Practica 1 - Subrutinas

24 de septiembre de 2020

Ejercicio 7 - Multiplicación de números sin signo

- El programa utiliza una subrutina para multiplicar dos números sin signo mayores que cero.
- Se pasan los números a multiplicar por valor.
- Se para por referencia la dirección donde se debe guardar el resultado.
- Todos los parámetros se pasan a través de la pila

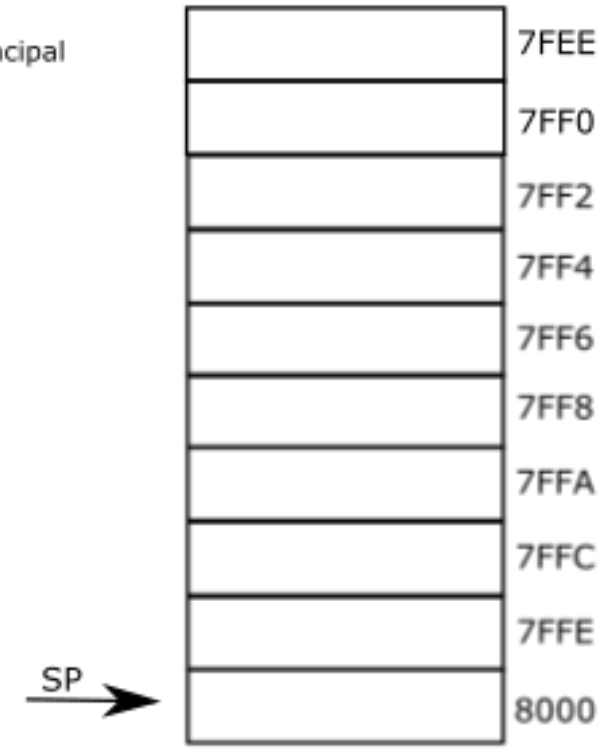
Ejercicio 7 - Pasaje de parámetros por pila

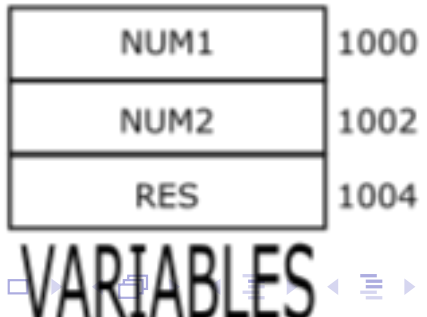
```
 ORG    3000H   ; Subrutina MUL
MUL:   PUSH   BX
       PUSH   CX
       PUSH   AX
       PUSH   DX
       MOV    BX, SP
       ADD    BX, 12
       MOV    CX, [BX]
       ADD    BX, 2
       MOV    AX, [BX]
       SUB    BX, 4
       MOV    BX, [BX]
       MOV    DX, 0
SUMA:  ADD    DX, AX
       DEC    CX
       JNZ    SUMA
       MOV    [BX], DX
       POP    DX
       POP    AX
       POP    CX
       POP    BX
       RET
```

```
ORG    2000H ; Programa Principal
MOV    AX, NUM1
PUSH   AX
MOV    AX, NUM2
PUSH   AX
MOV    AX, OFFSET RES
PUSH   AX
MOV    DX, 0
CALL   MUL
POP    AX
POP    AX
POP    AX
HLT
END


ORG    1000h ; Variables

NUM1 DW 5H
NUM2 DW 3H
RES  DW ?
```





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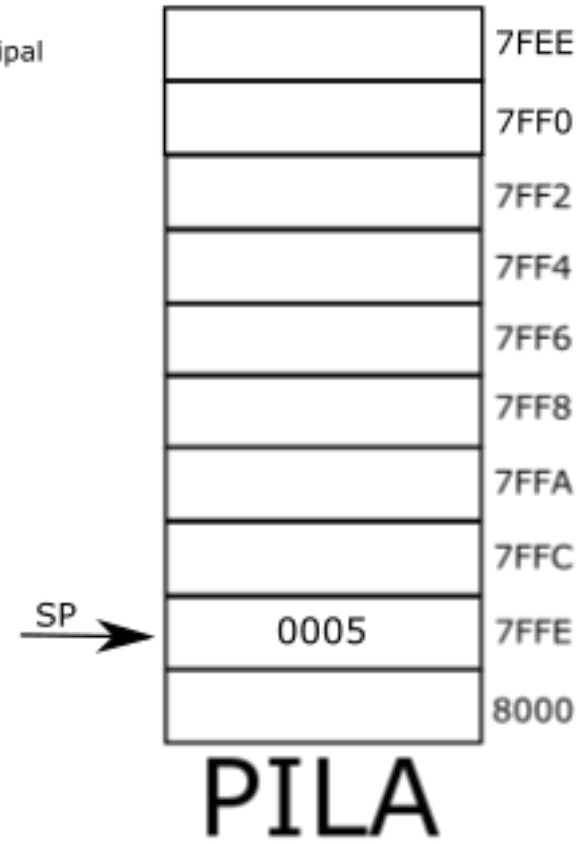

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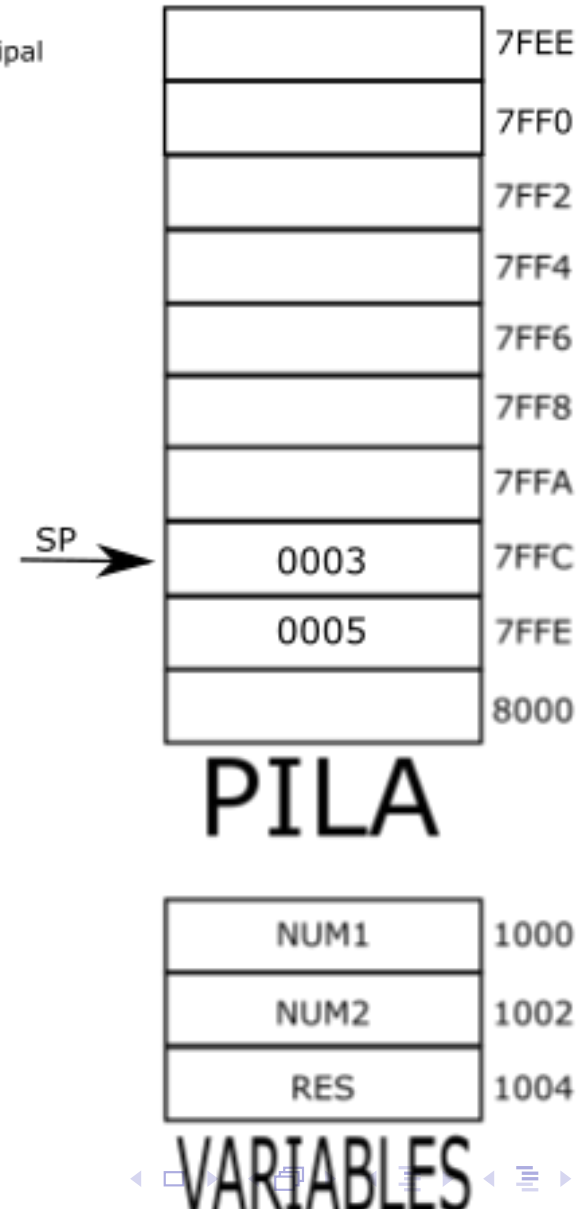

