Microprocessor and Interfacing

Digital Assignment - II

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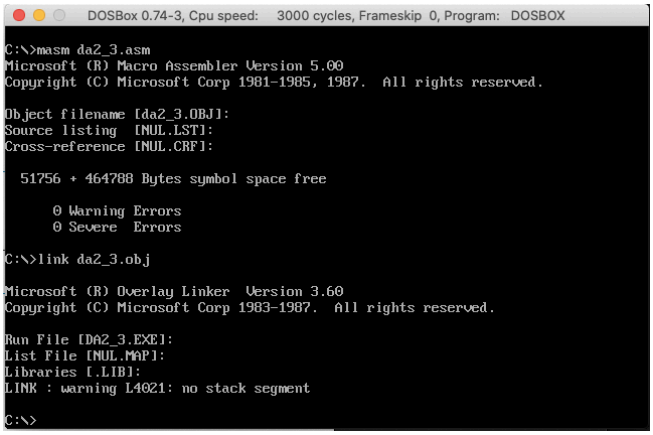
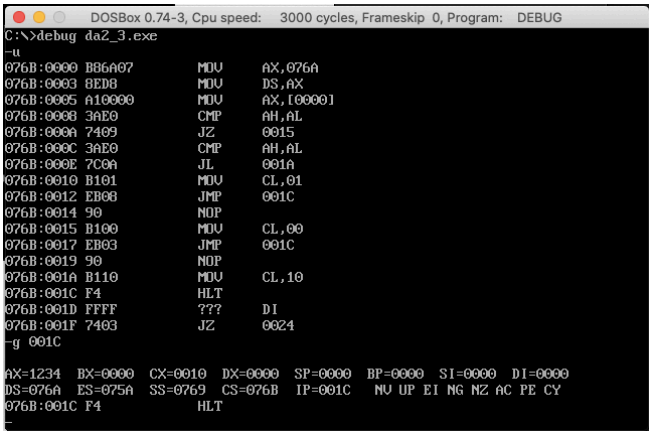
- 13 March 2020

Question - 3

```
ASSUME CS:CODE, DS:DATA
DATA SEGMENT
   var DW 1234H
DATA ENDS
CODE SEGMENT
START:
   mov ax,DATA
   mov ds,ax
   mov ax,var
   cmp ah,al
   je case1
   cmp ah,al
   jl case2
   mov cl,01H
   jmp final
   case1:
      mov cl,00H
      jmp final
   case2:
      mov cl,10H
```

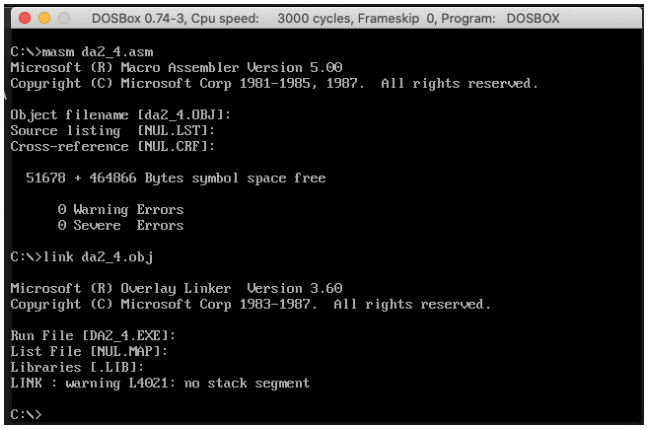
```
    final:
        hlt
CODE ENDS
END START
```

