



Bölüm 8: Makrolar

Mikroişlemciler



Makrolar

- Prosedürlere benzer.
- Derleme aşamasında gerçek komutlar ile değiştirilen geçici yapılardır.
- Kod içerisinde kullanılmayan makrolar görmezden gelinir.
- Makrolar, prosedürlerden farklı olarak,
 - kullanıldıkları kodun üzerinde tanımlanmalıdır.



Makro Tanımlama

```
name MACRO [parametreler,...]  
    <komutlar>  
ENDM
```



Örnek Kod Parçası

```
MyMacro MACRO p1, p2, p3
    MOV AX, p1
    MOV BX, p2
    MOV CX, p3
ENDM
```



```
MOV AX, 00001h
MOV BX, 00002h
MOV CX, 00003h
MOV AX, 00004h
MOV BX, 00005h
MOV CX, DX
```

```
ORG 100h
MyMacro 1, 2, 3 ; Makro kullanımı
MyMacro 4, 5, DX ; Başka bir örnek
RET
```



Örnek Kod Parçası

emulator: z01.com_

file math debug view external virtual devices virtual drive help

Load reload step back single step run step delay ms: 0

registers

| | H | L |
|----|-------|----|
| AX | 00 | 00 |
| BX | 00 | 00 |
| CX | 00 | 12 |
| DX | 00 | 00 |
| CS | 07 00 | |
| IP | 01 00 | |
| SS | 07 00 | |
| SP | FF FE | |
| BP | 00 00 | |
| SI | 00 00 | |
| DI | 00 00 | |
| DS | 07 00 | |
| ES | 07 00 | |

07 00: 01 00

```
07100: B8 184 7 MOU AX, 00001h
07101: 01 001 0 MOU BX, 00002h
07102: 00 000 NULL MOU CX, 00003h
07103: BB 187 7 MOU AX, 00004h
07104: 02 002 0 MOU BX, 00005h
07105: 00 000 NULL MOU CX, DX
07106: B9 185 7 RET
07107: 03 003 7 NOP
07108: 00 000 NULL NOP
07109: B8 184 7 NOP
0710A: 04 004 7 NOP
0710B: 00 000 NULL NOP
0710C: BB 187 7 NOP
0710D: 05 005 7 NOP
0710E: 00 000 NULL NOP
0710F: 8B 139 7 NOP
07110: CA 202 7 NOP
07111: C3 195 7 NOP
07112: 90 144 E NOP
07113: 90 144 E NOP
07114: 90 144 E NOP
07115: 90 144 E ...
```

screen source reset aux vars debug stack flags



Örnek Kod Parçası

emulator: z01.com_

file math debug view external virtual devices virtual drive help

Load reload step back single step run step delay ms: 0

registers

| | H | L |
|----|-------|----|
| AX | 00 | 04 |
| BX | 00 | 02 |
| CX | 00 | 03 |
| DX | 00 | 00 |
| CS | 07 00 | |
| IP | 01 0C | |
| SS | 07 00 | |
| SP | FF FE | |
| BP | 00 00 | |
| SI | 00 00 | |
| DI | 00 00 | |
| DS | 07 00 | |
| ES | 07 00 | |

07 00: 01 0C

| | | | |
|--------|----|-----|------|
| 07100: | B8 | 184 | ⌵ |
| 07101: | 01 | 001 | ⊖ |
| 07102: | 00 | 000 | NULL |
| 07103: | BB | 187 | ⌵ |
| 07104: | 02 | 002 | ⊖ |
| 07105: | 00 | 000 | NULL |
| 07106: | B9 | 185 | ⌵ |
| 07107: | 03 | 003 | ⌵ |
| 07108: | 00 | 000 | NULL |
| 07109: | B8 | 184 | ⌵ |
| 0710A: | 04 | 004 | ⌵ |
| 0710B: | 00 | 000 | NULL |
| 0710C: | BB | 187 | ⌵ |
| 0710D: | 05 | 005 | ⌵ |
| 0710E: | 00 | 000 | NULL |
| 0710F: | 8B | 139 | ⌵ |
| 07110: | CA | 202 | ⌵ |
| 07111: | C3 | 195 | ⌵ |
| 07112: | 90 | 144 | É |
| 07113: | 90 | 144 | É |
| 07114: | 90 | 144 | É |
| 07115: | 90 | 144 | É |

07 00: 01 0C

```
MOU AX, 00001h
MOU BX, 00002h
MOU CX, 00003h
MOU AX, 00004h
MOU BX, 00005h
MOU CX, DX
RET
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
...
```

screen source reset aux vars debug stack flags



Örnek Kod Parçası

emulator: z01.com_

file math debug view external virtual devices virtual drive help

Load reload step back single step run step delay ms: 0

registers

| | H | L |
|----|-------|----|
| AX | 00 | 04 |
| BX | 00 | 05 |
| CX | 00 | 03 |
| DX | 00 | 00 |
| CS | 07 00 | |
| IP | 01 0F | |
| SS | 07 00 | |
| SP | FF FE | |
| BP | 00 00 | |
| SI | 00 00 | |
| DI | 00 00 | |
| DS | 07 00 | |
| ES | 07 00 | |

07 00: 01 0F

| | | | |
|--------|----|-----|------|
| 07100: | B8 | 184 | ⌘ |
| 07101: | 01 | 001 | ⊖ |
| 07102: | 00 | 000 | NULL |
| 07103: | BB | 187 | ⌘ |
| 07104: | 02 | 002 | ⊖ |
| 07105: | 00 | 000 | NULL |
| 07106: | B9 | 185 | ⌘ |
| 07107: | 03 | 003 | ↓ |
| 07108: | 00 | 000 | NULL |
| 07109: | B8 | 184 | ⌘ |
| 0710A: | 04 | 004 | ◆ |
| 0710B: | 00 | 000 | NULL |
| 0710C: | BB | 187 | ⌘ |
| 0710D: | 05 | 005 | ♠ |
| 0710E: | 00 | 000 | NULL |
| 0710F: | 8B | 139 | ⌘ |
| 07110: | CA | 202 | ⌘ |
| 07111: | C3 | 195 | ⌘ |
| 07112: | 90 | 144 | É |
| 07113: | 90 | 144 | É |
| 07114: | 90 | 144 | É |
| 07115: | 90 | 144 | É |