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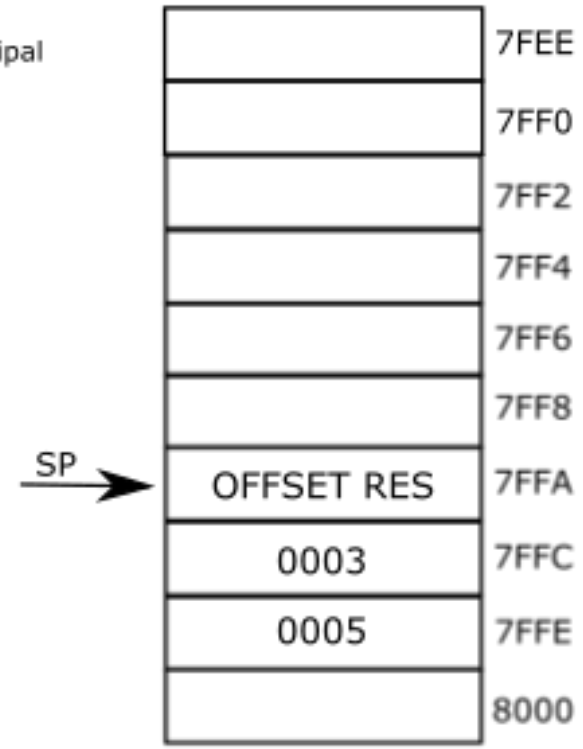

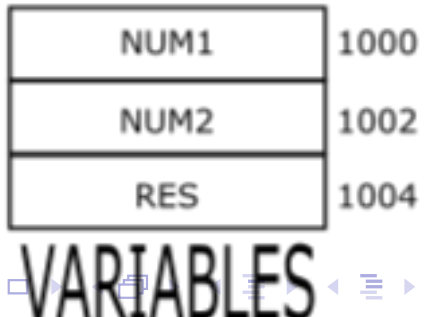

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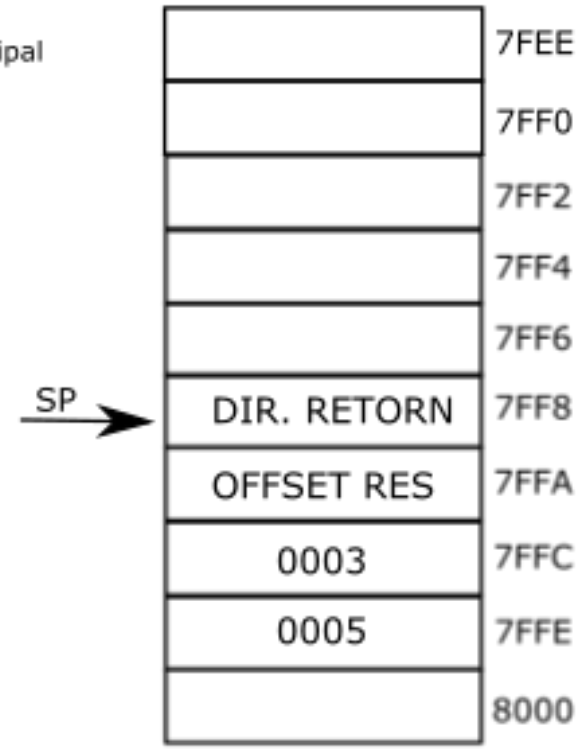

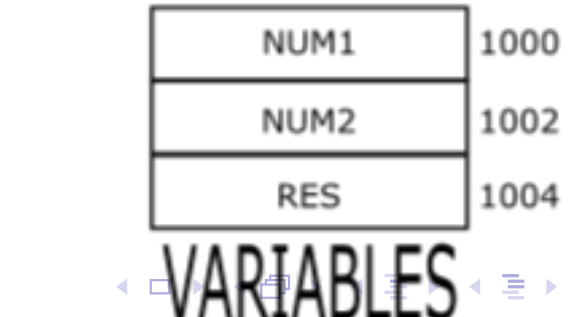

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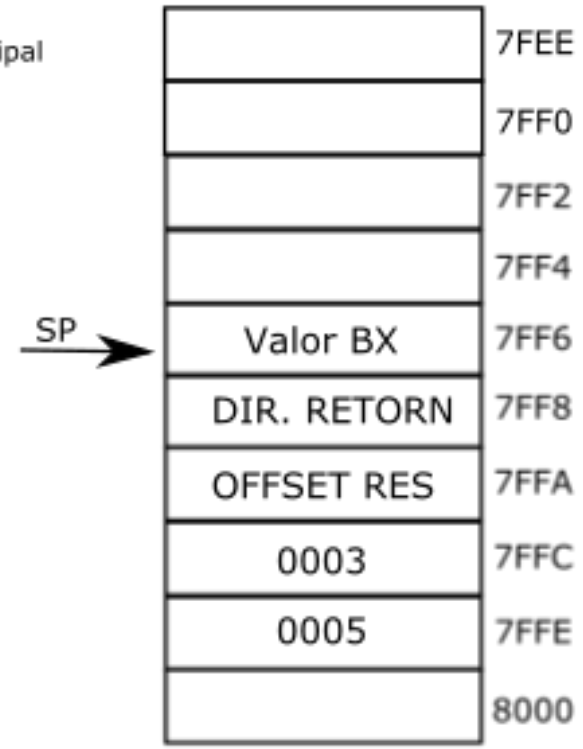

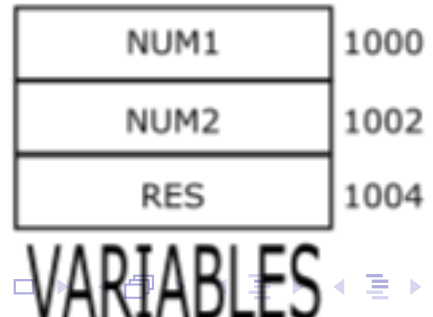

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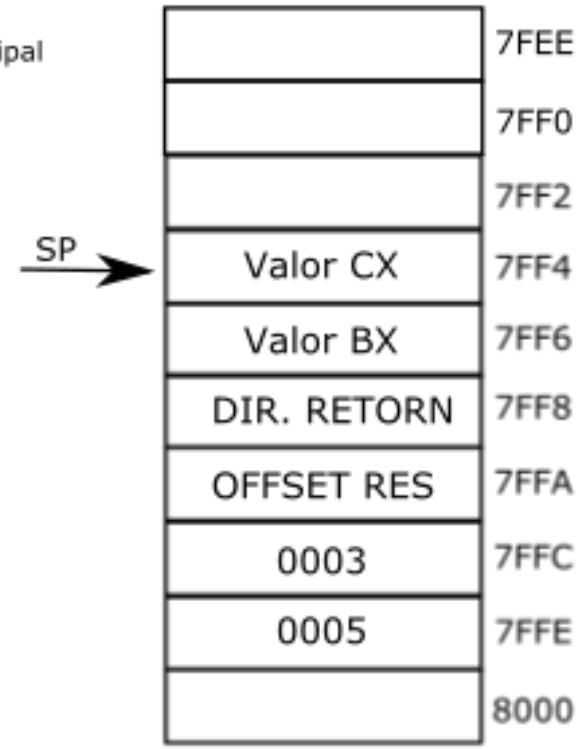

