1

(LAC)

SCZ

(LCARRY)

(LRESET)

(LINT)

**T46**

ENSPA

ENFLD

ENSPA

ENFLD

MW

(DECSP)

ENSPA

ENDES

ENSPA

ENDES

MW

(DECSP)

(LRESET)

(LINT)

**T47**

**T48**

**T49**

**T50**

14 - push

**T51**

**T52**

ENDES

LAC

ENSPA

ENFLD

ENSPA

ENFLD

MW

(DECSP)

ENSPA

ENDES

ENSPA

ENDES

MW

(DECSP)

(LRESET)

(LINT)

**T53**

15

**T54**

**T55**

**T56**

16 - push

**T57**

**T58**

**T59**

ENDES

SD0

(LAC)

(LRESET)

(LINT)

ENDES

SD0

(LAC)

(LRESET)

(LINT)

ENDES

SD0

(LAC)

(LRESET)

(LINT)

17 - 1° SHR

**T60**

**T61**

17 - 2° SHR

**T62**

17 - 3° SHR

ENDES

SD0

(LAC)

(LRESET)

(LINT)

17 - 4° SHR

**T63**

18

ENDES

LACC

**T64**

**T65**

(INCSP)

ENSPA

MR

ENSPA

MR

(LAC)

ENSPA

**T66**

**T67**

19 - Pop

**T68**

(INCSP)

ENSPA

MR

ENSPA

ENSPA

MR

(LINTE)

(LCARRY)

(LZERO)

(LRESET)

(LINT)

**T69**

**T70**

**T71**

19 - Pop (cont.)

**T72**

ENCG

CON

(LMD)

**T73**

ENDES

OP2

(LAC)

SCZ

(LCARRY)

(LZERO)

(LRESET)

(LINT)

20 - INC

**T74**

ENDES

LMD

**T75**

21

**T76**

22

ENDES

LACC

(INCSP)

ENSPA

MR

ENSPA

MR

(LAC)

ENSPA

(INCSP)

ENSPA

MR

ENSPA

**T77**

**T78**

**T79**

**T80**

23 - Pop

**T81**

**T82**

**T83**

ENSPA

MR

(LINTE)

(LCARRY)

(LZERO)

(LRESET)

(LINT)

**T84**

23 - Pop (cont.)

1. Máquina de Estados

**module mod(T1, clock);**

reg [32: begin0] T;

input clock;

output SIGNAL;

always @(negedge clock) begin

ENPCA = 0;

MR = 1;

LMAH = 0;

LMAL = 0;

INCPC = 0;

ENMAA = 0;

LMD = 0;

DECSP = 0;

ENDES = 0;

LAC = 0;

LMD = 0;

LAAC = 0;

LINT = 0;

LINTE = 0;

LRESET = 0;

SD0 = 0;

OP1 = 0;

OP2 = 0;

ENSPA = 0;

ERROR = 0;

end

always @(posedge clock) //begin

case (T) //begin

4: begin

ENPCA = 1;

T = 5;

end

5: begin

ENPCA = 1;

MR = 0;

T = 6;

end

6: begin

ENPCA = 1;

MR = 0;

LMAH = 1;

T = 7;

end

7: begin

INCPC = 1;

T = 8;

end

8: begin

ENPCA = 1;

T = 9;

end

9: begin

ENPCA = 1;

MR = 0;

T = 10;

end

10: begin

ENPCA = 1;

MR = 0;

LMAL = 1;

T = 11;

end

11: begin

INCPC = 1;

ENMAA = 1;

T = 12;

end

12: begin

ENMAA = 1;

MR = 0;

T = 13;

end

13: begin

ENMAA = 1;

MR = 0;

LMD = 1;

T = 14;

end

14: begin

ENDES = 1;

LAC = 1;

T = 15;

end

15: begin

ENSPA = 1;

ENFLD = 1;

T = 16;

end

16: begin

ENSPA = 1;

ENFLD = 1;

MW = 0;

T = 17;

end

17: begin

DECSP = 1;

T = 18;

end

18: begin

ENSPA = 1;

ENDES = 1;

T = 19;

end

19: begin

ENSPA = 1;

ENDES = 1;

MW = 0;

T = 20;

end

20: begin

DECSP = 1;

LRESET = 1;

LINT = 1;

T = 21;

end

21: begin

ENDES = 1;

LMD = 1;

T = 22;

end

22: begin

ENDES = 1;

OP2 = 1;

LAC = 1;

LRESET = 1;

LINT = 1;

T = 23;

end

23: begin

ENDES = 1;

LMD = 1;

T = 24;

end

24: begin

ENDES = 1;

OP2 = 1;

LAC = 1;

LRESET = 1;

LINT = 1;

T = 25;

end

25: begin

ENDES = 1;

LMD = 1;

T = 26;

end

26: begin

ENDES = 1;

OP2 = 1;

LAC = 1;

LRESET = 1;

LINT = 1;

T = 27;

end

27: begin

ENDES = 1;

LMD = 1;

T = 28;

end

28: begin

ENDES = 1;

OP2 = 1;

LAC = 1;

LRESET = 1;

LINT = 1;

T = 29;

end

29: begin

ENDES = 1;

SD0 = 1;

LAC = 1;

LRESET = 1;

LINT = 1;

T = 30;

end

30: begin

ENDES = 1;

SD0 = 1;

LAC = 1;

LRESET = 1;

LINT = 1;

T = 31;

end

31: begin

ENDES = 1;

