

Example 5.5: -

Before Calling The Function

After The Subroutine Is Called And All The Registers Used In The Subroutine Are Pushed

After Popping The Registers Used In The Subroutine And Returning Back From Where It Was Called After Sorting The Data

DOSBox 0.74-3, Cpu speed: 3000 cycles, Frameskip 0, Program: AFD

| | | | | | |
|---------|---------|---------|---------|---------------|-------------------------|
| AX 0005 | SI 0000 | CS 19F5 | IP 0163 | Stack +0 0000 | Flags 7295 |
| BX 0000 | DI 0000 | DS 19F5 | | +2 20CD | |
| CX 0073 | BP 0000 | ES 19F5 | HS 19F5 | +4 9FFF | OF DF IF SF ZF AF PF CF |
| DX 0000 | SP FFEE | SS 19F5 | FS 19F5 | +6 EA00 | 0 0 1 1 0 1 1 1 |

CMD > |

| | | |
|---------------|------|-------------|
| 0155 C20400 | RET | 0004 |
| 0163 B80D01 | MOV | AX,010D |
| 0166 50 | PUSH | AX |
| 0167 B80500 | MOV | AX,0005 |
| 016A 50 | PUSH | AX |
| 016B EBAFF | CALL | 0118 |
| 016E B804C | MOV | AX,4C00 |
| 0171 CD21 | INT | 21 |
| 0173 FE85C075 | INC | B/[75C0+DI] |

| | |
|---------|-------------------------|
| DS:0103 | 01 00 02 00 05 00 07 00 |
| DS:010B | 09 00 03 00 05 00 07 00 |
| DS:0113 | 01 00 09 00 00 55 89 E5 |
| DS:011B | 50 53 51 56 8B 5E 06 8B |
| DS:0123 | 4E 04 49 D1 E1 BE 00 00 |
| DS:012B | C6 06 17 01 00 8B 00 3B |
| DS:0133 | 40 02 76 0A 87 40 02 89 |
| DS:013B | 00 C6 06 17 01 01 81 C6 |
| DS:0143 | 02 00 39 CE 75 E7 80 3E |
| DS:014B | 17 01 01 74 D8 5E 59 5B |

| | | | |
|---------|-------------------------|-------------------------|--------------------|
| 2 | D E F 0 1 2 3 4 | 5 6 7 8 9 A B C | |
| DS:010D | 03 00 05 00 07 00 01 00 | 09 00 00 55 89 E5 50 53 |UerPS |
| DS:011D | 51 56 8B 5E 06 8B 4E 04 | 49 D1 E1 BE 00 00 C6 06 | QUI^,iN. I7B^...f. |
| DS:012D | 17 01 00 8B 00 3B 40 02 | 76 0A 87 40 02 89 00 C6 | ...i.:e. v.ge.e.f |
| DS:013D | 06 17 01 01 81 C6 02 00 | 39 CE 75 E7 80 3E 17 01 | ...u.f.. 9HutG>.. |
| DS:014D | 01 74 D8 5E 59 5B 58 5D | C2 04 00 B8 03 01 50 B8 | .t^YIXI T..f..Pj |

1 Step 2ProcStep 3Retrieve 4Help ON 5BRK Menu 6 7 up 8 dn 9 le 10 ri

And Same The Second Data Is Proceeded By The Same Sub Routine And Doing The Same Work Again

DOSBox 0.74-3, Cpu speed: 3000 cycles, Frameskip 0, Program: AFD

| | | | | | |
|---------|---------|---------|---------|---------------|-------------------------|
| AX 0005 | SI 0000 | CS 19F5 | IP 016E | Stack +0 0000 | Flags 7295 |
| BX 0000 | DI 0000 | DS 19F5 | | +2 20CD | |
| CX 0073 | BP 0000 | ES 19F5 | HS 19F5 | +4 9FFF | OF DF IF SF ZF AF PF CF |
| DX 0000 | SP FFEE | SS 19F5 | FS 19F5 | +6 EA00 | 0 0 1 1 0 1 1 1 |