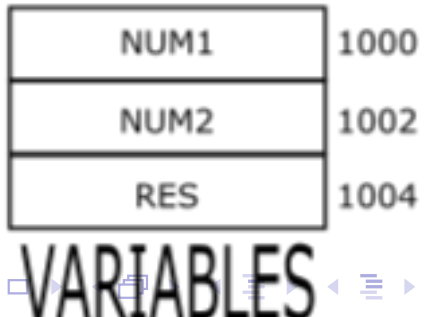

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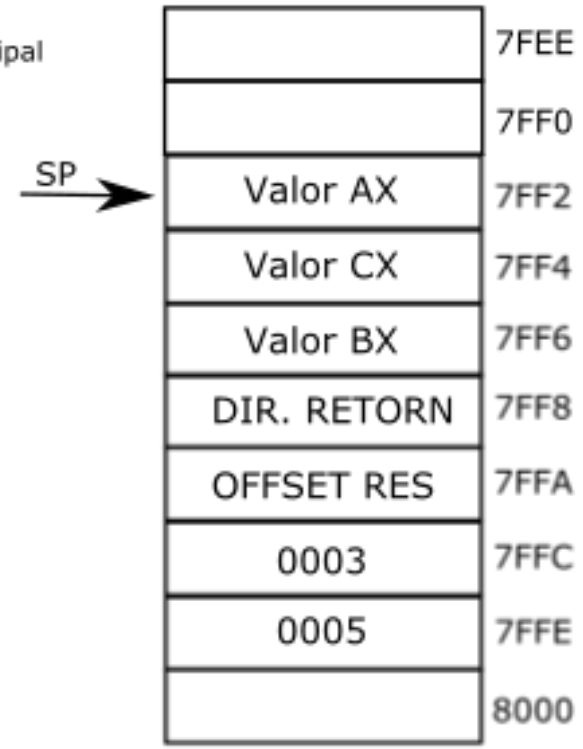

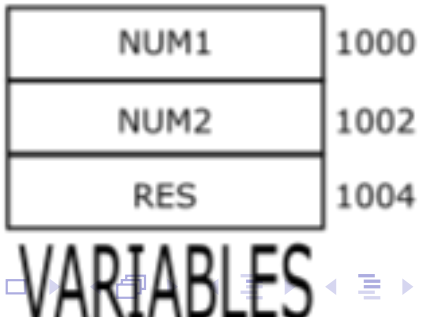

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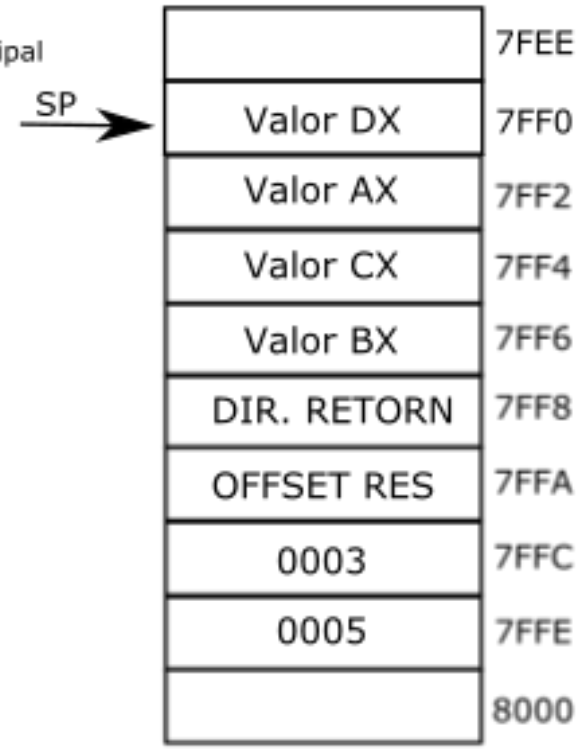

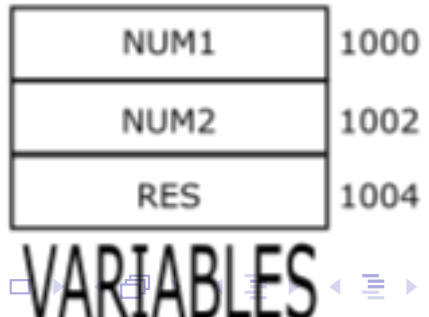

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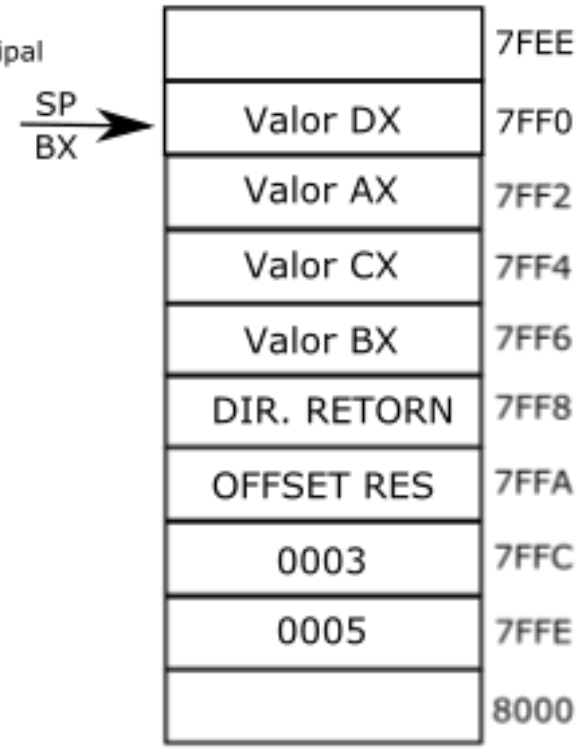

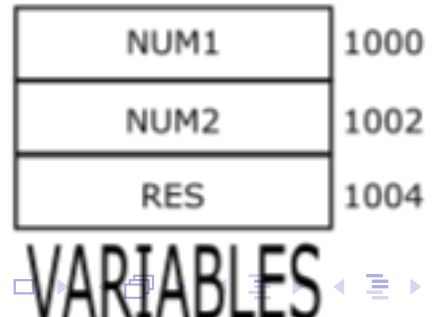

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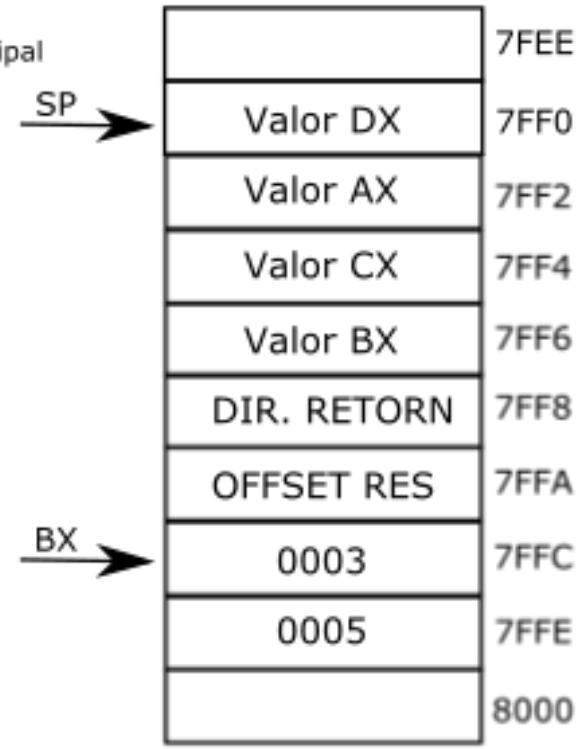