07 00: 01 0F

```
MOU AX, 00001h
MOU BX, 00002h
MOU CX, 00003h
MOU AX, 00004h
MOU BX, 00005h
MOU CX, DX
RET
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
...
```

screen source reset aux vars debug stack flags



Örnek Kod Parçası

emulator: z01.com_

file math debug view external virtual devices virtual drive help

Load reload step back single step run step delay ms: 0

registers

| | H | L |
|----|-------|----|
| AX | 00 | 04 |
| BX | 00 | 05 |
| CX | 00 | 00 |
| DX | 00 | 00 |
| CS | 07 00 | |
| IP | 01 11 | |
| SS | 07 00 | |
| SP | FF FE | |
| BP | 00 00 | |
| SI | 00 00 | |
| DI | 00 00 | |
| DS | 07 00 | |
| ES | 07 00 | |

07 00: 01 11

| | | | | |
|--------|----|-----|------|----------------|
| 07100: | B8 | 184 | 7 | MOU AX, 00001h |
| 07101: | 01 | 001 | 0 | MOU BX, 00002h |
| 07102: | 00 | 000 | NULL | MOU CX, 00003h |
| 07103: | BB | 187 | 7 | MOU AX, 00004h |
| 07104: | 02 | 002 | 0 | MOU BX, 00005h |
| 07105: | 00 | 000 | NULL | MOU CX, DX |
| 07106: | B9 | 185 | ! | RET |
| 07107: | 03 | 003 | ▼ | NOP |
| 07108: | 00 | 000 | NULL | NOP |
| 07109: | B8 | 184 | 7 | NOP |
| 0710A: | 04 | 004 | ◆ | NOP |
| 0710B: | 00 | 000 | NULL | NOP |
| 0710C: | BB | 187 | 7 | NOP |
| 0710D: | 05 | 005 | ♠ | NOP |
| 0710E: | 00 | 000 | NULL | NOP |
| 0710F: | 8B | 139 | i | NOP |
| 07110: | CA | 202 | | NOP |
| 07111: | C3 | 195 | | NOP |
| 07112: | 90 | 144 | É | NOP |
| 07113: | 90 | 144 | É | NOP |
| 07114: | 90 | 144 | É | NOP |
| 07115: | 90 | 144 | É | NOP |
| | | | | ... |

screen source reset aux vars debug stack flags



Prosedür Özellikler

- Prosedür CALL komutu ile çağrılır.
- Prosedür bir bellek adresinde bulunur.
- Çağrıldığında CPU kontrolü bu bölgeye aktarır.
- RET komutu ile kontrol, programın ana kısmına geri döner.
- Dönüş adresini saklamak için yığın kullanılır.
- Aynı prosedür 100 kez çağrılırsa dosyanın boyutunu çok az arttırır.
 - CALL komutu 3 byte yer kaplar,
- Prosedürlere parametre geçmek için yığın veya yazmaçlar kullanılır.
- Prosedürü sonlandırmak için prosedür adı ve ENDP direktifi yazılır.



Makro Özellikler

- Makro sadece adı yazılarak kullanılır.
- Makrolar program kodunda doğrudan genişletilir.
- Aynı makro 100 kez kullanılırsa, derleyici makroyu 100 kez genişletir.
 - Yürütülebilir dosya boyutu giderek büyür.
- Makroya parametre geçmek için makro adının ardından değerler yazılır.
- Makro sonlandırmak için ENDM direktifi yeterlidir.
- Macro tanımında etiketler varsa,
 - birden fazla kez kullanıldığında *Duplicate declaration* hatası alınabilir.
 - değişken, etiket, prosedür adları için LOCAL direktifi kullanılır.



Örnek Kod Parçası

```
MyMacro2 MACRO
```

```
    LOCAL label1, label2
```

```
    CMP  AX, 2
```

```
    JE  label1
```

```
    CMP  AX, 3
```

```
    JE  label2
```

```
label1:
```

```
    INC  AX
```

```
label2:
```

```
    ADD  AX, 2
```

```
ENDM
```



Ekranaya Karakter Yazdırma

; this macro prints a char in AL and advances the current cursor position

```
PUTC MACRO char
```

```
    push    ax
```

```
    mov     al, char
```

```
    mov     ah, 0eh
```

```
    int     10h
```

```
    pop     ax
```

```
ENDM
```

```
ORG 100h
```

```
START:
```

```
    PUTC   'A'
```

```
    PUTC   'B'
```



Ekranaya Karakter Yazdırma

emulator: fact.com_

file math debug view external virtual devices virtual drive help

Load reload step back single step run step delay ms: 0

registers

| | H | L |
|----|-------|----|
| AX | 00 | 00 |
| BX | 00 | 00 |
| CX | 00 | 10 |
| DX | 00 | 00 |
| CS | 07 00 | |
| IP | 01 00 | |
| SS | 07 00 | |
| SP | FF FE | |
| BP | 00 00 | |
| SI | 00 00 | |
| DI | 00 00 | |
| DS | 07 00 | |
| ES | 07 00 | |

0700:0100

| Address | Hex | Dec | Symbol |
|---------|-----|-----|--------|
| 07100: | 50 | 080 | P |
| 07101: | B0 | 176 | /// |
| 07102: | 41 | 065 | A |
| 07103: | B4 | 180 | |
| 07104: | 0E | 014 | µ |
| 07105: | CD | 205 | = |
| 07106: | 10 | 016 | ► |
| 07107: | 58 | 088 | X |
| 07108: | 50 | 080 | P |
| 07109: | B0 | 176 | /// |
| 0710A: | 42 | 066 | B |
| 0710B: | B4 | 180 | |
| 0710C: | 0E | 014 | µ |
| 0710D: | CD | 205 | = |
| 0710E: | 10 | 016 | ► |
| 0710F: | 58 | 088 | X |
| 07110: | 90 | 144 | É |
| 07111: | 90 | 144 | É |
| 07112: | 90 | 144 | É |
| 07113: | 90 | 144 | É |
| 07114: | 90 | 144 | É |
| 07115: | 90 | 144 | É |