CMD >S

| | | |
|---------------|------|--------------|
| 016B EBAFF | CALL | 0118 |
| 016E B804C | MOV | AX,4C00 |
| 0171 CD21 | INT | 21 |
| 0173 FE85C075 | INC | B/[75C0+DI] |
| 0177 0485 | ADD | AL,85 |
| 0179 F67412 | DIU | B/[SI+12] |
| 017C 8ED8 | MOV | DS,AX |
| 017E 837C0C01 | CMP | [SI+0C],0001 |
| 0182 750A | JNZ | 018E |

| | |
|---------|-------------------------|
| DS:0103 | 01 00 02 00 05 00 07 00 |
| DS:010B | 09 00 01 00 03 00 05 00 |
| DS:0113 | 07 00 09 00 00 55 89 E5 |
| DS:011B | 50 53 51 56 8B 5E 06 8B |
| DS:0123 | 4E 04 49 D1 E1 BE 00 00 |
| DS:012B | C6 06 17 01 00 8B 00 3B |
| DS:0133 | 40 02 76 0A 87 40 02 89 |
| DS:013B | 00 C6 06 17 01 01 81 C6 |
| DS:0143 | 02 00 39 CE 75 E7 80 3E |
| DS:014B | 17 01 01 74 D8 5E 59 5B |

| | | | |
|---------|-------------------------|-------------------------|--------------------|
| 2 | D E F 0 1 2 3 4 | 5 6 7 8 9 A B C | |
| DS:010D | 01 00 03 00 05 00 07 00 | 09 00 00 55 89 E5 50 53 |UerPS |
| DS:011D | 51 56 8B 5E 06 8B 4E 04 | 49 D1 E1 BE 00 00 C6 06 | QUI^,iN. I7B^...f. |
| DS:012D | 17 01 00 8B 00 3B 40 02 | 76 0A 87 40 02 89 00 C6 | ...i.:e. v.ge.e.f |
| DS:013D | 06 17 01 01 81 C6 02 00 | 39 CE 75 E7 80 3E 17 01 | ...u.f.. 9HutG>.. |
| DS:014D | 01 74 D8 5E 59 5B 58 5D | C2 04 00 B8 03 01 50 B8 | .t^YIXI T..f..Pj |

1 Step 2ProcStep 3Retrieve 4Help ON 5BRK Menu 6 7 up 8 dn 9 le 10 ri

Example 5.6: -

Before Calling The Subroutine, The Stack Is Used To Push The Data Address And Number Of Data

DOSBox 0.74-3, Cpu speed: 3000 cycles, Frameskip 0, Program: AFD

| | | | | | |
|---------|---------|---------|---------|---------------|-------------------------|
| AX 0005 | SI 0000 | CS 19F5 | IP 015B | Stack +0 0005 | Flags 7200 |
| BX 0000 | DI 0000 | DS 19F5 | | +2 0103 | |
| CX 0063 | BP 0000 | ES 19F5 | HS 19F5 | +4 0000 | OF DF IF SF ZF AF PF CF |
| DX 0000 | SP FFFA | SS 19F5 | FS 19F5 | +6 20CD | 0 0 1 0 0 0 0 0 |

| CMD > | 1 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A |
|--------------|------|--------------|---|---|---|---|---|---|---|
| 015A 50 | PUSH | AX | | | | | | | |
| 015B EB AFFF | CALL | 010D | | | | | | | |
| 015E B8 04 C | MOV | AX, 4C00 | | | | | | | |
| 0161 CD 21 | INT | 21 | | | | | | | |
| 0163 D1 E0 | SHL | AX, 1 | | | | | | | |
| 0165 D1 E0 | SHL | AX, 1 | | | | | | | |
| 0167 C5 ED 8 | LDS | EBX, [BP-28] | | | | | | | |
| 016A 01 C3 | ADD | EBX, AX | | | | | | | |
| 016C 8B 37 | MOV | SI, [EBX] | | | | | | | |

| 2 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A | B | C | D | E | F |
|---------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| DS:0000 | CD | 20 | FF | 9F | 00 | EA | F0 | FE | AD | DE | 1B | 05 | C5 | 06 | 00 | 00 |
| DS:0010 | 18 | 01 | 10 | 01 | 18 | 01 | 92 | 01 | 01 | 01 | 01 | 00 | 02 | FF | FF | FF |
| DS:0020 | FF | FF | FF | FF | FF | FF | FF | FF | FF | FF | FF | EB | 19 | C0 | 11 | |
| DS:0030 | A2 | 01 | 14 | 00 | 18 | 00 | F5 | 19 | FF | FF | FF | FF | 00 | 00 | 00 | 00 |
| DS:0040 | 05 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 |

1 Step 2 ProcStep 3 Retrieve 4 Help ON 5 BRK Menu 6 7 up 8 dn 9 le 10 ri

After The Subroutine Is Called A Space In The Stack Is Made For The Local Variable In This Case It Is The Swap Flag

