**SAP ROUTINE**

1.LDA Routine:

T1: MAR 🡨 PC

T2: PC 🡨 PC+1; IR 🡨 M[MAR]

T3: MAR 🡨 IR

T4: A 🡨 M[MAR]

2.ADD Routine:

T1: MAR 🡨 PC

T2: PC 🡨 PC+1; IR 🡨 M[MAR]

T3: A 🡨 A+B

T4: NOP

3.SUB Routine:

T1: MAR 🡨 PC

T2: PC 🡨 PC+1; IR 🡨 M[MAR]

T3: A 🡨 A+C’+1

T4: NOP

4.AND Routine:

T1: MAR 🡨 PC

T2: PC 🡨 PC+1; IR 🡨 M[MAR]

T3: A 🡨 A^B

T4: NOP

5.MOV Routine:

T1: MAR 🡨 PC

T2: PC 🡨 PC+1; IR 🡨 M[MAR]

T3: A 🡨 B

T4: NOP

6.JMP[M] Routine:

T1: MAR 🡨 PC

T2: PC 🡨 PC+1; IR 🡨 M[MAR]

T3: PC 🡨M[IR]

T4: MAR 🡨PC

7.JZ[M] Routine:

T1: MAR 🡨 PC

T2: PC 🡨 PC+1; IR 🡨 M[MAR]

T3: PC 🡨M[IR]

T4: MAR 🡨PC

8.OUT Routine:

T1: MAR 🡨 PC

T2: PC 🡨 PC+1; IR 🡨 M[MAR]

T3:OUT 🡨 A

T4:NOP

9.HLT Routine:

T1: MAR 🡨 PC

T2: PC 🡨 PC+1; IR 🡨 M[MAR]

T3:NOP

T4:NOP