Rajshahi University of Engineering & Technology

Course No.: CSE 3110
Course Title: Sessional Based on CSE 3109

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Problem No: 5

Problem Description:

Write a program that lets the user enter time in seconds, up to 65535, and outputs the time as hours, minutes and seconds. Use INDEC and OUTDEC to do the I/O.

Theory:

Registers used:

i) Accumulator (AX): For arithmetic and logical instructions.
ii) Base (BX): To hold the address of data.
iii) Data (DX): To hold data for output.
iv) Data Segment (DS): To point data segment of the memory where the data is stored.

Instructions used:

i) MOV
ii) CALL
iii) DIV
iv) PUSH
v) POP

Here, INDEC means input in decimal and OUTDEC means output in decimal. A stack was used to store the time in seconds.

Source Code:

Main:

```
.MODEL SMALL
.STACK 100H
.DATA
MESSAGE DB
0AH,0DH,'TIME-> $'
.CODE
MAIN PROC
 MOV AX,@DATA
 MOV DS,AX
 CALL INDEC
 MOV BX,3600
 DIV BX
 PUSH AX
 PUSH DX

MOV AH,9
LEA DX,MESSAGE
INT 21H
 POP DX
 POP AX
 CALL OUTDEC
 PUSH DX

 MOV AH,2
 MOV DL,':'
 INT 21H
   POP AX
 MOV BX,60
 MOV DX,0
 DIV BX
 CALL OUTDEC
 PUSH DX

 MOV AH,2
 MOV DL,':'
 INT 21H
 POP AX
 CALL OUTDEC

MOV AH,4CH
INT 21H
MAIN ENDP


INCLUDE
C:\emu8086\MySource\Lab\5\INDEC.ASM
INCLUDE
C:\emu8086\MySource\Lab\5\OUTDEC.ASM
END MAIN
```

INDEC:

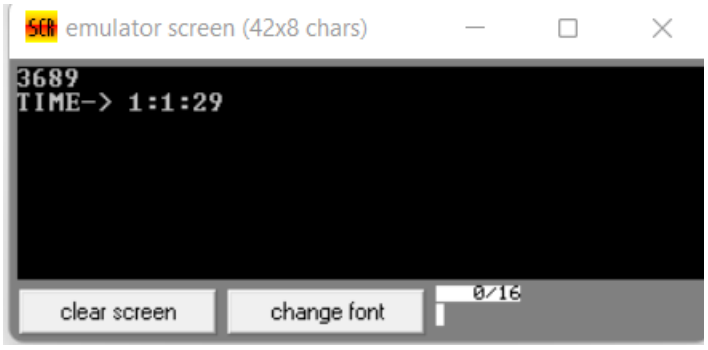
```
INDEC PROC

 PUSH BX
 PUSH CX
 PUSH DX

@BEGIN:
 XOR BX,BX
 XOR CX,CX
 MOV AH,1
 INT 21H
 CMP AL,'-'
 JE @MINUS
 CMP AL,'+'
 JE @PLUS
 JMP @REPEAT2
@MINUS: MOV CX,1
@PLUS: INT 21H

@REPEAT2:
 CMP AL,'0'
 JNGE @NOT_DIGIT
 CMP AL,'9'
 JNLE @NOT_DIGIT
 AND AX,000FH
 PUSH AX
 MOV AX,10
 MUL BX
CMP DX,0
JNE @NOT_DIGIT
 POP BX
 ADD BX,AX
JC @NOT_DIGIT
 MOV AH,1
 INT 21H
 CMP AL,0DH
 JNE @REPEAT2
 MOV AX,BX
 OR CX,CX
JE @EXIT
 NEG AX
@EXIT: POP DX
 POP CX
 POP BX
 RET
@NOT_DIGIT:
 MOV AH,2
 MOV DL,0DH
 INT 21H
 MOV DL,0AH
 INT 21H
 JMP @BEGIN
INDEC ENDP
```

OUTDEC:

```
OUTDEC PROC
PUSH AX
 PUSH BX
 PUSH CX
 PUSH DX
 OR AX,AX
 JGE @END_IF1

PUSH AX
 MOV DL,'-'
 MOV AH,2
 INT 21H

POP AX
 NEG AX
@END_IF1:
 XOR CX,CX
 MOV BX,10D
```

```
@REPEAT1:
 XOR DX,DX
 DIV BX
 PUSH DX
 INC CX
OR AX,AX
 JNE @REPEAT1

MOV AH,2
@PRINT_LOOP:
 POP DX
 OR DL,30H
 INT 21H

LOOP @PRINT_LOOP
POP DX
POP CX
POP BX
POP AX
RET
OUTDEC ENDP
```

Output:



Discussion:

Here, INDEC and OUTDEC code were written separately. They were included in the main code at the end and CALL instruction was used to call those methods. INDEC was used to take inputs in decimal. Then it was divided by 3600 and then 60 to get time in hours and minutes. The remainder was seconds. Then OUTDEC was used to show the time in hours, minutes and seconds.