

## EL-213: Computer Organization & Assembly Language Lab

<b>Lab 5: Procedures &amp; Filing</b>	<b>Session:</b> Fall 2019
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## CALL Instruction

The call instruction is used to call a procedure.

## Procedures in Irvine32 Library

- a. **Clrscr**  
Clears the console window and locates the cursor at the above left corner.
- b. **Crlf**  
Writes the end of line sequence to the console window.
- c. **Delay (EAX)**  
Pauses the program execution for a specified interval (in milliseconds).
- d. **DumpRegs**  
Displays the EAX, EBX, ECX, EDX, ESI, EDI, ESP, EIP and EFLAG registers.
- e. **GetMaxXY (DX=col, AX=row)**  
Gets the number of columns and rows in the console window buffer.
- f. **GetTextColor (Background= Upper AL, Foreground= Lower AL)**  
Returns the active foreground and background text colors in the console window.
- g. **SetTextColor (EAX= Foreground + (Background\*16))**  
Sets the foreground and background colors of all subsequent text output to the console.

black = 0	red = 4	gray = 8	lightRed = 12
blue = 1	magenta = 5	lightBlue = 9	lightMagenta = 13
green = 2	brown = 6	lightGreen = 10	yellow = 14
cyan = 3	lightGray = 7	lightCyan = 11	white = 15

- h. **Gotoxy (DH=row , DL=col)**  
Locates the cursor at a specific row and column in the console window.  
By default X coordinate range is 0-79, and Y coordinate range is 0-24.
- i. **ReadChar**  
Waits for single character to be typed at the keyboard and returns that character.
- j. **ReadDec**  
Reads an unsigned 32-bit integer from the keyboard.
- k. **ReadHex**  
Reads a 32-bit hexadecimal integers from the keyboard, terminated by the enter key.
- l. **ReadInt**  
Reads a signed 32-bit integer from the keyboard, terminated by the enter key.
- m. **ReadString (EDX=OFFSET, ECX=SIZEOF)**  
Reads a string from the keyboard, terminated by the enter key.
- n. **WriteBin**

- Writes an unsigned 32-bit integer to the console window in ASCII binary format.
- o. **WriteChar**  
Writes a single character to the console window.
- p. **WriteDec**  
Writes an unsigned 32-bit integer to the console window in decimal format.
- q. **WriteHex**  
Writes a 32-bit integer to the console window in hexadecimal format.
- r. **WriteInt**  
Writes a signed 32-bit integer to the console window in decimal format.
- s. **WriteString (EDX= OFFSET String)**  
Write a null-terminated string to the console window.
- t. **Randomize**  
Seeds the random number generator with a unique value.
- u. **WaitMsg**  
Display a message and wait for the Enter key to be pressed.
- v. **DumpMem (ESI=Starting OFFSET, ECX=LengthOf, EBX=Type)**  
Writes the block of memory to the console window in hexadecimal.

#### Example 1:

WriteDec: The integer to be displayed is passed in EAX  
 WriteString: The offset of string to be written is passed in EDX  
 WriteChar: The character to be displayed is passed in AL

```
.data
    divider BYTE " - ", 0
    codepage DWORD 1252
.code
    mov ecx, 255
    mov eax, 1
    mov edx, OFFSET divider
L1:
    call WriteDec           ; EAX is a counter
    call WriteString        ; EDX points to string
    call WriteChar          ; AL is the character
    call Crlf
    inc al                  ; next character
    Loop L1
```

#### Example 2:

SetTextColor: Background & foreground colors are passed to EAX

```
.data
    str1 BYTE "Sample string in color", 0dh, 0ah, 0
.code
    mov     eax, yellow + (blue * 16)
    call    SetTextColor

    mov     edx, OFFSET str1
    call    WriteString

    call    DumpRegs
    exit
```

### Example 3:

DumpMem: Pass offset of array in ESI, length of array in ECX & type in EBX

ReadInt: Reads the signed integer into EAX

WriteInt: Signed integer to be written is passed in EAX

WriteHex: Hex value to be written is passed in EAX

WriteBin: Binary value to be written is passed in EAX

```
.data
    COUNT = 4
    BlueTextOnGray = blue + (lightGray * 16)
    DefaultColor = lightGray + (black * 16)
    arrayD SDWORD 12345678h, 1A4B2000h, 3434h, 7AB9h
    prompt BYTE "Enter a 32-bit signed integer: ", 0

.code
; Set text color to blue text on a light gray background
    mov eax, BlueTextOnGray
    call SetTextColor
    call Clrscr                                ; clear the screen

; Display an array using DumpMem.

    mov     esi, OFFSET arrayD                ; starting OFFSET
    mov     ebx, TYPE arrayD                  ; doubleword = 4 bytes
    mov     ecx, LENGTHOF arrayD              ; number of units in arrayD
    call    DumpMem                           ; display memory

; Ask the user to input a sequence of signed integers
    call    Crlf                               ; new line
    mov     ecx, COUNT

L1:
    mov     edx, OFFSET prompt
    call    WriteString
    call    ReadInt                            ; input integer into EAX
    call    Crlf                               ; new line

; Display the integer in decimal, hexadecimal, and binary
    call    WriteInt                           ; display in signed decimal
    call    Crlf
    call    WriteHex                           ; display in hexadecimal
    call    Crlf
    call    WriteBin                           ; display in binary
    call    Crlf
    call    Crlf
Loop L1                                        ; repeat the loop

; Return console window to default colors.
    call    WaitMsg                            ; "Press any key..."
    mov     eax, DefaultColor
    call    SetTextColor
    call    Clrscr
```