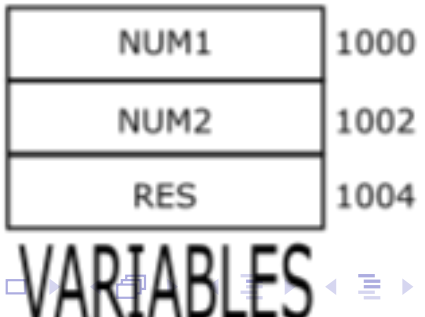

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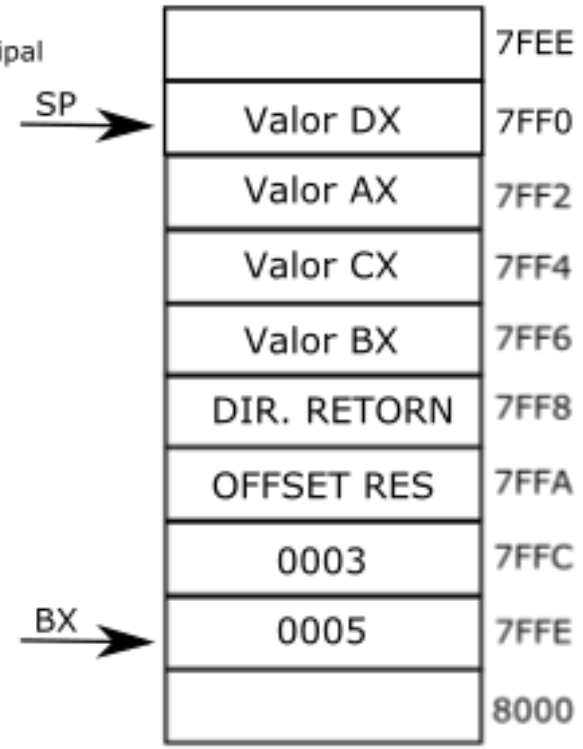

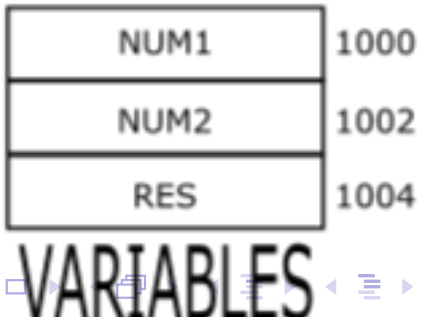

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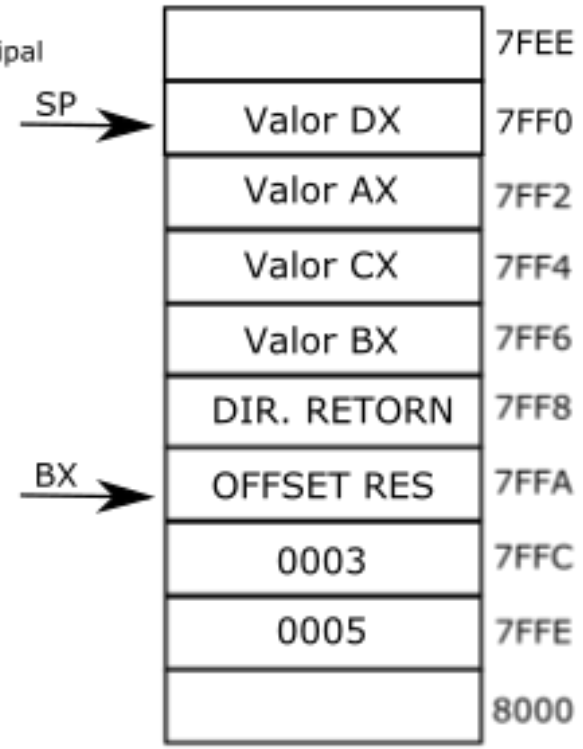
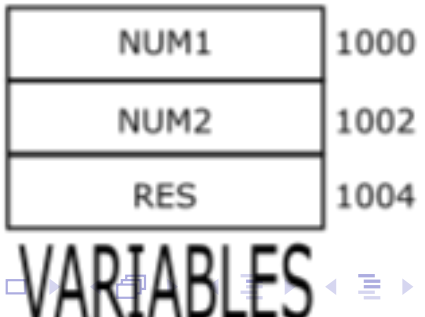




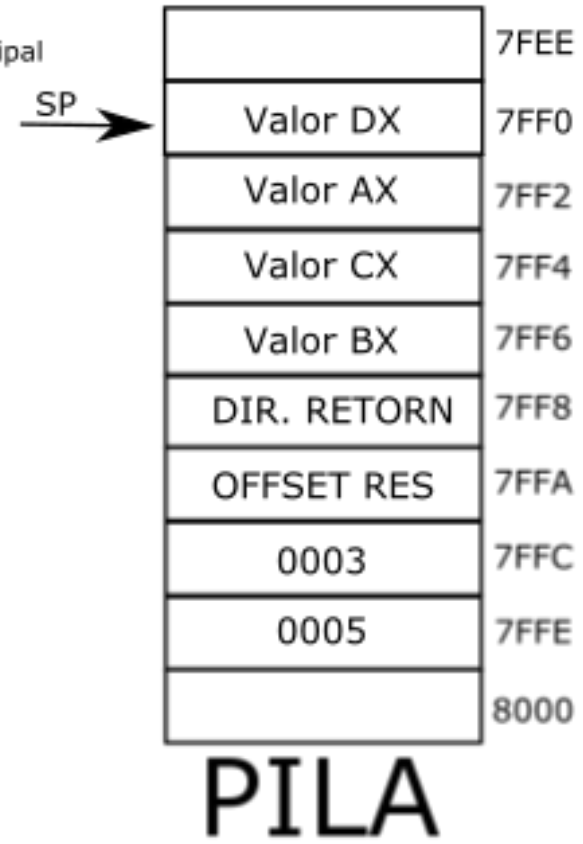
Ejercicio 7 - Pasaje de parámetros por pila

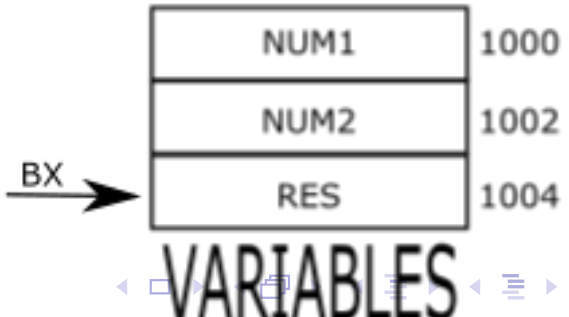
```
 ORG    3000H   ; Subrutina MUL
MUL:   PUSH   BX
       PUSH   CX
       PUSH   AX
       PUSH   DX
       MOV    BX, SP
       ADD    BX, 12
       MOV    CX, [BX]
       ADD    BX, 2
       MOV    AX, [BX]
       SUB    BX, 4
       MOV    BX, [BX]
       MOV    DX, 0
SUMA:  ADD    DX, AX
       DEC    CX
       JNZ    SUMA
       MOV    [BX], DX
       POP    DX
       POP    AX
       POP    CX
       POP    BX
       RET
```

```
ORG    2000H ; Programa Principal
MOV    AX, NUM1
PUSH   AX
MOV    AX, NUM2
PUSH   AX
MOV    AX, OFFSET RES
PUSH   AX
MOV    DX, 0
CALL   MUL
POP    AX
POP    AX
POP    AX
HLT
END


ORG    1000h ; Variables

NUM1 DW 5H
NUM2 DW 3H
RES  DW ?
```