DOSBox 0.74-3, Cpu speed: 3000 cycles, Frameskip 0, Program: AFD

| | | | | | |
|---------|---------|---------|---------|---------------|-------------------------|
| AX 0005 | SI 0000 | CS 19F5 | IP 0118 | Stack +0 0000 | Flags 7280 |
| BX 0000 | DI 0000 | DS 19F5 | | +2 0063 | |
| CX 0063 | BP FFF6 | ES 19F5 | HS 19F5 | +4 0000 | OF DF IF SF ZF AF PF CF |
| DX 0000 | SP FFEC | SS 19F5 | FS 19F5 | +6 0005 | 0 0 1 1 0 0 0 0 |

| CMD > | 1 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A |
|---------------------|------|-----------------|---|---|---|---|---|---|---|
| 0117 56 | PUSH | SI | | | | | | | |
| 0118 8B 5E 06 | MOV | EBX, [BP+06] | | | | | | | |
| 011B 8B 4E 04 | MOV | ECX, [BP+04] | | | | | | | |
| 011E 49 | DEC | CX | | | | | | | |
| 011F D1 E1 | SHL | CX, 1 | | | | | | | |
| 0121 BE 00 00 | MOV | SI, 0000 | | | | | | | |
| 0124 C7 46 FE 00 00 | MOV | [BP-02], 0000 | | | | | | | |
| 0129 8B 00 | MOV | EBX, [BP+SI] | | | | | | | |
| 012B 3B 40 02 | CMP | EBX, [BP+SI+02] | | | | | | | |

| 2 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A | B | C | D | E | F |
|---------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| DS:0000 | CD | 20 | FF | 9F | 00 | EA | F0 | FE | AD | DE | 1B | 05 | C5 | 06 | 00 | 00 |
| DS:0010 | 18 | 01 | 10 | 01 | 18 | 01 | 92 | 01 | 01 | 01 | 01 | 00 | 02 | FF | FF | FF |
| DS:0020 | FF | FF | FF | FF | FF | FF | FF | FF | FF | FF | FF | EB | 19 | C0 | 11 | |
| DS:0030 | A2 | 01 | 14 | 00 | 18 | 00 | F5 | 19 | FF | FF | FF | FF | 00 | 00 | 00 | 00 |
| DS:0040 | 05 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 |

1 Step 2 ProcStep 3 Retrieve 4 Help ON 5 BRK Menu 6 7 up 8 dn 9 le 10 ri

After The Data Is Sorted

```

DOSBox 0.74-3, Cpu speed: 3000 cycles, Frameskip 0, Program: AFD
AX 0007 SI 0000 CS 19F5 IP 014A Stack +0 0063 Flags 7295
BX 0103 DI 0000 DS 19F5 +2 0000
CX 0008 BP FFF6 ES 19F5 HS 19F5 +4 0005 OF DF IF SF ZF AF PF CF
DX 0000 SP FFE6 SS 19F5 FS 19F5 +6 0000 0 0 1 1 0 1 1 1

CMD >

0149 5E POP SI
014A 59 POP CX
014B 5B POP BX
014C 58 POP AX
014D 89EC MOV SP,BP
014F 5D POP BP
0150 C20400 RET 0004
0153 B80301 MOV AX,0103
0156 50 PUSH AX

2 0 1 2 3 4 5 6 7 8 9 A B C D E F
DS:0000 CD 20 FF 9F 00 EA F0 FE AD DE 1B 05 C5 06 00 00 = f.Ω= i|..+...
DS:0010 18 01 10 01 18 01 92 01 01 01 01 00 02 FF FF FF .....f. ....
DS:0020 FF FF FF FF FF FF FF FF FF FF FF FF EB 19 C0 11 .....δ.L.
DS:0030 A2 01 14 00 18 00 F5 19 FF FF FF FF 00 00 00 00 6.....J. ....
DS:0040 05 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
1 Step 2ProcStep 3Retrieve 4Help ON 5BRK Menu 6 7 up 8 dn 9 le 10 ri

