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Microprograma na linguagem MAL com o novo conjunto de instruções

CODOPS das instruções:

Inst. 1: 1111 0001 xxxx yyyy jrlr

Inst. 2: 1111 0011 xxxx yyyy move

Inst. 3: 1111 0101 xxxx yyyy biz

Inst. 4: 1111 0111 xxxx yyyy instrução 4

Inst. 5: 1111 1001 xxxx yyyy instrução 5

Significado das instruções:

1. Jrlr Ra, Rb : 1111 0001 xxxx yyyy

Significado: Rb := PC; PC := Ra

2. Move Ra, Rb

Significado: Ra := (Rb)

3. Biz Ra, Rb

Significado:

PC := (Ra) If Rb == 0 else PC := PC+1

4 - AC := Ra AND Rb OR Ra

5 - AC := Ra AND (NOT Rb)

Microprograma:

Observação: as novas instruções estão em vermelho.

0: mar : = pc;rd;

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1: pc : = pc + 1;rd;

2: ir : = mbr;if n then goto 28;

3: tir : = lshift(ir + ir); if n then goto   19;

4: tir : = lshift(tir); if n then goto   11;

5: alu : = tir; if n then goto 9;

6: mar : =   ir;rd;----------------------LODD

7: rd;

8: ac : =   mbr; goto 0;

9: mar := ir; mbr := ac; wr:

10: wr ;goto 0;

11 : alu : = tir; if n then goto 15;

12: mar := ir; rd;

13: rd;

14: ac := mbr + ac; goto 0;

15: mar : = ir; rd;

16: ac := ac + 1; rd;

17: a := inv (mbr) ;

18: ac := ac + a; goto 0;

19: tir := lshift (tir); ir n then goto 25;

20: alu : = tir; ir n then goto 23;

21 : alu := ac; if n then goto 0;

22: pc := band (ir, amask); goto 0;

23: alu := ac; if n then goto 22;

24: goto 0;

25: alu: = tir; if n then goto 27;

26: pc := band (ir, amask); goto 0;
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27: ac : = band (ir, amask); goto 0;

28: tir := lshift (ir + ir); if n then goto 40;

29: tir := lshift (tir); if n then goto 35;

30: alu := tir; if n then goto 33;

31 : a := ir + sp;

32: mar : = a; rd; goto 7;

33: a : = ir + sp ;

34: mar := a; mbr := ac; wr; goto 10;

35: alu : = tir; if n then goto 38;

36: a := ir + sp ;

37: mar: = a; rd; goto 13;

38: a : = ir + sp;

39: mar : = a;rd; goto 16;

40: tir : = lshift (tir); lf n then goto 46;

41 : alu := tir; if n then goto 44;

42: alu := ac; lf n then goto 22;

43: goto 0;

44: alu : = ac; if z then goto 0;

45: pc := band (ir, amask); then goto 0;

46: tir := lshift(tir); lf n then goto 50;

47: sp := sp + (-1);

48: mar := sp; mbr := pc; wr;

49: pc : = band (ir, amask); wr; goto 0;

50: tir := lshift (tir); lf n then goto 77 ; ---------- 1111XXXX

51 : tir: = lshift (tir); lf n then goto 64;

52: tir: = lshift (tir); lf n then goto 59;

53: alu : = tir; lf n then goto 57;

54: mar : = ac; rd; ----------PSHI 11110000

55: sp := sp + (-1); rd;

56: mar := sp; wr; goto 10;

57: rb := pc;----------JRLR 11110001

58: pc := ra; goto 0;

59: alu : = tir; lf n then goto 63;

60: mar := sp; sp := sp + 1; rd;----------POPI 11110010

61: rd;

62: mar : = ac; wr; goto 10;

63: ra := rb; goto 0; ----------MOVE 11110011

64 : tir: = lshift (tir); lf n then goto 71;

65: alu : = tir; lf n then goto 68;

66: sp := sp + (-1);----------PUSH 11110100

67: mar := sp; mbr := ac; wr; goto 10;

68: ula := rb; if z then goto 70;----------BIZ 11110101

69: pc := pc + 1;goto 0;

70: pc := ra; goto 0;

71: alu : = tir; lf n then goto 75;

72: mar := sp; sp := sp + 1; rd; ----------POP 11110110

73: rd;

74: ac: = mbr; goto 0;

75: a := band(ra,rb);----------AC := Ra AND Rb OR Ra 11110111

76: ac:= bor(a,ra); goto 0;

77 : tir: = lshift (tir); lf n then goto 89;

78: tir: = lshift (tir); lf n then goto 85;

79: alu : = tir; lf n then goto 83;

80: mar :=sp; sp := sp + I; rd;---------- RETN 11111000

81: rd;

82: pc: = mbr; goto 0;

83: a := inv(rb); ----------5 - AC := Ra AND (NOT Rb) 11111001

84: ac := band(a,ra); goto 0;

85: alu : = tir; lf n then goto 0; --------1111 1011

86: a := ac;----------SWAP 11111010

87: ac := sp;

88: sp: = a; goto 0;

89: tir: = lshift (tir); lf n then goto 94;

90: alu : = tir; lf n then goto 0;-- 1111 1101

91: a:= band (ir, smask);----------INSP 11111100

92: sp : = sp + a; goto 0;

93: alu : = tir; lf n then goto 0;---1111 1111

94: a : = band (ir, smask);----------DESP 11111110

95: a : = inv (a);

96: a:= a+ 1; goto 92;