0700:0100

```
PUSH AX
MOV AL, 041h
MOV AH, 0Eh
INT 010h
POP AX
PUSH AX
MOV AL, 042h
MOV AH, 0Eh
INT 010h
POP AX
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
...
```

screen source reset aux vars debug stack flags



Ekranaya Karakter Yazdırma

emulator: fact.com_

file math debug view external virtual devices virtual drive help

Load reload step back single step run step delay ms: 0

registers

| | H | L |
|----|-------|----|
| AX | 00 | 00 |
| BX | 00 | 00 |
| CX | 00 | 10 |
| DX | 00 | 00 |
| CS | 07 00 | |
| IP | 01 01 | |
| SS | 07 00 | |
| SP | FF FC | |
| BP | 00 00 | |
| SI | 00 00 | |
| DI | 00 00 | |
| DS | 07 00 | |
| ES | 07 00 | |

0700:0101

```
07100: 50 080 P
07101: B0 176
07102: 41 065 A
07103: B4 180 |
07104: 0E 014 |
07105: CD 205 =
07106: 10 016 >
07107: 58 088 X
07108: 50 080 P
07109: B0 176
0710A: 42 066 B
0710B: B4 180 |
0710C: 0E 014 |
0710D: CD 205 =
0710E: 10 016 >
0710F: 58 088 X
07110: 90 144 E
07111: 90 144 E
07112: 90 144 E
07113: 90 144 E
07114: 90 144 E
07115: 90 144 E
```

0700:0101

```
PUSH AX
MOV AL, 041h
MOV AH, 0Eh
INT 010h
POP AX
PUSH AX
MOV AL, 042h
MOV AH, 0Eh
INT 010h
POP AX
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
...
```

screen source reset aux vars debug stack flags



Ekran Karakter Yazdırma

emulator: fact.com_

file math debug view external virtual devices virtual drive help

Load reload step back single step run step delay ms: 0

registers

| | H | L |
|----|-------|----|
| AX | 00 | 41 |
| BX | 00 | 00 |
| CX | 00 | 10 |
| DX | 00 | 00 |
| CS | 07 00 | |
| IP | 01 03 | |
| SS | 07 00 | |
| SP | FF FC | |
| BP | 00 00 | |
| SI | 00 00 | |
| DI | 00 00 | |
| DS | 07 00 | |
| ES | 07 00 | |

0700:0103

| | | | |
|--------|----|-----|---|
| 07100: | 50 | 080 | P |
| 07101: | B0 | 176 | ⌘ |
| 07102: | 41 | 065 | A |
| 07103: | B4 | 180 | |
| 07104: | 0E | 014 | ⌘ |
| 07105: | CD | 205 | = |
| 07106: | 10 | 016 | ▶ |
| 07107: | 58 | 088 | X |
| 07108: | 50 | 080 | P |
| 07109: | B0 | 176 | ⌘ |
| 0710A: | 42 | 066 | B |
| 0710B: | B4 | 180 | |
| 0710C: | 0E | 014 | ⌘ |
| 0710D: | CD | 205 | = |
| 0710E: | 10 | 016 | ▶ |
| 0710F: | 58 | 088 | X |
| 07110: | 90 | 144 | É |
| 07111: | 90 | 144 | É |
| 07112: | 90 | 144 | É |
| 07113: | 90 | 144 | É |
| 07114: | 90 | 144 | É |
| 07115: | 90 | 144 | É |

0700:0103

```
PUSH AX
MOU AL, 041h
MOU AH, 0Eh
INT 010h
POP AX
PUSH AX
MOU AL, 042h
MOU AH, 0Eh
INT 010h
POP AX
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
...
```

screen source reset aux vars debug stack flags



Ekranaya Karakter Yazdırma

emulator: fact.com_

file math debug view external virtual devices virtual drive help

Load reload step back single step run step delay ms: 0

registers

| | H | L |
|----|-------|----|
| AX | 0E | 41 |
| BX | 00 | 00 |
| CX | 00 | 10 |
| DX | 00 | 00 |
| CS | 07 00 | |
| IP | 01 05 | |
| SS | 07 00 | |
| SP | FF FC | |
| BP | 00 00 | |
| SI | 00 00 | |
| DI | 00 00 | |
| DS | 07 00 | |
| ES | 07 00 | |

0700:0105

| | | | |
|--------|----|-----|---|
| 07100: | 50 | 080 | P |
| 07101: | B0 | 176 | ⌘ |
| 07102: | 41 | 065 | A |
| 07103: | B4 | 180 | |
| 07104: | 0E | 014 | ⌘ |
| 07105: | CD | 205 | = |
| 07106: | 10 | 016 | ▶ |
| 07107: | 58 | 088 | X |
| 07108: | 50 | 080 | P |
| 07109: | B0 | 176 | ⌘ |
| 0710A: | 42 | 066 | B |
| 0710B: | B4 | 180 | |
| 0710C: | 0E | 014 | ⌘ |
| 0710D: | CD | 205 | = |
| 0710E: | 10 | 016 | ▶ |
| 0710F: | 58 | 088 | X |
| 07110: | 90 | 144 | É |
| 07111: | 90 | 144 | É |
| 07112: | 90 | 144 | É |
| 07113: | 90 | 144 | É |
| 07114: | 90 | 144 | É |
| 07115: | 90 | 144 | É |

0700:0105

```
PUSH AX
MOV AL, 041h
MOV AH, 0Eh
INT 010h
POP AX
PUSH AX
MOV AL, 042h
MOV AH, 0Eh
INT 010h
POP AX
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
...
```

screen source reset aux vars debug stack flags



Ekрана Karakter Yazdırma

emulator: fact.com_

file math debug view external virtual devices virtual drive help

Load reload step back single step run step delay ms: 0

registers

| | H | L |
|----|------|----|
| AX | 0E | 41 |
| BX | 00 | 00 |
| CX | 00 | 10 |
| DX | 00 | 00 |
| CS | F400 | |
| IP | 0190 | |
| SS | 0700 | |
| SP | FFF6 | |
| BP | 0000 | |
| SI | 0000 | |
| DI | 0000 | |
| DS | 0700 | |
| ES | 0700 | |