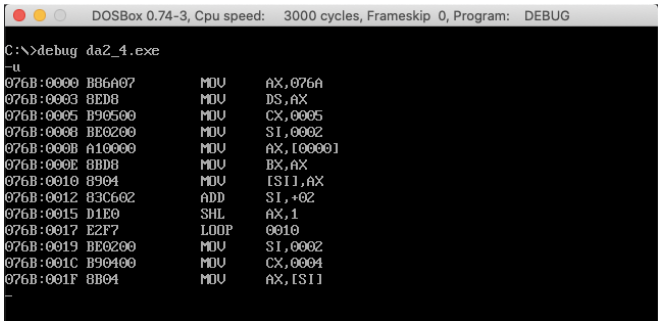


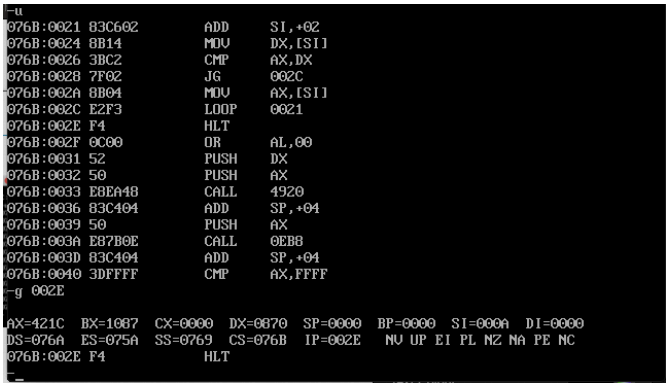


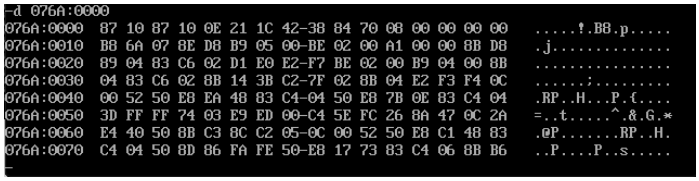
Question - 4

```
ASSUME CS:CODE, DS:DATA
DATA SEGMENT
   var dw 1087H
   arr dw 5 dup(0)
DATA ENDS
CODE SEGMENT
START:
   mov ax,DATA
   mov ds,ax
   mov cx,05H
   mov si, OFFSET arr
   mov ax,var
   mov bx,ax
   RPT:
      mov [si],ax
      add si,02H
      shl ax,01H
      loop RPT
   mov si, OFFSET arr
   mov cx,04H
   mov ax,[si]
   RPT2:
      add si,02H
      mov dx,[si]
      cmp ax,dx
      jg CONTINUE
      mov ax,[si]
   CONTINUE:
      loop RPT2
   hlt
CODE ENDS
END START
```


DOSBox 0.74-3, Cpu speed: 3000 cycles, Frameskip 0, Program: DOSBOX
C:\>masm da2_4.asm
Microsoft (R) Macro Assembler Version 5.00
Copyright (C) Microsoft Corp 1981-1985, 1987. All rights reserved.
Object filename [da2_4.OBJ]:
Source listing [NUL.LST]:
Cross-reference [NUL.CRF]:
51678 + 464866 Bytes symbol space free
0 Warning Errors
0 Severe Errors
C:\>link da2_4.obj
Microsoft (R) Overlay Linker Version 3.60
Copyright (C) Microsoft Corp 1983-1987. All rights reserved.
Run File [DA2_4.EXE]:
List File [NUL.MAP]:
Libraries [.LIB]:
LINK : warning L4021: no stack segment
C:\>

