1 η ΕΡΓΑΣΤΗΡΙΑΚΗ ΑΣΚΗΣΗ
ΓΙΑ ΤΟ ΜΑΘΗΜΑ "Εργαστήριο Μικροϋπολογιστών"

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1.
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LXI B,03E8H ;BC=1000 IN ORDER TO HAVE 1 SEC DELAY
MVI E,FFH ; TO START FORM 0 IN EVERY LOOP


START:
LDA 2000H ;A=(2000) TAKE THE INPUT
ANI 0FH ; ONLY USE 4 LSB
JZ START
MOV D,A ; D=4LSB

UP:
LDA 2000H ; STOP THE COUNTER IF THE MSB OFF
ANI 80H
JZ UP

INR E ; INR THE COUNTER
MOV A,E
CALL DELB ; DELAY 1 SEC
CMA
STA 3000H ; DISPLAY
CMA
CMP D ; IF YOU HAVE REACHED THE 4LSB START TO DECREASE
          ; THE COUNTER, ELSE INR THE COUNTER UNTIL YOU
          ;REACHED 4LSB
JNZ UP

DOWN:
LDA 2000H ; STOP THE COUNTER IF THE MSB OFF
ANI 80H
JZ DOWN

DCR E ; DCR THE COUNTER
MOV A,E
CALL DELB
CMA
STA 3000H ; DISPLAY THE COUNTER
CMA
CPI 00H ; UNTIL REACH ZERO
JNZ DOWN
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JMP START
END
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2.

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IN 10H

START:
MVI A,00H ; INITIALISE THE POSITIONS ON THE DISPLAY
STA 0900H
STA 0901H
STA 0902H

READ_X:
CALL KIND
MOV B,A ; B=X


READ_Y:
CALL KIND
MOV C,A ;C=Y

MVI A,00H

MVI D,10H ; MUL THE X WITH 16 TO FORM THE NUMBER
LOOP16X:
ADD B
DCR D
JNZ LOOP16X
ADD C  ; X*16+Y TO FORM THE NUMBER
; NOW WE HAVE TO SUN THE NUMBER TO HUD AND TENS
; AND THE SAVE THIW TO EACH POSITION IN THE DISPLAY
HUD: ; IF THE NUMBER IF GRATER THAN 100 ADD 1 TO HUD AND
          ;SUB 100 FROM THE NUMBER
CPI 64H
JNC ADD_HUD
TENS: ; SAME FOR THE TENS
CPI 0AH
JNC ADD_TENS ; THE REST NUMBER IS SMALLER THAN 10
               ;SO WE JUST SHOW THE REST
STA 0900H
JMP DISPLAY


ADD_HUD:
MOV B,A
LDA 0902H
INR A
STA 0902H
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MOV A,B
MVI B,64H
SUB B
JMP HUD

ADD_TENS:
MOV B,A
LDA 0901H
INR A
STA 0901H
MOV A,B
MVI B,0AH
SUB B
JMP TENS

DISPLAY:
LXI D,0900H
CALL STDM
CALL DCD
JMP START
END
```

3.

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LXI B,01F4H ; DELAY OF 0,5SEC  B=500
MVI E,01H ; E IS THE POSITION OF THE TRAIN
MOV A,E
CALL DELB
CMA
STA 3000H ; SHOW THE FIRST POSITION

; START WITH THE LEFT ROTATION BECAUSE WE ARE ON THE 01 LSB OF THE
; BOARD
ROTATE_LEFT:
     LDA 2000H ; CHECK IF THE MSB IS ON ,SO YOU STAY THERE ,
                         ;ELSE MOVE ON
     ANI 80H
     CPI 80H
     JNZ ROTATE_LEFT

     LDA 2000H ; CHECK IF WE HAVE PRESS THE BUTTON ON NO
     ;WHEN WE ARE AT 1 LSB THEN YOU MOVE AT THE CORRECT DIRECTION
                    ;ELSE WE MOVE IN THE INVERSE ONE
     ANI 01H
     JZ ROTATE_RIGHT_INVERSE

     MOV A,E ; IF WE HAVE REACH THE END ON THE LEFT ONE WHEN WE HIT
               ;THE BUTTON TO CHANGE FROM THE INVERSE TO NORMAL WE GO
                    ;TO THE ROTATE_RIGHT
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      CPI 80H
      CALL DELB
      JZ ROTATE_RIGHT

      MOV A,E ;
      RLC ; ROTATE LEFT THE TRAIN
      MOV E,A
      CMA
      STA 3000H ; DISPLAY THE TRAIN
      CMA
      CALL DELB
      CPI 80H ; WHILE WE DONT HAVE REACH THE END ON THE ROTATE_LEFT
                    ;WE KEEP GOING ELSE WE MOVE TO ROTATE_RIGHT

      JNZ ROTATE_LEFT
      CALL DELB
      JZ ROTATE_RIGHT

ROTATE_RIGHT:
      LDA 2000H
      ANI 80H
      JZ ROTATE_RIGHT

      LDA 2000H
      ANI 01H
      JZ ROTATE_LEFT_INVERSE

      MOV A,E
      CPI 01H ; CHECK IF WE HAVE PRESSED THE LSB ON THE 01H POSITION
                    ; AND WE HAVE TO MOVE LEFT
      CALL DELB
      JZ ROTATE_LEFT


      MOV A,E
      RRC ; ROTARE RIGHT THE POSITION OF THE TRAIN
      MOV E,A
      CMA
      STA 3000H ; DISPLAY IT
      CMA
      CALL DELB
      CPI 01H
      JNZ ROTATE_RIGHT ; WHILE THE HAVENT REACH THE LSB OF THE DISPLAY
                                      ; KEEP GOING , ELSE GO TO LEFT
      CALL DELB
      JZ ROTATE_LEFT
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ROTATE_RIGHT_INVERSE:
     LDA 2000H
     ANI 80H
     JZ ROTATE_RIGHT_INVERSE

     LDA 2000H
     ANI 01H ; CHECK IF THE LSB BUTTON IS UNPUSHED SO WE HAVE TO GO
                    ; TO THE NORMAL ROTATION ONCE AGAIN
     JNZ ROTATE_LEFT

     MOV A,E
     CPI 01H
     CALL DELB
     JZ ROTATE_LEFT_INVERSE

     MOV A,E
     RRC
     MOV E,A
     CMA
     STA 3000H
     CMA
     CALL DELB
     CPI 01H
     JNZ ROTATE_RIGHT_INVERSE
     CALL DELB
     JZ ROTATE_LEFT_INVERSE

ROTATE_LEFT_INVERSE:
     LDA 2000H
     ANI 80H
     JZ ROTATE_LEFT_INVERSE

     LDA 2000H
     ANI 01H
     JNZ ROTATE_RIGHT

     MOV A,E
     CPI 80H
     CALL DELB
     JZ ROTATE_RIGHT_INVERSE

     MOV A,E
     RLC
     MOV E,A
     CMA
     STA 3000H
     CMA
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```
     CALL DELB
     CPI 80H
     JNZ ROTATE_LEFT_INVERSE
     CALL DELB
     JZ ROTATE_RIGHT_INVERSE
END
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