F400:0190

| | | | |
|--------|----|-----|------|
| F4190: | FF | 255 | RES |
| F4191: | FF | 255 | RES |
| F4192: | CD | 205 | = |
| F4193: | 10 | 016 | ▶ |
| F4194: | CF | 207 | ± |
| F4195: | 00 | 000 | NULL |
| F4196: | 00 | 000 | NULL |
| F4197: | 00 | 000 | NULL |
| F4198: | 00 | 000 | NULL |
| F4199: | 00 | 000 | NULL |
| F419A: | 00 | 000 | NULL |
| F419B: | 00 | 000 | NULL |
| F419C: | 00 | 000 | NULL |
| F419D: | 00 | 000 | NULL |
| F419E: | 00 | 000 | NULL |
| F419F: | 00 | 000 | NULL |
| F41A0: | FF | 255 | RES |
| F41A1: | FF | 255 | RES |
| F41A2: | CD | 205 | = |
| F41A3: | 12 | 018 | ↓ |
| F41A4: | CF | 207 | ± |
| F41A5: | 00 | 000 | NULL |

BIOS DI

```
INT 010h
IRET
ADD [BX + SI], AL
ADD [BX + SI], AL
ADD [BX + SI], AL
ADD [BX + SI], AL
ADD [BX + SI], AL
ADD [BX + SI], AL
DEC BP
ADC CL, BH
ADD [BX + SI], AL
ADD [BX + SI], AL
ADD [BX + SI], AL
ADD [BX + SI], AL
ADD [BX + SI], AL
ADD [BX + SI], AL
DEC BP
ADC CX, DI
ADD [BX + SI], AL
ADD [BX + SI], AL
...
```

screen source reset aux vars debug stack flags



Ekran Karakter Yazdırma

emulator: fact.com_

file math debug view external virtual devices virtual drive help

Load reload step back single step run step delay ms: 0

registers

| | H | L |
|----|------|----|
| AX | 0E | 41 |
| BX | 00 | 00 |
| CX | 00 | 10 |
| DX | 00 | 00 |
| CS | F400 | |
| IP | 0194 | |
| SS | 0700 | |
| SP | FFF6 | |
| BP | 0000 | |
| SI | 0000 | |
| DI | 0000 | |
| DS | 0700 | |
| ES | 0700 | |

F400:0194

| | | | |
|--------|----|-----|------|
| F4190: | FF | 255 | RES |
| F4191: | FF | 255 | RES |
| F4192: | CD | 205 | = |
| F4193: | 10 | 016 | ▶ |
| F4194: | CF | 207 | ± |
| F4195: | 00 | 000 | NULL |
| F4196: | 00 | 000 | NULL |
| F4197: | 00 | 000 | NULL |
| F4198: | 00 | 000 | NULL |
| F4199: | 00 | 000 | NULL |
| F419A: | 00 | 000 | NULL |
| F419B: | 00 | 000 | NULL |
| F419C: | 00 | 000 | NULL |
| F419D: | 00 | 000 | NULL |
| F419E: | 00 | 000 | NULL |
| F419F: | 00 | 000 | NULL |
| F41A0: | FF | 255 | RES |
| F41A1: | FF | 255 | RES |
| F41A2: | CD | 205 | = |
| F41A3: | 12 | 018 | ‡ |
| F41A4: | CF | 207 | ± |
| F41A5: | 00 | 000 | NULL |

F400:0194

```
BIOS DI
INT 010h
IRET
ADD [BX + SI], AL
ADD [BX + SI], AL
ADD [BX + SI], AL
ADD [BX + SI], AL
ADD [BX + SI], AL
ADD BH, BH
DEC BP
ADC CL, BH
ADD [BX + SI], AL
ADD [BX + SI], AL
ADD [BX + SI], AL
ADD [BX + SI], AL
ADD [BX + SI], AL
ADD [BX + SI], AL
ADD BH, BH
DEC BP
ADC CX, DI
ADD [BX + SI], AL
ADD [BX + SI], AL
...
```

screen source reset aux vars debug stack fla

emulator screen (80x25 chars)

```
A
```

clear screen change font 0/16



Ekranaya Karakter Yazdırma

emulator: fact.com_

file math debug view external virtual devices virtual drive help

Load reload step back single step run step delay ms: 0

registers

| | H | L |
|----|-------|----|
| AX | 0E | 41 |
| BX | 00 | 00 |
| CX | 00 | 10 |
| DX | 00 | 00 |
| CS | 07 00 | |
| IP | 01 07 | |
| SS | 07 00 | |
| SP | FF FC | |
| BP | 00 00 | |
| SI | 00 00 | |
| DI | 00 00 | |
| DS | 07 00 | |
| ES | 07 00 | |

07 00: 01 07

| Address | Hex | Asm |
|---------|----------|--------------|
| 07107: | 58 088 X | POP AX |
| 07108: | 50 080 P | PUSH AX |
| 07109: | B0 176 | MOV AL, 042h |
| 0710A: | 42 066 B | MOV AH, 0Eh |
| 0710B: | B4 180 | INT 010h |
| 0710C: | 0E 014 | POP AX |
| 0710D: | CD 205 = | NOP |
| 0710E: | 10 016 > | NOP |
| 0710F: | 58 088 X | NOP |
| 07110: | 90 144 é | NOP |
| 07111: | 90 144 é | NOP |
| 07112: | 90 144 é | NOP |
| 07113: | 90 144 é | NOP |
| 07114: | 90 144 é | NOP |
| 07115: | 90 144 é | NOP |
| 07116: | 90 144 é | NOP |
| 07117: | 90 144 é | NOP |
| 07118: | 90 144 é | NOP |
| 07119: | 90 144 é | NOP |
| 0711A: | 90 144 é | NOP |
| 0711B: | 90 144 é | NOP |
| 0711C: | 90 144 é | NOP |
| ... | | ... |

screen source reset aux vars debug stack flags



Ekranaya Karakter Yazdırma

emulator: fact.com_

file math debug view external virtual devices virtual drive help

Load reload step back single step run step delay ms: 0

registers

| | H | L |
|----|------|----|
| AX | 0E | 42 |
| BX | 00 | 00 |
| CX | 00 | 10 |
| DX | 00 | 00 |
| CS | F400 | |
| IP | 0194 | |
| SS | 0700 | |
| SP | FFF6 | |
| BP | 0000 | |
| SI | 0000 | |
| DI | 0000 | |
| DS | 0700 | |
| ES | 0700 | |