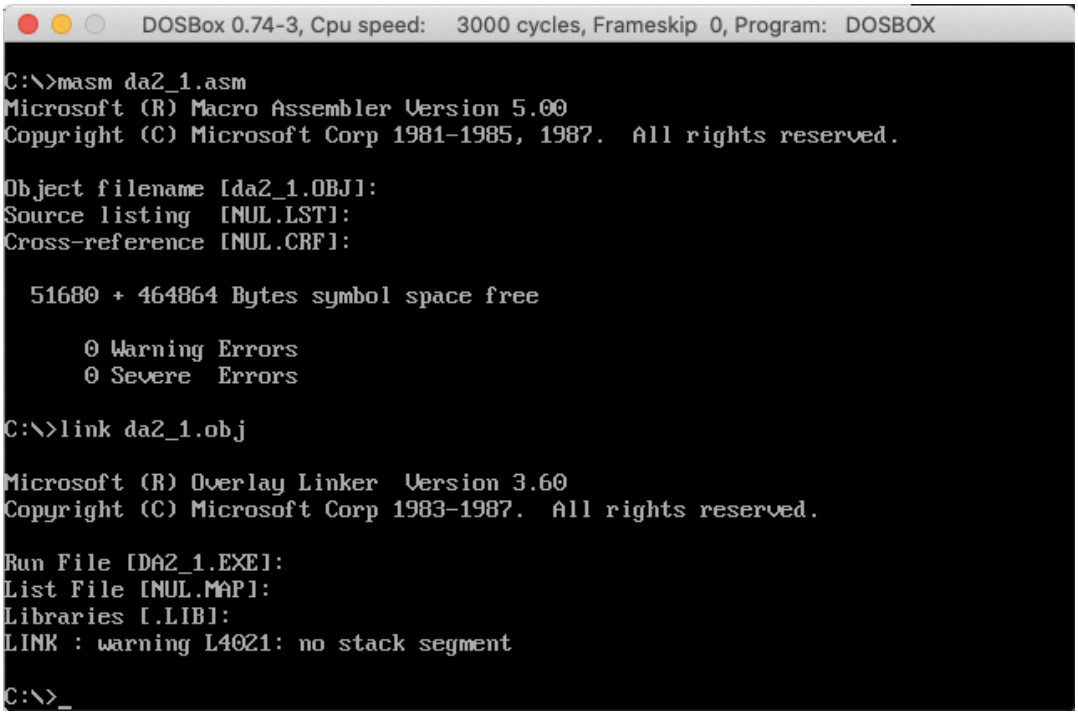

DOSBox 0.74-3, Cpu speed: 3000 cycles, Frameskip 0, Program: DEBUG
C:\>debug da2_4.exe
-u
076B:0000 B86A07 MOV AX,076A
076B:0003 8ED8 MOV DS,AX
076B:0005 B90500 MOV CX,0005
076B:0008 BE0200 MOV SI,0002
076B:000B A10000 MOV AX,[0000]
076B:000E 8BD8 MOV BX,AX
076B:0010 8904 MOV [SI],AX
076B:0012 83C602 ADD SI,+02
076B:0015 D1E0 SHL AX,1
076B:0017 E2F7 LOOP 0010
076B:0019 BE0200 MOV SI,0002
076B:001C B90400 MOV CX,0004
076B:001F 8B04 MOV AX,[SI]

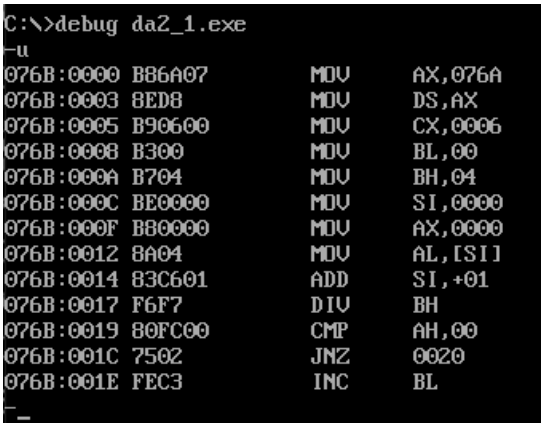

-u
076B:0021 83C602 ADD SI,+02
076B:0024 8B14 MOV DX,[SI]
076B:0026 3BC2 CMP AX,DX
076B:0028 7F02 JG 002C
076B:002A 8B04 MOV AX,[SI]
076B:002C E2F3 LOOP 0021
076B:002E F4 HLT
076B:002F 0C00 OR AL,00
076B:0031 52 PUSH DX
076B:0032 50 PUSH AX
076B:0033 E8EA48 CALL 4920
076B:0036 83C404 ADD SP,+04
076B:0039 50 PUSH AX
076B:003A E87B0E CALL 0EB8
076B:003D 83C404 ADD SP,+04
076B:0040 3DFFFF CMP AX,FFFF
-g 002E
AX=421C BX=1087 CX=0000 DX=0870 SP=0000 BP=0000 SI=000A DI=0000
DS=076A ES=075A SS=0769 CS=076B IP=002E NV UP EI PL NZ NA PE NC
076B:002E F4 HLT