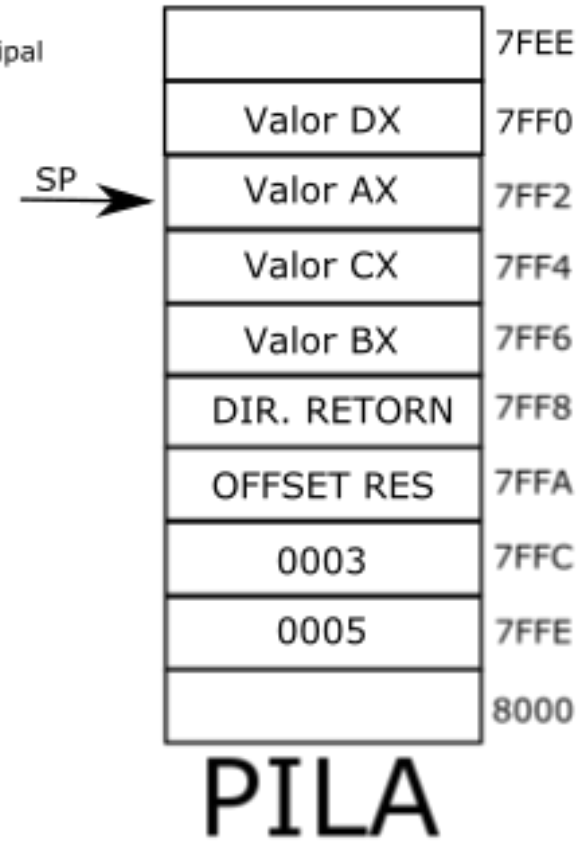
Ejercicio 7 - Pasaje de parámetros por pila

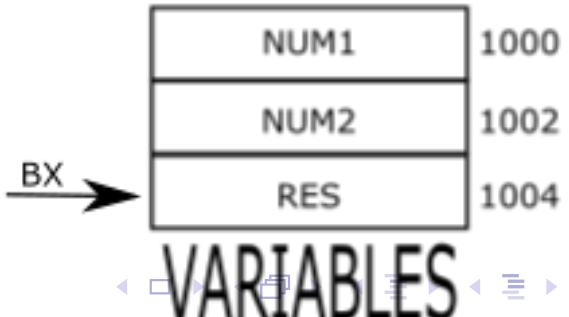
```
 ORG    3000H   ; Subrutina MUL
MUL:   PUSH   BX
       PUSH   CX
       PUSH   AX
       PUSH   DX
       MOV    BX, SP
       ADD    BX, 12
       MOV    CX, [BX]
       ADD    BX, 2
       MOV    AX, [BX]
       SUB    BX, 4
       MOV    BX, [BX]
       MOV    DX, 0
SUMA:  ADD    DX, AX
       DEC    CX
       JNZ    SUMA
       MOV    [BX], DX
       POP    DX
       POP    AX
       POP    CX
       POP    BX
       RET
```

```
ORG    2000H ; Programa Principal
MOV    AX, NUM1
PUSH   AX
MOV    AX, NUM2
PUSH   AX
MOV    AX, OFFSET RES
PUSH   AX
MOV    DX, 0
CALL   MUL
POP    AX
POP    AX
POP    AX
HLT
END


ORG    1000h ; Variables

NUM1 DW 5H
NUM2 DW 3H
RES  DW ?
```





Ejercicio 7 - Pasaje de parámetros por pila

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 ORG    3000H   ; Subrutina MUL
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       MOV    BX, [BX]
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       JNZ    SUMA
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       POP    DX
       POP    AX
       POP    CX
       POP    BX
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```

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END


ORG    1000h ; Variables

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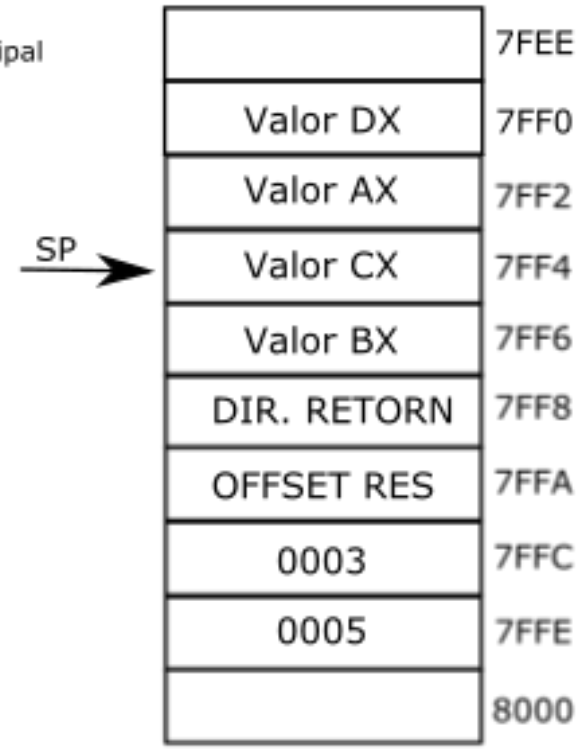

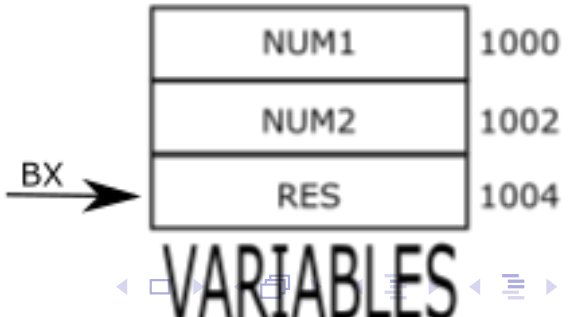

Ejercicio 7 - Pasaje de parámetros por pila

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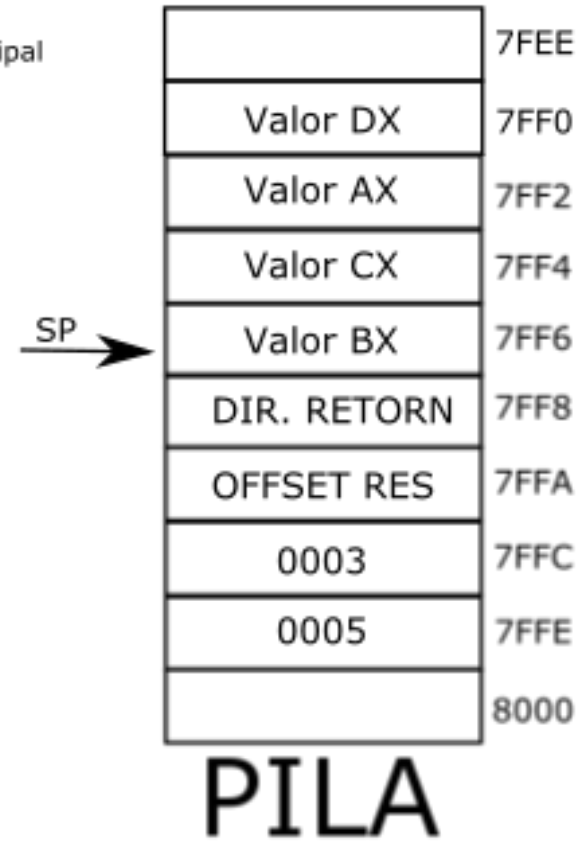