F400:0194

| | | | |
|--------|----|-----|------|
| F4190: | FF | 255 | RES |
| F4191: | FF | 255 | RES |
| F4192: | CD | 205 | = |
| F4193: | 10 | 016 | ▶ |
| F4194: | CF | 207 | ± |
| F4195: | 00 | 000 | NULL |
| F4196: | 00 | 000 | NULL |
| F4197: | 00 | 000 | NULL |
| F4198: | 00 | 000 | NULL |
| F4199: | 00 | 000 | NULL |
| F419A: | 00 | 000 | NULL |
| F419B: | 00 | 000 | NULL |
| F419C: | 00 | 000 | NULL |
| F419D: | 00 | 000 | NULL |
| F419E: | 00 | 000 | NULL |
| F419F: | 00 | 000 | NULL |
| F41A0: | FF | 255 | RES |
| F41A1: | FF | 255 | RES |
| F41A2: | CD | 205 | = |
| F41A3: | 12 | 018 | ‡ |
| F41A4: | CF | 207 | ± |
| F41A5: | 00 | 000 | NULL |

F400:0194

```
BIOS DI
INT 010h
IRET
ADD [BX + SI], AL
ADD [BX + SI], AL
ADD [BX + SI], AL
ADD [BX + SI], AL
ADD [BX + SI], AL
ADD BH, BH
DEC BP
ADC CL, BH
ADD [BX + SI], AL
ADD [BX + SI], AL
ADD [BX + SI], AL
ADD [BX + SI], AL
ADD [BX + SI], AL
ADD [BX + SI], AL
ADD BH, BH
DEC BP
ADC CX, DI
ADD [BX + SI], AL
ADD [BX + SI], AL
...
```

screen source reset aux vars debug stack fla

emulator screen (80x25 chars)

```
AB
```

clear screen change font 0/16



Üs Alma

POWER macro b, e, r

```
mov ax, 1          ; geçici sonucu 1 yap
mov cx, e          ; üs değerini cx yazmacına yükle
mov bx, b          ; taban değerini bx yazmacına yükle
```

powerloop:

```
    mul bx          ; taban ile geçici sonucu çarp
    loop powerloop ; üs kere döngüyü tekrarla
```

```
mov r, ax ; sonucu result değişkenine yaz
```

endm

start:

```
    POWER base, exponent, result ; power makrosunu çağır
```

ret

```
base      dw      2      ; taban değeri
exponent  dw      3      ; üs değeri
result    dw      ?      ; sonuç
```


Üs Alma



The screenshot shows an emulator window titled "emulator: noname.bin_". The interface includes a menu bar (file, math, debug, view, external, virtual devices, virtual drive, help) and a toolbar with buttons for Load, reload, step back, single step, run, and a step delay slider set to 0 ms.

The registers section on the left shows the following values:

| Register | H | L |
|----------|------|----|
| AX | 00 | 00 |
| BX | 00 | 00 |
| CX | 00 | 00 |
| DX | 00 | 00 |
| CS | 0100 | |
| IP | 0000 | |
| SS | 0100 | |
| SP | FFFE | |
| BP | 0000 | |
| SI | 0000 | |
| DI | 0000 | |
| DS | 0100 | |
| ES | 0100 | |

The assembly code window is split into two panes. The left pane shows memory addresses from 01000 to 01015 with their corresponding hex values and mnemonics. The right pane shows the disassembled instructions for the same memory range.

| Address | Hex | Mnemonic | Disassembly |
|---------|--------|----------|-------------------|
| 01000 | B8 184 | j | MOV AX, 00001h |
| 01001 | 01 001 | Ⓞ | MOV CX, [00015h] |
| 01002 | 00 000 | NULL | MOV BX, [00013h] |
| 01003 | 8B 139 | i | MUL BX |
| 01004 | 0E 014 | Ⓜ | LOOP 0Bh |
| 01005 | 15 021 | Ⓢ | MOV [00017h], AX |
| 01006 | 00 000 | NULL | RET |
| 01007 | 8B 139 | i | ADD AL, [BX + SI] |
| 01008 | 1E 030 | ▲ | ADD AX, [BX + SI] |
| 01009 | 13 019 | !! | ADD [BX + SI], AL |
| 0100A | 00 000 | NULL | NOP |
| 0100B | F7 247 | ≈ | NOP |
| 0100C | E3 227 | π | NOP |
| 0100D | E2 226 | Γ | NOP |
| 0100E | FC 252 | ” | NOP |
| 0100F | A3 163 | ú | NOP |
| 01010 | 17 023 | ‡ | NOP |
| 01011 | 00 000 | NULL | NOP |
| 01012 | C3 195 | † | NOP |
| 01013 | 02 002 | Ⓞ | NOP |
| 01014 | 00 000 | NULL | NOP |
| 01015 | 03 003 | ▼ | ... |

At the bottom of the emulator window, there are buttons for screen, source, reset, aux, vars, debug, stack, and flags.



