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ICS 312
Homework Solution #11
Due Date: September 29, 2009

Part 1: Call by value, subroutine fixes the stack. Program Code

```
;; program5-1 -- This program calls a subroutine to return the larger digit of
;; two. The subroutine employ a call by value with the subroutine fixing up
;; the stack
        .model small
        .stack 100

        .data
prompt1 db          0dh, 0ah, 'Please enter a digit: $'
prompt2 db          0dh, 0ah, 'The larger of the two digits is: $'

        .code
main1   proc
        mov         ax, @data
        mov         ds, ax

        lea         dx, prompt1           ; prompt the first user input num.
        mov         ah, 9h
        int         21h
        mov         ah, 1h
        int         21h
        cwd
        push        ax                   ; push the first num onto the stack.
        lea         dx, prompt1         ; prompt the second user input num.
        mov         ah, 9h
        int         21h
        mov         ah, 1h
        int         21h
        cwd
        push        ax                   ; push the second num onto the stack.
        lea         dx, prompt2         ; print out result message.
        mov         ah, 9h
        int         21h
```

```

        call    choose1        ; call subroutine.
        mov     dl, al         ; print out al, which contains the
        mov     ah, 2h        ; return value.
        int     21h

        mov     al, 0         ; return code of 0
        mov     ah, 4ch       ; function code for exit to os
        int     21h
main1   endp

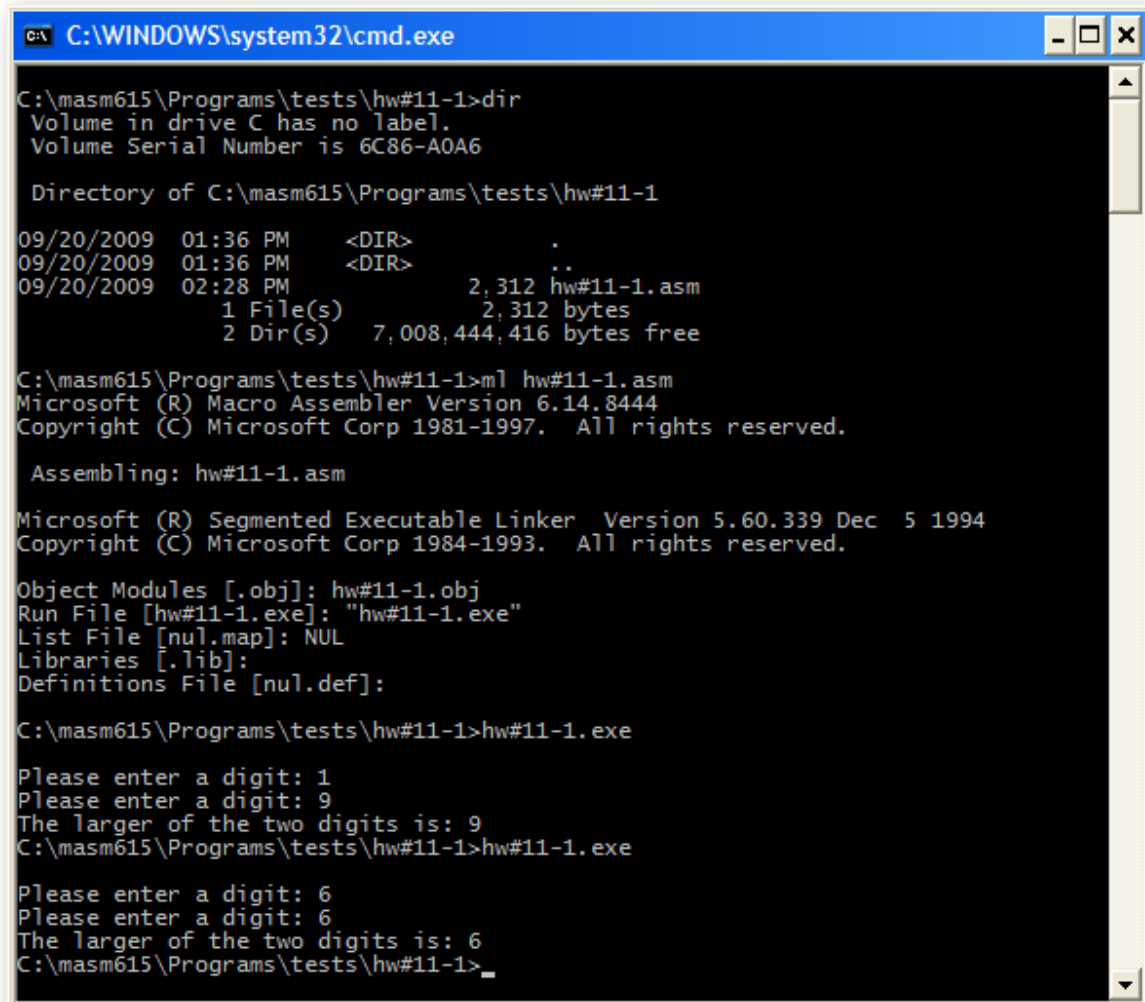
choose1 proc
        push    bp           ; save bp
        mov     bp, sp      ; let bp points to the stack top
        push    bx           ; save bx
        mov     bx, [bp+6]   ; move X to bx
        cmp     bx, [bp+4]   ; compare X with Y
        jg     Xlarger      ; if X is larger, set ax = X.
        mov     ax, [bp+4]   ; otherwise set ax = Y.
        jmp     done

Xlarger:
        mov     ax, bx

done:
        pop     bx           ; restore bx
        pop     bp           ; restore bp
        ret     4            ; pop IP and add 4 bytes to sp.
choose1 endp
end     main1