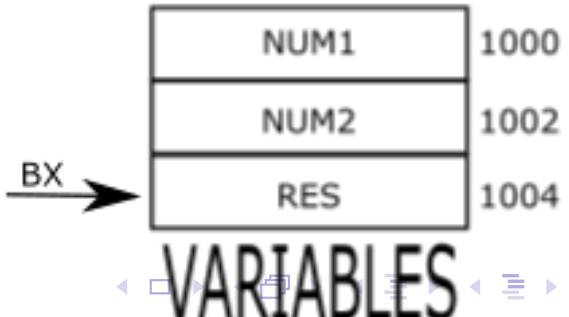

Ejercicio 7 - Pasaje de parámetros por pila

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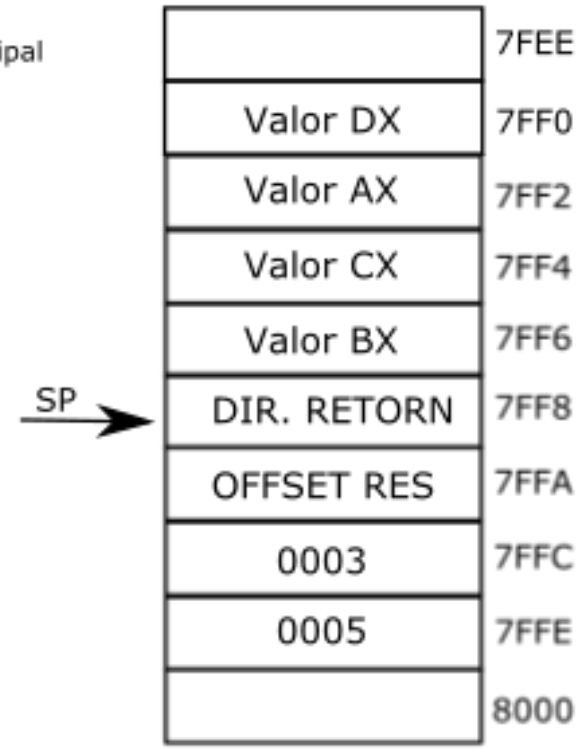

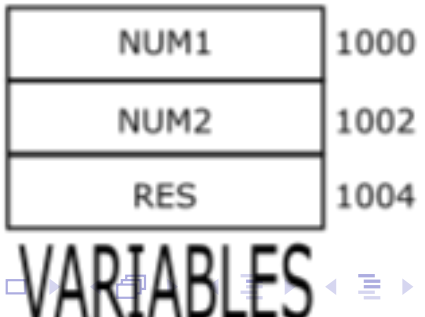

Ejercicio 7 - Pasaje de parámetros por pila

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       POP    DX
       POP    AX
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ORG    2000H ; Programa Principal
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NUM2 DW 3H
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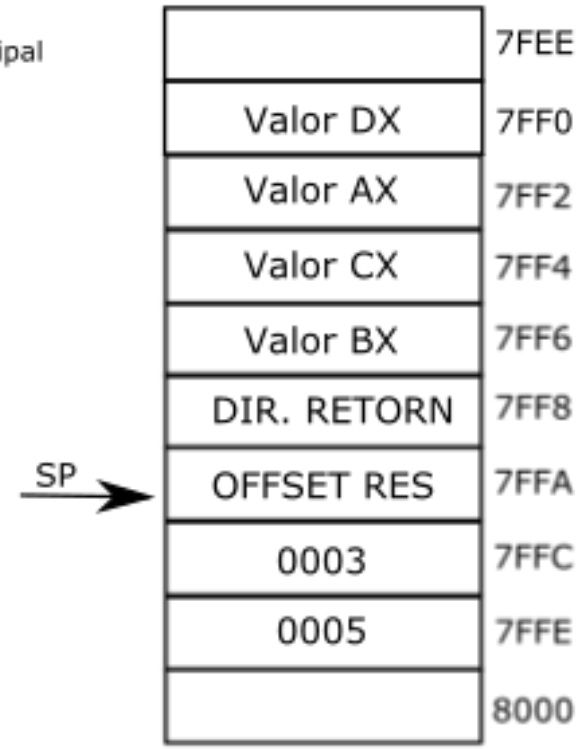

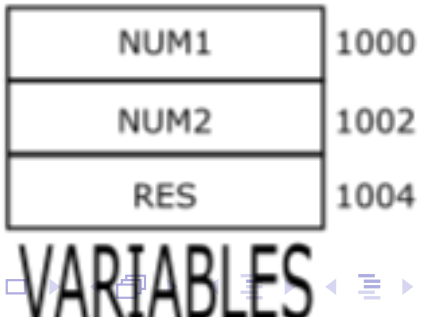

Ejercicio 7 - Pasaje de parámetros por pila

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       POP    DX
       POP    AX
       POP    CX
       POP    BX
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PUSH   AX
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HLT
END


ORG    1000h ; Variables

NUM1 DW 5H
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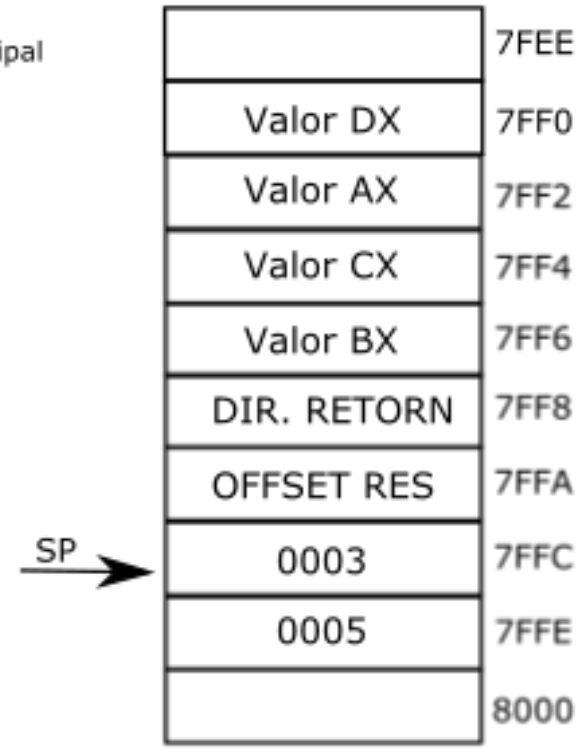

