1. Create, assemble, and link the source code for "prog51.asm". Verify that the program operates correctly. Now, for each of the following, modify the source code as indicated, reassemble, and indicate how the change affects program operation and/or assembly. If an error occurs, explain the error message.

(a) In the segment definition, delete the 'Code' classification.
(b) Change the ORG 100H statement to ORG 200H.
(c) Change line 19 to MOV AX, E00H.
(d) Change the interrupt instruction in line 20 to INT 10 (delete the H).
(e) In line 23, change the JNZ IIA to JNZ IIIA.
(f) Delete the statement CSEG ENDS.
(g) Delete the label START from the program end statement.
(h) Change line 25 to 'CSEG ENDS (add the apostrophe).

prog51.asm

```
==================================================
 1.  Page     58,132
 2.  Title    Program 5.1

 3.  ;*******************************************
 4.  ;          Display ASCII Character Set      *
 5.  ;*                                          *
 6.  ;*  This program displays all of the ASCII  *
 7.  ;*  characters with codes 0-127.            *
 8.  ;*                                          *
 9.  ;*******************************************

10. cseg    segment  'code'
11. assume   cs:cseg, ds:cseg, ss:cseg, es:cseg

12. org       100h                ;Leave room for PSP

13. start: mov      ax,0002        ;BIOS service 0, video mode 2
14. int      10h              ;Set video mode and clear screen
15. mov      ah,2             ;BIOS service 2
16. mov      dx,0a00h         ;Row 10, column 0
17. mov      bh,0             ;Page 0
18. int      10h              ;Position cursor
19. mov      ax,0e00h         ;BIOS service 0E, first character is 0
20. IIA:     int      10h              ;Print character
21. inc      al               ;Next
22. cmp      al,80h           ;Done?
23. jnz      IIA              ;No: loop again
24. int      20h              ;Yes: back to DOS

25. cseg    ends
26. end      start

==================================================
```

2. Write the program described in Analysis and Design Question 5.2 (see Homework handout 5) in assembly language format using MASM. Verify proper program operation and print a copy of the list file.

Debug program:
```
================================================================
MOV     AH,00
MOV     AL,02
INT     10
MOV     AX,0920
MOV     BL,1A
MOV     CX,07D0
INT     10
MOV     AH,02
MOV     DX,0A00
MOV     BH,00
INT     10
MOV     AH,0E
MOV     AL,00
INT     10
INC     AL
CMP     AL,80
JNZ     011D
INT     20


================================================================
```

Answers to Problems:

1.
(a) PROGSl.ASM(17): warning A4012: line number information for segment without class
'CODE' : cseg. CodeView cannot process modules with code in segments with class names
that do not end with "CODE."

(b) LlNK : warning L4055: start address not equal to 0x100 for /TINY. COM programs (/TINY
memory model) must start at 0100H.

(c) PROG51 .ASM(23): error ,42006: undefined symbol :eOOh. Assembler "thinks" this number
is a label.

(d) Program assembles without error. However, when run, the output screen is blank. The
wrong interrupt (number 10 instead of 16) is being called.

(e) PROG51 .ASM(27): error A2006: undefined symbol : IIIA. This symbol is not defined
anywhere in the program

(f) PROG51 .ASM(31): fatal error A101 0: unmatched block nesting : cseg. Assembler cannot
find the end of the segment.

(g) LlNK :warning L4055: start address not equal to 0x100 for /TINY. Linker cannot find a
starting address.

(h) 102 errors! PROG51 .ASM(30): error A2046: missing single or double quotation mark in
string. PROG51 .ASM(30): error A2039: line too long.

Problem 2

```
                Page    58,132
                Title   Program AD6.3


                ;**********************************************
                ;*   Display ASCII Character Set              *
                ;*                                            *
                ;*   This program displays all of the ASCII   *
                ;*   characters with codes 0-127.             *
                ;*                                            *
                ;*   The screen is progammed for bright green *
                ;*   on a blue background.                    *
                ;*                                            *
                ;**********************************************

                            cseg    segment    'Code'
                            assume  cs:cseg, ds:cseg, ss:cseg, es:cseg

                            org     100h            ;Leave room for PSP

0100   B4 00      start:  mov  ah,0         ;BIOS service 0
0102   B0 02              mov  al,2         ;Video mode 2
0104   CD 10              int  10h          ;Set video mode and clear screen
0106   B8 0920            mov  ax,0920h     ;Service 9, ASCII space
0109   B3 1A              mov  bl,1ah       ;Bright green on blue
010B   B9 07C8            mov  cx,7c8h      ;Fill screen
010E   CD 10              int  10h          ;Set screen color
0110   B4 02              mov  ah,2         ;BIOS service 2
0112   BA 0A00            mov  dx,0a00h     ;Row 10, column 0
0115   B7 00              mov  bh,0         ;Page 0
0117   CD 10              int  10h          ;Set cursor
0119   B4 0E              mov  ah,0eh       ;BIOS servce 0E
011B   B0 00              mov  al,0         ;First character is 0
011D   CD 10      A1:   int  10h          ;Print character
011F   FE C0              inc  al           ;Next
0121   3C 80              cmp  al,80h       ;Done?
0123   75 F8              jnz  A1           ;No: loop again
0125   CD 20              int  20h          ;Yes: back to DOS

0127                      cseg ends
                          end  start
```