Üs Alma

emulator: noname.bin_

file math debug view external virtual devices virtual drive help

Load reload step back single step run step delay ms: 0

registers

| | H | L |
|----|------|----|
| AX | 00 | 01 |
| BX | 00 | 00 |
| CX | 00 | 00 |
| DX | 00 | 00 |
| CS | 0100 | |
| IP | 0003 | |
| SS | 0100 | |
| SP | FFFE | |
| BP | 0000 | |
| SI | 0000 | |
| DI | 0000 | |
| DS | 0100 | |
| ES | 0100 | |

| 0100:0003 | | | 0100:0003 | | |
|-----------|----|-----|-----------|------|---------------|
| 01000: | B8 | 184 | ⌗ | MOU | AX, 00001h |
| 01001: | 01 | 001 | ⊖ | MOU | CX, [00015h] |
| 01002: | 00 | 000 | NULL | MOU | BX, [00013h] |
| 01003: | 8B | 139 | ⌗ | MUL | BX |
| 01004: | 0E | 014 | ⌗ | LOOP | 0Bh |
| 01005: | 15 | 021 | § | MOU | [00017h], AX |
| 01006: | 00 | 000 | NULL | RET | |
| 01007: | 8B | 139 | ⌗ | ADD | AL, [BX + SI] |
| 01008: | 1E | 030 | ▲ | ADD | AX, [BX + SI] |
| 01009: | 13 | 019 | !! | ADD | [BX + SI], AL |
| 0100A: | 00 | 000 | NULL | NOP | |
| 0100B: | F7 | 247 | ≈ | NOP | |
| 0100C: | E3 | 227 | ⌗ | NOP | |
| 0100D: | E2 | 226 | ⌗ | NOP | |
| 0100E: | FC | 252 | ™ | NOP | |
| 0100F: | A3 | 163 | ú | NOP | |
| 01010: | 17 | 023 | ‡ | NOP | |
| 01011: | 00 | 000 | NULL | NOP | |
| 01012: | C3 | 195 | ‡ | NOP | |
| 01013: | 02 | 002 | ⊖ | NOP | |
| 01014: | 00 | 000 | NULL | NOP | |
| 01015: | 03 | 003 | ▼ | ... | |

screen source reset aux vars debug stack flags

Üs Alma



emulator: noname.bin_

file math debug view external virtual devices virtual drive help

Load reload step back single step run step delay ms: 0

| registers | H | L |
|-----------|------|----|
| AX | 00 | 01 |
| BX | 00 | 00 |
| CX | 00 | 03 |
| DX | 00 | 00 |
| CS | 0100 | |
| IP | 0007 | |
| SS | 0100 | |
| SP | FFFE | |
| BP | 0000 | |
| SI | 0000 | |
| DI | 0000 | |
| DS | 0100 | |
| ES | 0100 | |

| 0100:0007 | 0100:0007 |
|--------------------|-------------------|
| 01000: B8 184 7 | MOV AX, 00001h |
| 01001: 01 001 0 | MOV CX, [00015h] |
| 01002: 00 000 NULL | MOV BX, [00013h] |
| 01003: 8B 139 i | MUL BX |
| 01004: 0E 014 j | LOOP 0Bh |
| 01005: 15 021 S | MOV [00017h], AX |
| 01006: 00 000 NULL | RET |
| 01007: 8B 139 i | ADD AL, [BX + SI] |
| 01008: 1E 030 A | ADD AX, [BX + SI] |
| 01009: 13 019 !! | ADD [BX + SI], AL |
| 0100A: 00 000 NULL | NOP |
| 0100B: F7 247 S | NOP |
| 0100C: E3 227 n | NOP |
| 0100D: E2 226 r | NOP |
| 0100E: FC 252 n | NOP |
| 0100F: A3 163 u | NOP |
| 01010: 17 023 z | NOP |
| 01011: 00 000 NULL | NOP |
| 01012: C3 195 | NOP |
| 01013: 02 002 0 | NOP |
| 01014: 00 000 NULL | NOP |
| 01015: 03 003 v | ... |

screen source reset aux vars debug stack flags

Üs Alma



emulator: noname.bin_

file math debug view external virtual devices virtual drive help

Load reload step back single step run step delay ms: 0

registers

| | H | L |
|----|------|----|
| AX | 00 | 01 |
| BX | 00 | 02 |
| CX | 00 | 03 |
| DX | 00 | 00 |
| CS | 0100 | |
| IP | 000B | |
| SS | 0100 | |
| SP | FFFE | |
| BP | 0000 | |
| SI | 0000 | |
| DI | 0000 | |
| DS | 0100 | |
| ES | 0100 | |

0100:000B

| Address | Hex | Dec | Symbol |
|---------|-----|-----|--------|
| 01000: | B8 | 184 | ı |
| 01001: | 01 | 001 | ⊖ |
| 01002: | 00 | 000 | NULL |
| 01003: | 8B | 139 | i |
| 01004: | 0E | 014 | Œ |
| 01005: | 15 | 021 | Œ |
| 01006: | 00 | 000 | NULL |
| 01007: | 8B | 139 | i |
| 01008: | 1E | 030 | ▲ |
| 01009: | 13 | 019 | !! |
| 0100A: | 00 | 000 | NULL |
| 0100B: | F7 | 247 | ≈ |
| 0100C: | E3 | 227 | ∏ |
| 0100D: | E2 | 226 | ∏ |
| 0100E: | FC | 252 | ∞ |
| 0100F: | A3 | 163 | ú |
| 01010: | 17 | 023 | ‡ |
| 01011: | 00 | 000 | NULL |
| 01012: | C3 | 195 | ‡ |
| 01013: | 02 | 002 | ⊖ |
| 01014: | 00 | 000 | NULL |
| 01015: | 03 | 003 | ∨ |

0100:000B

```
MOU AX, 00001h
MOU CX, [00015h]
MOU BX, [00013h]
MUL BX
LOOP 0Bh
MOU [00017h], AX
RET
ADD AL, [BX + SI]
ADD AX, [BX + SI]
ADD [BX + SI], AL
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
...
```

screen source reset aux vars debug stack flags

Üs Alma



emulator: noname.bin_

file math debug view external virtual devices virtual drive help

Load reload step back single step run step delay ms: 0

registers

| | H | L |
|----|------|----|
| AX | 00 | 02 |
| BX | 00 | 02 |
| CX | 00 | 03 |
| DX | 00 | 00 |
| CS | 0100 | |
| IP | 0000 | |
| SS | 0100 | |
| SP | FFFE | |
| BP | 0000 | |
| SI | 0000 | |
| DI | 0000 | |
| DS | 0100 | |
| ES | 0100 | |