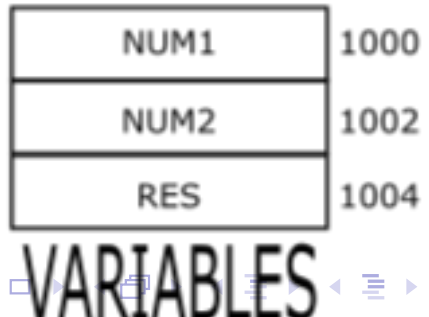

Ejercicio 7 - Pasaje de parámetros por pila

```
 ORG    3000H   ; Subrutina MUL
MUL:   PUSH   BX
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       PUSH   AX
       PUSH   DX
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       ADD    BX, 2
       MOV    AX, [BX]
       SUB    BX, 4
       MOV    BX, [BX]
       MOV    DX, 0
SUMA:  ADD    DX, AX
       DEC    CX
       JNZ    SUMA
       MOV    [BX], DX
       POP    DX
       POP    AX
       POP    CX
       POP    BX
       RET
```

```
ORG    2000H ; Programa Principal
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PUSH   AX
MOV    AX, OFFSET RES
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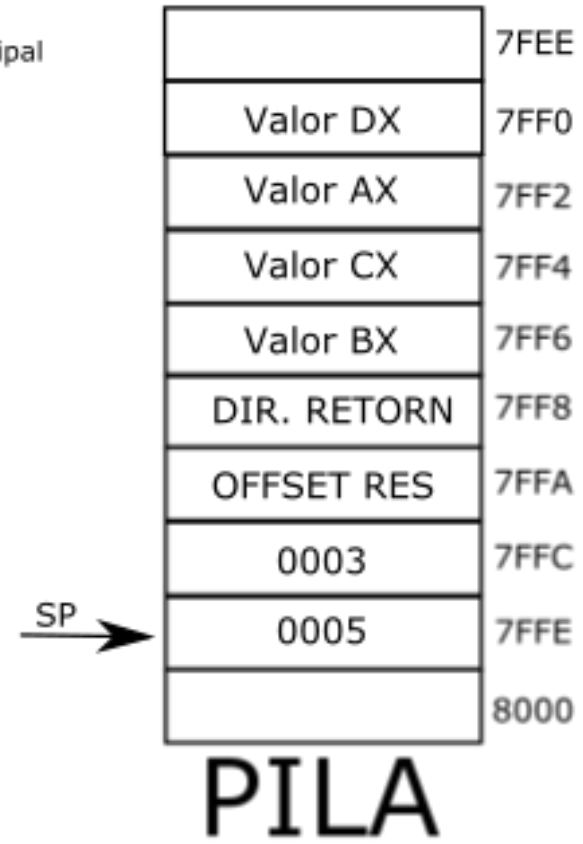
MOV    DX, 0
CALL   MUL
POP    AX
POP    AX
POP    AX
HLT
END


ORG    1000h ; Variables

NUM1 DW 5H
NUM2 DW 3H
RES  DW ?
```



Ejercicio 7 - Pasaje de parámetros por pila

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SUMA:  ADD    DX, AX
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       JNZ    SUMA
       MOV    [BX], DX
       POP    DX
       POP    AX
       POP    CX
       POP    BX
       RET
```

```
ORG    2000H ; Programa Principal
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POP    AX
POP    AX
HLT
END


ORG    1000h ; Variables

NUM1 DW 5H
NUM2 DW 3H
RES  DW ?
```
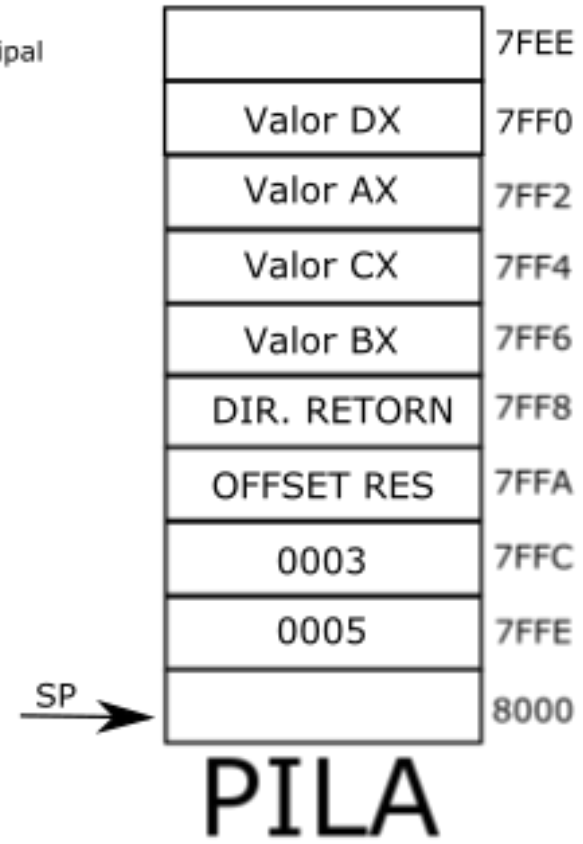



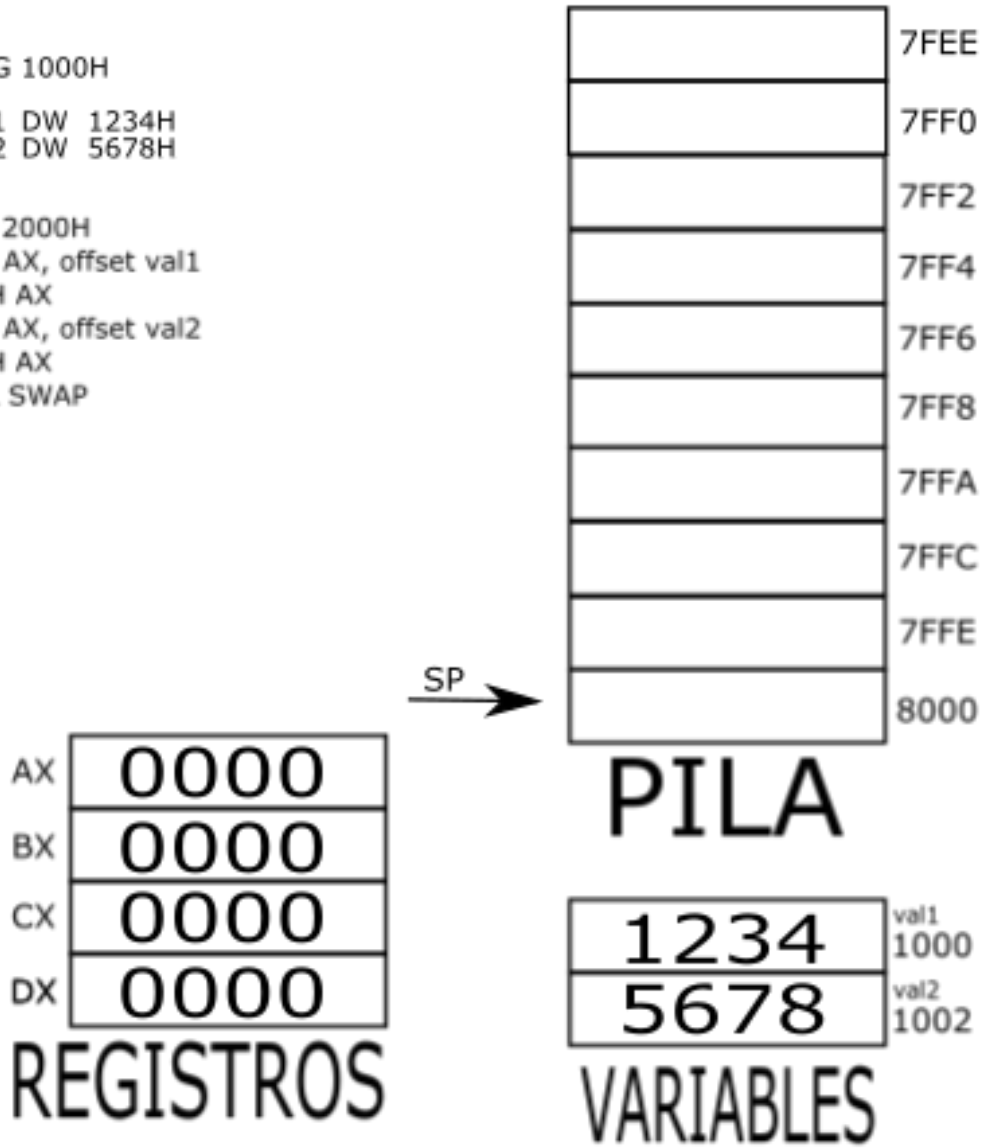
Ejercicio 10 - SWAP (intercambio)

- Escribir una subrutina SWAP que intercambie dos datos de 16 bits almacenados en memoria.
- Los parámetros deben ser pasados por referencia desde el programa principal a través de la pila.

Ejercicio 10 - SWAP