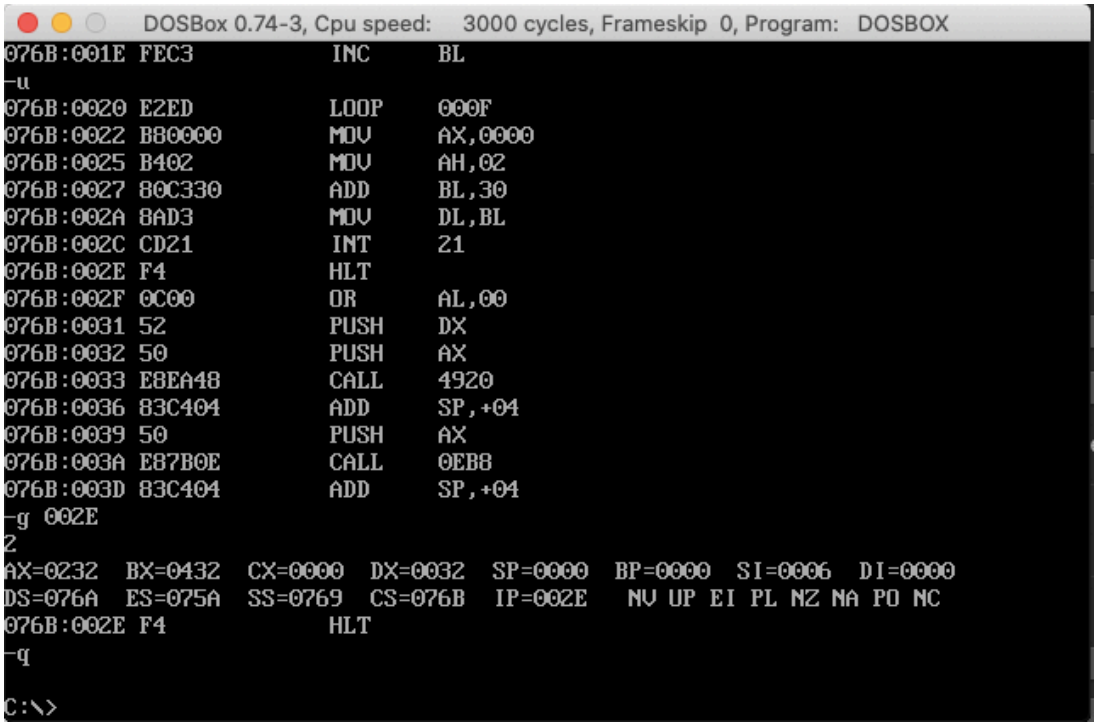

-d 076A:0000
076A:0000 87 10 87 10 0E 21 1C 42-38 84 70 08 00 00 00 00 .....!.B8.p.....
076A:0010 B8 6A 07 8E D8 B9 05 00-BE 02 00 A1 00 00 8B D8 .j..............
076A:0020 89 04 83 C6 02 D1 E0 E2-F7 BE 02 00 B9 04 00 8B ....
076A:0030 04 83 C6 02 8B 14 3B C2-7F 02 8B 04 E2 F3 F4 0C ......;.........
076A:0040 00 52 50 E8 EA 48 83 C4-04 50 E8 7B 0E 83 C4 04 .RP..H...P.{....
076A:0050 3D FF FF 74 03 E9 ED 00-C4 5E FC 26 8A 47 0C 2A =..t.....^.&.G.*
076A:0060 E4 40 50 8B C3 8C C2 05-0C 00 52 50 E8 C1 48 83 .@P.......RP..H.
076A:0070 C4 04 50 8D 86 FA FE 50-E8 17 73 83 C4 06 8B B6 ..P....P..s.....