```

Part 1: Call by value, subroutine fixes the stack. Program Output



```
C:\WINDOWS\system32\cmd.exe
C:\masm615\Programs\tests\hw#11-1>dir
Volume in drive C has no label.
Volume Serial Number is 6C86-A0A6

Directory of C:\masm615\Programs\tests\hw#11-1

09/20/2009  01:36 PM    <DIR>          .
09/20/2009  01:36 PM    <DIR>          ..
09/20/2009  02:28 PM                2,312 hw#11-1.asm
             1 File(s)                2,312 bytes
             2 Dir(s)  7,008,444,416 bytes free

C:\masm615\Programs\tests\hw#11-1>ml hw#11-1.asm
Microsoft (R) Macro Assembler Version 6.14.8444
Copyright (C) Microsoft Corp 1981-1997.  All rights reserved.

Assembling: hw#11-1.asm

Microsoft (R) Segmented Executable Linker  Version 5.60.339 Dec  5 1994
Copyright (C) Microsoft Corp 1984-1993.  All rights reserved.

Object Modules [.obj]: hw#11-1.obj
Run File [hw#11-1.exe]: "hw#11-1.exe"
List File [nul.map]: NUL
Libraries [.lib]:
Definitions File [nul.def]:

C:\masm615\Programs\tests\hw#11-1>hw#11-1.exe

Please enter a digit: 1
Please enter a digit: 9
The larger of the two digits is: 9
C:\masm615\Programs\tests\hw#11-1>hw#11-1.exe

Please enter a digit: 6
Please enter a digit: 6
The larger of the two digits is: 6
C:\masm615\Programs\tests\hw#11-1>_
```

Part 2: Call by reference, main routine fixes the stack. Program Code

```
;; program5-2 - This program calls a subroutine to return the larger digit of
;; two. The subroutine employ a call by reference with the main routine fixing
;; up the stack.
```

```
        .model small
        .stack 100

        .data
X        dw          0                ; define a memory spot for X.
Y        dw          0                ; define a memory spot for Y.
prompt1 db          0dh, 0ah, 'Please enter a digit: $'
prompt2 db          0dh, 0ah, 'The larger of the two digits is: $'

        .code
main2    proc
        mov         ax, @data
        mov         ds, ax

        lea        dx, prompt1        ; prompt the first user input num.
        mov         ah, 9h
        int        21h
        mov         ah, 1h
        int        21h
        cwd
        mov         X, ax              ; store the input in X.
        mov         bx, offset X
        push        bx                ; push the address of X onto stack.
        lea        dx, prompt1        ; prompt the second user input num.
        mov         ah, 9h
        int        21h
        mov         ah, 1h
        int        21h
        cwd
        mov         Y, ax              ; store the input in Y.
        mov         bx, offset Y
        push        bx                ; push the address of Y onto stack.
```

```

        lea        dx, prompt2            ; print out result message.
        mov        ah, 9h
        int        21h
        call       choose2                ; call subroutine.
        add        sp, 4                  ; fix up the stack.
        mov        dl, al                 ; print out al, which contains the
        mov        ah, 2h                 ; return value.
        int        21h

        mov        al, 0                  ; return code of 0
        mov        ah, 4ch                ; function code for exit to os
        int        21h
main2   endp

choose2 proc
        push       bp                    ; save bp.
        mov        bp, sp                ; let bp points to the stack top.
        push       bx                    ; save bx.
        mov        bx, [bp+6]            ; move the address of X to bx.
        mov        ax, [bx]              ; move X to ax.
        mov        bx, [bp+4]            ; move the address of Y to bx.
        cmp        ax, [bx]              ; compare X and Y.
        jg         done
        mov        ax, [bx]              ; ax stores the larger digit.
done:
        pop        bx                    ; restore bx.
        pop        bp                    ; restore bp.
        ret
choose2 endp
end     main2

```

Part 2: Call by reference, main routine fixes the stack. Program Output

```
C:\WINDOWS\system32\cmd.exe
C:\masm615\Programs\tests\hw#11-2>dir
Volume in drive C has no label.
Volume Serial Number is 6C86-A0A6

Directory of C:\masm615\Programs\tests\hw#11-2

09/20/2009  02:25 PM    <DIR>          .
09/20/2009  02:25 PM    <DIR>          ..
09/20/2009  02:25 PM                2,759 hw#11-2.asm
             1 File(s)                2,759 bytes
             2 Dir(s)  7,008,460,800 bytes free

C:\masm615\Programs\tests\hw#11-2>ml hw#11-2.asm
Microsoft (R) Macro Assembler Version 6.14.8444
Copyright (C) Microsoft Corp 1981-1997.  All rights reserved.

Assembling: hw#11-2.asm

Microsoft (R) Segmented Executable Linker  Version 5.60.339 Dec  5 1994
Copyright (C) Microsoft Corp 1984-1993.  All rights reserved.

Object Modules [.obj]: hw#11-2.obj
Run File [hw#11-2.exe]: "hw#11-2.exe"
List File [nul.map]: NUL
Libraries [.lib]:
Definitions File [nul.def]:

C:\masm615\Programs\tests\hw#11-2>hw#11-2.exe

Please enter a digit: 2
Please enter a digit: 7
The larger of the two digits is: 7
C:\masm615\Programs\tests\hw#11-2>hw#11-2.exe

Please enter a digit: 4
Please enter a digit: 4
The larger of the two digits is: 4
C:\masm615\Programs\tests\hw#11-2>_
```