SD0 = 1;

LAC = 1;

LRESET = 1;

LINT = 1;

T = 32;

end

32: begin

ENDES = 1;

SD0 = 1;

LAC = 1;

LRESET = 1;

LINT = 1;

T = 33;

end

33: begin

ENDES = 1;

LMD = 1;

T = 34;

end

34: begin

INCSP = 1;

T = 35;

end

35: begin

ENSPA = 1;

T = 36;

end

36: begin

ENSPA = 1;

MR = 0;

T = 37;

end

37: begin

ENSPA = 1;

MR = 0;

LAC = 1;

T = 38;

end

38: begin

INCSP = 1;

T = 39;

end

39: begin

ENSPA = 1;

T = 40;

end

40: begin

ENSPA = 1;

MR = 0;

T = 41;

end

41: begin

ENSPA = 1;

MR = 0;

LINTE = 1;

LCARRY = 1;

LZERO = 1;

LRESET = 1;

LINT = 1;

T = 42;

end

42: begin

ENDES = 1;

SD0 = 1;

LAC = 1;

LRESET = 1;

LINT = 1;

T = 43;

end

43: begin

ENDES = 1;

SD0 = 1;

LAC = 1;

LRESET = 1;

LINT = 1;

T = 44;

end

44: begin

ENDES = 1;

SD0 = 1;

LAC = 1;

LRESET = 1;

LINT = 1;

T = 45;

end

45: begin

ENDES = 1;

SD0 = 1;

LAC = 1;

LRESET = 1;

LINT = 1;

if(MD < 1) begin

ERROR=1;

T = 0;

end

else begin

T = 46;

end

end

46: begin

ENDES = 1;

LACC = 1;

if(AC<MD) begin

ENDES = 1;

OP2 = 1;

OP1 = 1;

LAC = 1;

SCZ = 1;

LCARRY = 1;

LRESET = 1;

LINT = 1;

T = 47;

end

else begin

ENDES = 1;

LAC = 1;

T = 0;

end

end

default: begin

T=0;

end

47: begin

ENSPA = 1;

ENFLD = 1;

T=48;

end

48: begin

ENSPA = 1;

ENFLD = 1;

MW =0;

T=49;

end

49: begin

DECSP=1;

T=50;

end

50: begin

ENSPA = 1;

ENDES = 1;

T=51;

end

51: begin

ENSPA = 1;

ENFLD = 1;

MW =0;

T=52;

end

52: begin

DECSP = 1;

LRESET = 1;

LINT =1;

T=53;

end

53: begin

ENDES = 1;

LAC = 1;

T=54;

end

54: begin

ENSPA = 1;

ENFLD = 1;

T=55;

end

55: begin

ENSPA = 1;

ENFLD = 1;

MW = 0;

T=56;

end

56: begin

DECSP = 1;

T=57;

end

57: begin

ENSPA = 1;

ENDES = 1;

T=58;

end

58: begin

ENSPA = 1;

ENDES = 1;

MW = 0;

T=59;

end

59: begin

DECSP = 1;

LRESET = 1;

LINT = 1;

T=60;

end

60: begin

ENDES = 1;

SD0 = 1;

LAC = 1;

LRESET = 1;

LINT = 1;

T=61;

end

61: begin

ENDES = 1;

SD0 = 1;

LAC = 1;

LRESET = 1;

LINT = 1;

T=62;

end

62: begin

ENDES = 1;

SD0 = 1;

LAC = 1;

LRESET = 1;

LINT = 1;

T=63;

end

63: begin

ENDES = 1;

SD0 = 1;

LAC = 1;

LRESET = 1;

LINT = 1;

T=64;

end

64: begin

ENDES = 1;

LACC = 1;

T=65;

end

65: begin

INCSP = 1;

T=66;

end

66: begin

ENSPA = 1;

T=67;

end

67: begin

ENSPA = 1;

MR = 0;

T=68;

end

68: begin

ENSPA = 1;

MR = 0;

LAC = 1;

T=69;

end

69: begin

INCSP = 1;

T=70;

end

70: begin

ENSPA = 1;

T=71;

end

71: begin

ENSPA = 1;

MR = 0;

T=72;

end

72: begin

ENSPA = 1;

MR = 0;

LINTE = 1;

LCARRY = 1;

LZERO = 1;

LRESET = 1;

LINT = 1;

T=73;

end

73: begin

ENCG = 1;

CON = 1;

LMD = 1;

T=74;

end

74: begin

ENDES = 1;

OP2 = 1;

LAC = 1;

SCZ = 1;

LCARRY = 1;

LZERO = 1;

LRESET = 1;

LINT = 1;

T=75;

end

75: begin

ENDES = 1;

LMD = 1;

T=76;

end

76: begin

ENDES = 1;

LACC = 1;

T=77;

end

77: begin

INCSP = 1;

T=78;

end

78: begin

ENSPA = 1;

T=79;

end

79: begin

ENSPA = 1;

MR = 0;

T=80;

end

80: begin

ENSPA = 1;

MR = 0;

LAC = 1;

T=81;

End

81: begin

INCSP = 1;

T=82;

end

82: begin

ENSPA = 1;

T=83;

end

83: begin

ENSPA = 1;

MR = 0;

T=84;

end

84: begin

ENSPA = 1;

MR = 0;

LINTE = 1;

LCARRY = 1;

LZERO = 1;

LRESET = 1;

LINT = 1;

T=46;

end

default: begin

T=0;

end

endcase

//end

endmodule