### Example 4:

GetMSeconds: Value is returned in EAX

```
.data
    startTime DWORD ?

.code
```

```

call GetMseconds
mov startTime, eax
L1:
; (loop body)
loop L1
call GetMseconds
sub eax, startTime

```

## Creating A New File

EAX contains the newly created file's handle or `INVALID_HANDLE_VALUE` if creation is unsuccessful

### Example:

```

.data
    filehandle DWORD ?
    filename BYTE "MyFile.txt", 0

.code
    mov edx, offset filename
    call CreateOutputFile
    mov filehandle, eax

```

## Opening An Existing File

Offset of file name is passed to EDX. Handle of opened file is returned in EAX

### Example:

```

.data
    filehandle DWORD ?
    filename BYTE "MyExistingFile.txt", 0

.code
    mov edx, OFFSET filename
    call OpenInputFile
    mov filehandle, EAX

```

## Reading From A File

Call arguments:

EAX = an open file handle  
 EDX = offset of the input buffer  
 ECX = maximum number of bytes to read

Return arguments:

If CF = 0, EAX contains the number of bytes read.  
 If CF = 1, EAX contains a system error code

### Example:

```

.data
    buffSize = 10 ; if we want to read just 10 bytes
    buffer BYTE buffSize DUP(?) ; buffer will contain the text read from the file

.code
    mov eax, filehandle ;assuming filehandle contains handle of an open file
    mov edx, OFFSET buffer ;buffer will contain the text read from the file
    mov ecx, BUFSIZE ;specify how many bytes to read
    call ReadFromFile

```

## Writing To A File:

Call arguments:

EAX = an open file handle

EDX = offset of the buffer

ECX = maximum number of bytes to write

Return arguments:

If CF = 0, EAX contains the number of bytes written.

If CF = 1, EAX contains a system error code.

### Example:

```
.data
    bufferSize = 10                ;if we want to write just 10 bytes
    buffer BYTE bufferSize DUP(?) ;uninitialized in this example but buffer will contain the text to be
    written to file

.code
    mov  eax, filehandle            ; assuming that filehandle contains handle of an open file
    mov  edx, OFFSET buffer        ;buffer from where text will be written to file
    mov  ecx, bufferSize            ;number of bytes to be written to file from the buffer
    call WriteToFile
```

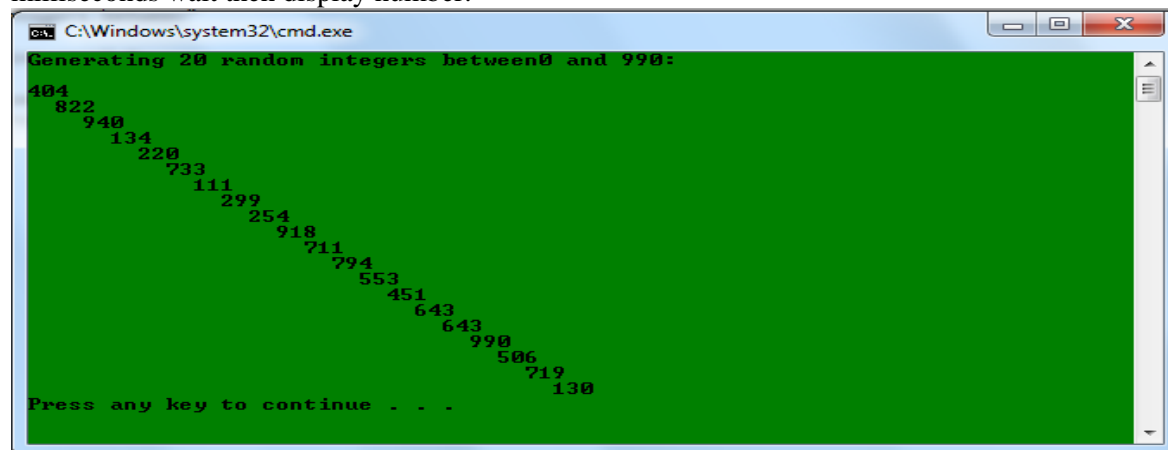
## Closing A File

### Example:

```
mov  eax, filehandle            ;assuming filehandle contains handle of an open file
call CloseFile
```

### Activity:

Write a program to display random number list in diagonal pattern before each number display 5 milliseconds wait then display number.



Write a program to take input data for an employee and store it in appropriate variables. The program should ask for Employee ID, Name, Year of Birth & Annual Salary from the user. The program should then calculate the annual tax on that employee's annual salary if it exceeds Rs. 50,000 and display the tax message in a message box. The tax is calculated according to formula:

Tax = Monthly Salary / 2

Make a program to create a text file name Fibo.txt and write the first 8 fibonacci numbers to that file.

Print the following pattern (using GotoXY and any other library procedure) without using the “Space” character.

```
*  
**  
***  
****  
*****
```