0100:0000

| Address | Hex | Dec | Symbol |
|---------|-----|-----|--------|
| 01000: | B8 | 184 | ı |
| 01001: | 01 | 001 | 0 |
| 01002: | 00 | 000 | NULL |
| 01003: | 8B | 139 | i |
| 01004: | 0E | 014 | Ÿ |
| 01005: | 15 | 021 | Š |
| 01006: | 00 | 000 | NULL |
| 01007: | 8B | 139 | i |
| 01008: | 1E | 030 | ▲ |
| 01009: | 13 | 019 | !! |
| 0100A: | 00 | 000 | NULL |
| 0100B: | F7 | 247 | ≈ |
| 0100C: | E3 | 227 | Π |
| 0100D: | E2 | 226 | Γ |
| 0100E: | FC | 252 | ” |
| 0100F: | A3 | 163 | ú |
| 01010: | 17 | 023 | ‡ |
| 01011: | 00 | 000 | NULL |
| 01012: | C3 | 195 | ‡ |
| 01013: | 02 | 002 | 0 |
| 01014: | 00 | 000 | NULL |
| 01015: | 03 | 003 | ▼ |

0100:0000

```
MOV AX, 00001h
MOV CX, [00015h]
MOV BX, [00013h]
MUL BX
LOOP 0Bh
MOV [00017h], AX
RET
ADD AL, [BX + SI]
ADD AX, [BX + SI]
ADD [BX + SI], AL
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
...
```

screen source reset aux vars debug stack flags

Üs Alma



emulator: noname.bin_

file math debug view external virtual devices virtual drive help

Load reload step back single step run step delay ms: 0

registers

| | H | L |
|----|------|----|
| AX | 00 | 02 |
| BX | 00 | 02 |
| CX | 00 | 02 |
| DX | 00 | 00 |
| CS | 0100 | |
| IP | 000B | |
| SS | 0100 | |
| SP | FFFE | |
| BP | 0000 | |
| SI | 0000 | |
| DI | 0000 | |
| DS | 0100 | |
| ES | 0100 | |

0100:000B

| Address | Hex | Dec | Symbol |
|---------|-----|-----|--------|
| 01000: | B8 | 184 | ı |
| 01001: | 01 | 001 | ⊙ |
| 01002: | 00 | 000 | NULL |
| 01003: | 8B | 139 | ı |
| 01004: | 0E | 014 | Ÿ |
| 01005: | 15 | 021 | § |
| 01006: | 00 | 000 | NULL |
| 01007: | 8B | 139 | ı |
| 01008: | 1E | 030 | ▲ |
| 01009: | 13 | 019 | !! |
| 0100A: | 00 | 000 | NULL |
| 0100B: | F7 | 247 | ≈ |
| 0100C: | E3 | 227 | Π |
| 0100D: | E2 | 226 | Γ |
| 0100E: | FC | 252 | ˆ |
| 0100F: | A3 | 163 | ú |
| 01010: | 17 | 023 | ‡ |
| 01011: | 00 | 000 | NULL |
| 01012: | C3 | 195 | ‡ |
| 01013: | 02 | 002 | ⊙ |
| 01014: | 00 | 000 | NULL |
| 01015: | 03 | 003 | ▼ |

0100:000B

```
MOV AX, 00001h
MOV CX, [00015h]
MOV BX, [00013h]
MUL BX
LOOP 0Bh
MOV [00017h], AX
RET
ADD AL, [BX + SI]
ADD AX, [BX + SI]
ADD [BX + SI], AL
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
...
```

screen source reset aux vars debug stack flags

Üs Alma



emulator: noname.bin_

file math debug view external virtual devices virtual drive help

Load reload step back single step run step delay ms: 0

registers

| | H | L |
|----|------|----|
| AX | 00 | 04 |
| BX | 00 | 02 |
| CX | 00 | 02 |
| DX | 00 | 00 |
| CS | 0100 | |
| IP | 0000 | |
| SS | 0100 | |
| SP | FFFE | |
| BP | 0000 | |
| SI | 0000 | |
| DI | 0000 | |
| DS | 0100 | |
| ES | 0100 | |

0100:0000

```
01000: B8 184 7
01001: 01 001 0
01002: 00 000 NULL
01003: 8B 139 i
01004: 0E 014 j
01005: 15 021 S
01006: 00 000 NULL
01007: 8B 139 i
01008: 1E 030 A
01009: 13 019 !!
0100A: 00 000 NULL
0100B: F7 247 s
0100C: E3 227 n
0100D: E2 226 r
0100E: FC 252 n
0100F: A3 163 u
01010: 17 023 z
01011: 00 000 NULL
01012: C3 195 |
01013: 02 002 0
01014: 00 000 NULL
01015: 03 003 v
```

0100:0000

```
MOV AX, 00001h
MOV CX, [00015h]
MOV BX, [00013h]
MUL BX
LOOP 0Bh
MOV [00017h], AX
RET
ADD AL, [BX + SI]
ADD AX, [BX + SI]
ADD [BX + SI], AL
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
...
```

screen source reset aux vars debug stack flags

Üs Alma



emulator: noname.bin_

file math debug view external virtual devices virtual drive help

Load reload step back single step run step delay ms: 0

registers

| | H | L |
|----|------|----|
| AX | 00 | 04 |
| BX | 00 | 02 |
| CX | 00 | 01 |
| DX | 00 | 00 |
| CS | 0100 | |
| IP | 000B | |
| SS | 0100 | |
| SP | FFFE | |
| BP | 0000 | |
| SI | 0000 | |
| DI | 0000 | |
| DS | 0100 | |
| ES | 0100 | |

0100:000B

| Address | Hex | Dec | Symbol |
|---------|-----|-----|--------|
| 01000: | B8 | 184 | ı |
| 01001: | 01 | 001 | ⊖ |
| 01002: | 00 | 000 | NULL |
| 01003: | 8B | 139 | ı |
| 01004: | 0E | 014 | ı |
| 01005: | 15 | 021 | ı |
| 01006: | 00 | 000 | NULL |
| 01007: | 8B | 139 | ı |
| 01008: | 1E | 030 | ▲ |
| 01009: | 13 | 019 | !! |
| 0100A: | 00 | 000 | NULL |
| 0100B: | F7 | 247 | ≈ |
| 0100C: | E3 | 227 | ı |
| 0100D: | E2 | 226 | ı |
| 0100E: | FC | 252 | ı |
| 0100F: | A3 | 163 | ú |
| 01010: | 17 | 023 | ı |
| 01011: | 00 | 000 | NULL |
| 01012: | C3 | 195 | ı |
| 01013: | 02 | 002 | ⊖ |
| 01014: | 00 | 000 | NULL |
| 01015: | 03 | 003 | ▼ |