Question - 1

```
ASSUME CS:CODE,DS:DATA
DATA SEGMENT
   arr db 31d, 23d, 61d, 23d, 44d, 00d
   count db 00h
DATA ENDS
CODE SEGMENT
START:
   mov ax,DATA
   mov ds,ax
   mov cx,06h
   mov bl,00h
   mov bh,04d
   mov si, OFFSET arr
   L1:
      mov ax,0000h
      mov al,[si]
      add si,01h
      div bh
      cmp ah,00h
      jne L2
      inc bl
      L2:
         loop L1
   mov ax,0000h
   mov ah,02h
   add bl,48d
   mov dl,bl
   int 21h
   hlt
CODE ENDS
END START
```


DOSBox 0.74-3, Cpu speed: 3000 cycles, Frameskip 0, Program: DOSBOX
C:\>masm da2_1.asm
Microsoft (R) Macro Assembler Version 5.00
Copyright (C) Microsoft Corp 1981-1985, 1987. All rights reserved.
Object filename [da2_1.OBJ]:
Source listing [NUL.LST]:
Cross-reference [NUL.CRF]:
51680 + 464864 Bytes symbol space free
0 Warning Errors
0 Severe Errors
C:\>link da2_1.obj
Microsoft (R) Overlay Linker Version 3.60
Copyright (C) Microsoft Corp 1983-1987. All rights reserved.
Run File [DA2_1.EXE]:
List File [NUL.MAP]:
Libraries [.LIB]:
LINK : warning L4021: no stack segment
C:\>_


C:\>debug da2_1.exe
-u
076B:0000 B86A07 MOV AX,076A
076B:0003 8ED8 MOV DS,AX
076B:0005 B90600 MOV CX,0006
076B:0008 B300 MOV BL,00
076B:000A B704 MOV BH,04
076B:000C BE0000 MOV SI,0000
076B:000F B80000 MOV AX,0000
076B:0012 8A04 MOV AL,[SI]
076B:0014 83C601 ADD SI,+01
076B:0017 F6F7 DIV BH
076B:0019 80FC00 CMP AH,00
076B:001C 7502 JNZ 0020
076B:001E FEC3 INC BL
-_


DOSBox 0.74-3, Cpu speed: 3000 cycles, Frameskip 0, Program: DOSBOX
076B:001E FEC3 INC BL
-u
076B:0020 E2ED LOOP 000F
076B:0022 B80000 MOV AX,0000
076B:0025 B402 MOV AH,02
076B:0027 80C330 ADD BL,30
076B:002A 8AD3 MOV DL,BL
076B:002C CD21 INT 21
076B:002E F4 HLT
076B:002F 0C00 OR AL,00
076B:0031 52 PUSH DX
076B:0032 50 PUSH AX
076B:0033 E8EA48 CALL 4920
076B:0036 83C404 ADD SP,+04
076B:0039 50 PUSH AX
076B:003A E87B0E CALL 0EB8
076B:003D 83C404 ADD SP,+04
-g 002E
2
AX=0232 BX=0432 CX=0000 DX=0032 SP=0000 BP=0000 SI=0006 DI=0000
DS=076A ES=075A SS=0769 CS=076B IP=002E NV UP EI PL NZ NA PO NC
076B:002E F4 HLT
-q
C:\>

Question - 2

Delay time = 12ms
Clock frequency = 5MHz
$T = 1/(5 \times 10^6) = 2 \times 10^{-7}$ s $= 2 \times 10^{-4}$ ms

Instruction	Clock Cycles
Mov cx, count	4
Dec cx	2
Nop	3
Jnz L1	16
Total	**21**

Total time by the instructions of each loop : $21 \times (2 \times 10^{-4})$
No of states (N) = $12 / (21 \times 2 \times 10^{-4}) = (2858)d = (B2A)H$

ALP :

```
ASSUME CS:CODE
CODE SEGMENT
START:
   mov cx, 0B2AH
   L1:
      dec cx
      nop
      jnz L1
   mov ah,04Ch
   int 21h
   hlt
CODE ENDS
END START
```