Parameter Passing

- Parameter passing in assembly language is different
  - More complicated than that used in a high-level language
- In assembly language
  - Place all required parameters in an accessible storage area
  - Then call the procedure
- Two types of storage areas used
  - Registers: general-purpose registers are used (register method)
  - Memory: stack is used (stack method)
- Two common mechanisms of parameter passing
  - Pass-by-value: parameter **value** is passed
  - Pass-by-reference: **address** of parameter is passed

Parameter Passing Through Stack

- Parameters can be saved on the stack before a procedure is called.
- The called procedure can easily access the parameters using either the ESP or EBP registers without altering ESP register.
- Example

Suppose you want to implement the following pseudo-code:

```
i = 25;
 j = 4;
Test(i, j, 1);
```

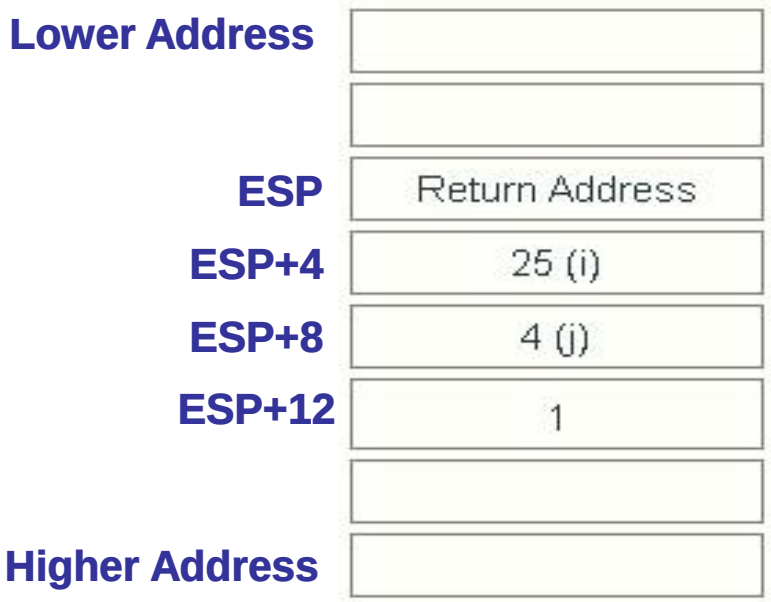
Then, the assembly language code fragment looks like:

```
mov i, 25
mov j, 4
push 1
push j
push i
call Test
```

Parameter Passing Through Stack

Example: Accessing parameters on the stack

```
Test  PROC
   mov AX, [ESP + 4] ;get i
   add AX, [ESP + 8] ;add j
   sub AX, [ESP + 12] ;subtract parm 3
                          (1) from sum
   ret
Test ENDP
```



Freeing Passed Parameters From Stack

- Use RET N instruction to free parameters from stack

Example: Accessing parameters on the stack

```
Test  PROC
   mov AX, [ESP + 4] ;get i
   add AX, [ESP + 8] ;add j
   sub AX, [ESP + 12] ;subtract parm. 3
                          (1) from sum
   ret 12
Test ENDP
```

Call & Return Instructions

Instruction	Operand	Note
CALL	label name	Push IP IP= IP + displacement relative to next instruction
CALL	r/m	Push IP IP = [r/m]
CALL	label name (FAR)	Push CS Push IP CS:IP=address of label name
CALL	m (FAR)	Push CS Push IP CS:IP= [m]
RET		Pop IP
RET	imm	Pop IP SP = SP + imm
RET	(FAR)	Pop IP Pop CS
RET	imm (FAR)	Pop IP Pop CS SP = SP + imm

Freeing Passed Parameters From Stack

- Use RET N instruction to free parameters from stack

Example: Accessing parameters on the stack

```
Test  PROC
   mov AX, [ESP + 4] ;get i
   add AX, [ESP + 8] ;add j
   sub AX, [ESP + 12] ;subtract parm. 3
                          (1) from sum
   ret 12
Test ENDP
```

Local Variables

- Local variables are dynamic data whose values must be preserved over the lifetime of the procedure, but not beyond its termination.
- At the termination of the procedure, the current environment disappears and the previous environment must be restored.
- Space for local variables can be reserved by subtracting the required number of bytes from ESP.
- Offsets from ESP are used to address local variables.

Local Variables

Pseudo-code (Java-like)	Assembly Language

void Test(int i){
  int k;
 	
  k = i+9;
  ……
}
	Test PROC
	  push EBP
	  mov EBP, ESP
	  sub ESP, 4
	  push EAX
	  mov DWORD PTR [EBP-4], 9
	  mov EAX, [EBP + 8]
	  add [EBP-4], EAX
	  ……
	  pop EAX
	  mov ESP, EBP
	  pop EBP
	  ret 4
	Test ENDP

Summary

- Procedure – Named block of executable code
  - CALL: call a procedure, push return address on top of stack
  - RET: pop the return address and return from procedure
  - Preserve registers across procedure calls
- Runtime stack – LIFO structure – Grows downwards
  - Holds return addresses, saved registers, etc.
  - PUSH – insert value on top of stack, decrement ESP
  - POP – remove top value of stack, increment ESP
- Use the Irvine32.lib library for standard I/O
  - Include Irvine32.inc to make procedure prototypes visible
  - You can learn more by studying Irvine32.asm code