```

The Registers Values Stored Before In The Stack Are Popped To Return Their Before Values And The Local Variable Is Also Destructed Here As We Previously Assigned A Place For It In The Stack And Now We Are Removing It

```

DOSBox 0.74-3, Cpu speed: 3000 cycles, Frameskip 0, Program: AFD
AX 0005 SI 0000 CS 19F5 IP 0150 Stack +0 015E Flags 7295
BX 0000 DI 0000 DS 19F5 +2 0005
CX 0063 BP 0000 ES 19F5 HS 19F5 +4 0103 OF DF IF SF ZF AF PF CF
DX 0000 SP FFF8 SS 19F5 FS 19F5 +6 0000 0 0 1 1 0 1 1 1

CMD >

014F 5D POP BP
0150 C20400 RET 0004
0153 B80301 MOV AX,0103
0156 50 PUSH AX
0157 B80500 MOV AX,0005
015A 50 PUSH AX
015B E8AFFE CALL 010D
015E B8004C MOV AX,4C00
0161 CD21 INT 21

2 0 1 2 3 4 5 6 7 8 9 A B C D E F
DS:0000 CD 20 FF 9F 00 EA F0 FE AD DE 1B 05 C5 06 00 00 = f.Ω= i|..+...
DS:0010 18 01 10 01 18 01 92 01 01 01 01 00 02 FF FF FF .....f. ....
DS:0020 FF FF FF FF FF FF FF FF FF FF FF FF EB 19 C0 11 .....δ.L.
DS:0030 A2 01 14 00 18 00 F5 19 FF FF FF FF 00 00 00 00 6.....J. ....
DS:0040 05 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
1 Step 2ProcStep 3Retrieve 4Help ON 5BRK Menu 6 7 up 8 dn 9 le 10 ri

```

After Returning From The Subroutine

DOSBox 0.74-3, Cpu speed: 3000 cycles, Frameskip 0, Program: AFD

| | | | | | |
|---------|---------|---------|---------|---------------|-------------------------|
| AX 0005 | SI 0000 | CS 19F5 | IP 015E | Stack +0 0000 | Flags 7295 |
| BX 0000 | DI 0000 | DS 19F5 | | +2 20CD | |
| CX 0063 | BP 0000 | ES 19F5 | HS 19F5 | +4 9FFF | OF DF IF SF ZF AF PF CF |
| DX 0000 | SP FFFE | SS 19F5 | FS 19F5 | +6 EA00 | 0 0 1 1 0 1 1 1 |

CMD >

| | | | | |
|-------------|-----|------------|---------|-------------------------|
| 0150 C20400 | RET | 0004 | DS:0103 | 01 00 02 00 05 00 07 00 |
| 015E B8004C | MOV | AX,4C00 | DS:010B | 09 00 55 89 E5 81 EC 02 |
| 0161 CD21 | INT | 21 | DS:0113 | 00 50 53 51 56 8B 5E 06 |
| 0163 D1E0 | SHL | AX,1 | DS:011B | 8B 4E 04 49 D1 E1 BE 00 |
| 0165 D1E0 | SHL | AX,1 | DS:0123 | 00 C7 46 FE 00 00 8B 00 |
| 0167 C55ED8 | LDS | BX,[BP-28] | DS:012B | 3B 40 02 76 0A 87 40 02 |
| 016A 01C3 | ADD | BX,AX | DS:0133 | 89 00 C7 46 FE 01 00 81 |
| 016C 8B37 | MOV | SI,[BX] | DS:013B | C6 02 00 39 CE 75 E7 81 |
| 016E 8B4702 | MOV | AX,[BX+02] | DS:0143 | 7E FE 01 00 74 D8 5E 59 |
| | | | DS:014B | 5B 58 89 EC 5D C2 04 00 |

| | | | | | | | | | | | | | | | | | |
|---------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|------------------|
| 2 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A | B | C | D | E | F | |
| DS:0000 | CD | 20 | FF | 9F | 00 | EA | F0 | FE | AD | DE | 1B | 05 | C5 | 06 | 00 | 00 | = f.Ω≡■ i ..+... |
| DS:0010 | 18 | 01 | 10 | 01 | 18 | 01 | 92 | 01 | 01 | 01 | 01 | 00 | 02 | FF | FF | FF |ff. |
| DS:0020 | FF | FF | FF | FF | FF | FF | FF | FF | FF | FF | FF | FF | EB | 19 | C0 | 11 | δ.L. |
| DS:0030 | A2 | 01 | 14 | 00 | 18 | 00 | F5 | 19 | FF | FF | FF | FF | 00 | 00 | 00 | 00 | ó.....J. |
| DS:0040 | 05 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | |

1 Step 2ProcStep 3Retrieve 4Help ON 5BRK Menu 6 7 up 8 dn 9 le 10 ri