0100:000B

```
MOV AX, 00001h
MOV CX, [00015h]
MOV BX, [00013h]
MUL BX
LOOP 0Bh
MOV [00017h], AX
RET
ADD AL, [BX + SI]
ADD AX, [BX + SI]
ADD [BX + SI], AL
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
...
```

screen source reset aux vars debug stack flags

Üs Alma



emulator: noname.bin_

file math debug view external virtual devices virtual drive help

Load reload step back single step run step delay ms: 0

registers

| | H | L |
|----|------|----|
| AX | 00 | 08 |
| BX | 00 | 02 |
| CX | 00 | 01 |
| DX | 00 | 00 |
| CS | 0100 | |
| IP | 0000 | |
| SS | 0100 | |
| SP | FFFE | |
| BP | 0000 | |
| SI | 0000 | |
| DI | 0000 | |
| DS | 0100 | |
| ES | 0100 | |

0100:0000

| Address | Hex | Dec | Symbol |
|---------|-----|-----|--------|
| 01000: | B8 | 184 | ı |
| 01001: | 01 | 001 | ⊖ |
| 01002: | 00 | 000 | NULL |
| 01003: | 8B | 139 | ı |
| 01004: | 0E | 014 | ı |
| 01005: | 15 | 021 | ı |
| 01006: | 00 | 000 | NULL |
| 01007: | 8B | 139 | ı |
| 01008: | 1E | 030 | ▲ |
| 01009: | 13 | 019 | !! |
| 0100A: | 00 | 000 | NULL |
| 0100B: | F7 | 247 | ı |
| 0100C: | E3 | 227 | ı |
| 0100D: | E2 | 226 | ı |
| 0100E: | FC | 252 | ı |
| 0100F: | A3 | 163 | ı |
| 01010: | 17 | 023 | ı |
| 01011: | 00 | 000 | NULL |
| 01012: | C3 | 195 | ı |
| 01013: | 02 | 002 | ⊖ |
| 01014: | 00 | 000 | NULL |
| 01015: | 03 | 003 | ı |

0100:0000

```
MOV AX, 00001h
MOV CX, [00015h]
MOV BX, [00013h]
MUL BX
LOOP 0Bh
MOV [00017h], AX
RET
ADD AL, [BX + SI]
ADD AX, [BX + SI]
ADD [BX + SI], AL
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
...
```

screen source reset aux vars debug stack flags

Üs Alma



emulator: noname.bin_

file math debug view external virtual devices virtual drive help

Load reload step back single step run step delay ms: 0

registers

| | H | L |
|----|------|----|
| AX | 00 | 08 |
| BX | 00 | 02 |
| CX | 00 | 00 |
| DX | 00 | 00 |
| CS | 0100 | |
| IP | 000F | |
| SS | 0100 | |
| SP | FFFE | |
| BP | 0000 | |
| SI | 0000 | |
| DI | 0000 | |
| DS | 0100 | |
| ES | 0100 | |

0100:000F

| Address | Hex | Dec | Symbol |
|---------|-----|-----|--------|
| 01000: | B8 | 184 | ı |
| 01001: | 01 | 001 | ⊖ |
| 01002: | 00 | 000 | NULL |
| 01003: | 8B | 139 | i |
| 01004: | 0E | 014 | µ |
| 01005: | 15 | 021 | § |
| 01006: | 00 | 000 | NULL |
| 01007: | 8B | 139 | i |
| 01008: | 1E | 030 | ▲ |
| 01009: | 13 | 019 | !! |
| 0100A: | 00 | 000 | NULL |
| 0100B: | F7 | 247 | ≈ |
| 0100C: | E3 | 227 | Π |
| 0100D: | E2 | 226 | Γ |
| 0100E: | FC | 252 | ” |
| 0100F: | A3 | 163 | ú |
| 01010: | 17 | 023 | ‡ |
| 01011: | 00 | 000 | NULL |
| 01012: | C3 | 195 | † |
| 01013: | 02 | 002 | ⊖ |
| 01014: | 00 | 000 | NULL |
| 01015: | 03 | 003 | ▼ |

0100:000F

```
MOV AX, 00001h
MOV CX, [00015h]
MOV BX, [00013h]
MUL BX
LOOP 0Bh
MOV [00017h], AX
RET
ADD AL, [BX + SI]
ADD AX, [BX + SI]
ADD [BX + SI], AL
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
...
```

screen source reset aux vars debug stack flags

Üs Alma



emulator: noname.bin_

file math debug view external virtual devices virtual drive help

Load reload step back single step run step delay ms: 0

registers

| | H | L |
|----|------|----|
| AX | 00 | 08 |
| BX | 00 | 02 |
| CX | 00 | 00 |
| DX | 00 | 00 |
| CS | 0100 | |
| IP | 0012 | |
| SS | 0100 | |
| SP | FFFE | |
| BP | 0000 | |
| SI | 0000 | |
| DI | 0000 | |
| DS | 0100 | |
| ES | 0100 | |

0100:0012

```
01000: B8 184 7
01001: 01 001 0
01002: 00 000 NULL
01003: 8B 139 i
01004: 0E 014 j
01005: 15 021 S
01006: 00 000 NULL
01007: 8B 139 i
01008: 1E 030 A
01009: 13 019 !!
0100A: 00 000 NULL
0100B: F7 247 z
0100C: E3 227 n
0100D: E2 226 r
0100E: FC 252 n
0100F: A3 163 u
01010: 17 023 t
01011: 00 000 NULL
01012: C3 195 |
01013: 02 002 e
01014: 00 000 NULL
01015: 03 003 v
```

0100:0012

```
MOV AX, 00001h
MOV CX, [00015h]
MOV BX, [00013h]
MUL BX
LOOP 0Bh
MOV [00017h], AX
RET
ADD AL, [BX + SI]
ADD AX, [BX + SI]
OR [BX + SI], AL
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
NOP
...
```

screen source reset aux vars debug stack flags



SON