```
ORG 3000H
SWAP: PUSH BX
      PUSH AX
      PUSH DX

      MOV BX, SP
      ADD BX, 8
      MOV BX, [BX]
      MOV CX, [BX]

      MOV BX, SP
      ADD BX, 10
      MOV BX, [BX]
      MOV DX, [BX]

      MOV BX, SP
      ADD BX, 8
      MOV BX, [BX]
      MOV [BX], DX

      MOV BX, SP
      ADD BX, 10
      MOV BX, [BX]
      MOV [BX], CX

      POP DX
      POP AX
      POP BX
      RET
```

```
ORG 1000H

val1 DW 1234H
val2 DW 5678H

ORG 2000H
MOV AX, offset val1
PUSH AX
MOV AX, offset val2
PUSH AX
CALL SWAP
HLT
```



Ejercicio 10 - SWAP

```
ORG 3000H
SWAP: PUSH BX
      PUSH AX
      PUSH DX

      MOV BX, SP
      ADD BX, 8
      MOV BX, [BX]
      MOV CX, [BX]

      MOV BX, SP
      ADD BX, 10
      MOV BX, [BX]
      MOV DX, [BX]

      MOV BX, SP
      ADD BX, 8
      MOV BX, [BX]
      MOV [BX], DX

      MOV BX, SP
      ADD BX, 10
      MOV BX, [BX]
      MOV [BX], CX

      POP DX
      POP AX
      POP BX
      RET
```

```
ORG 1000H

val1 DW 1234H
val2 DW 5678H

ORG 2000H
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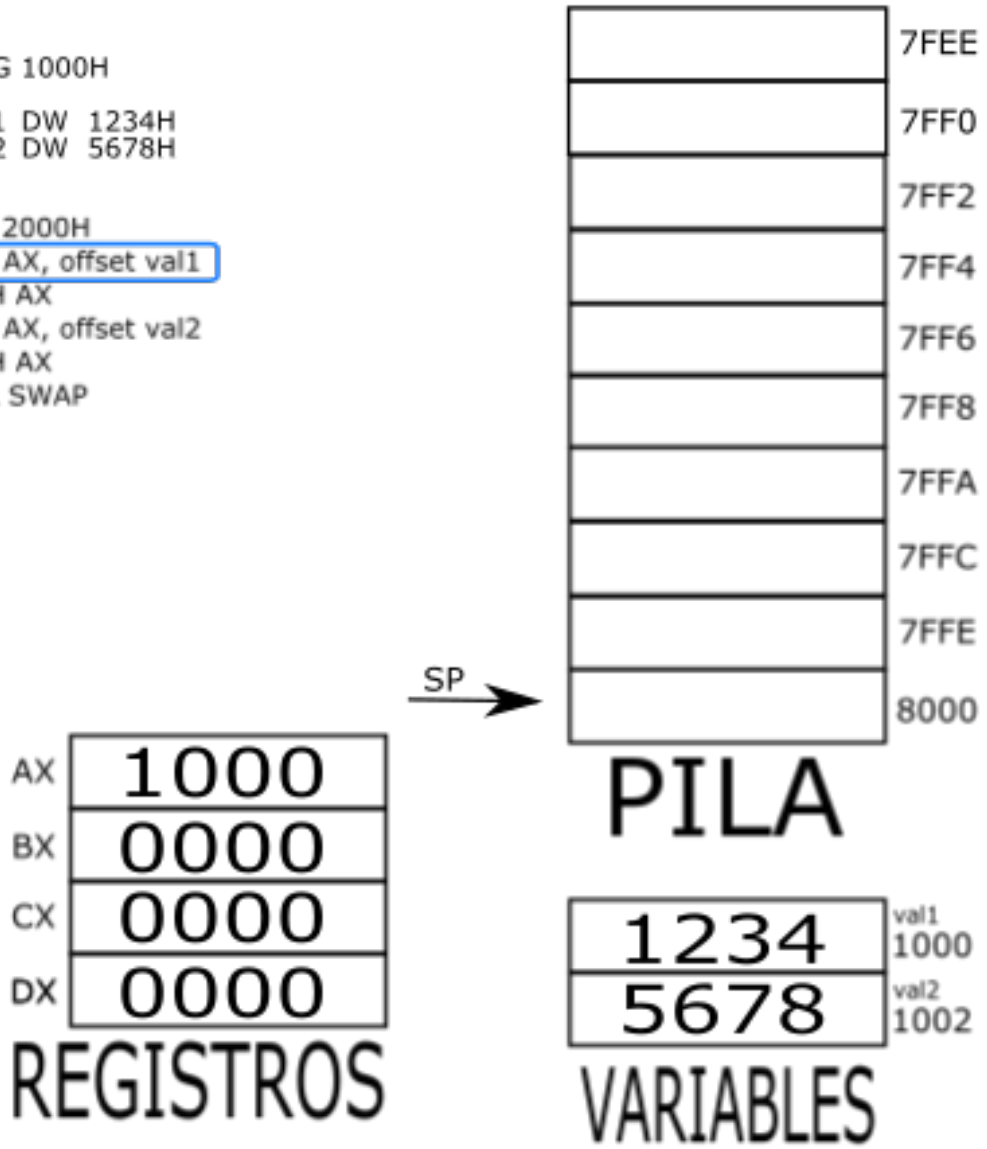

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      ADD BX, 10
      MOV BX, [BX]
      MOV DX, [BX]

      MOV BX, SP
      ADD BX, 8
      MOV BX, [BX]
      MOV [BX], DX

      MOV BX, SP
      ADD BX, 10
      MOV BX, [BX]
      MOV [BX], CX

      POP DX
      POP AX
      POP BX
      RET
```

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ORG 1000H

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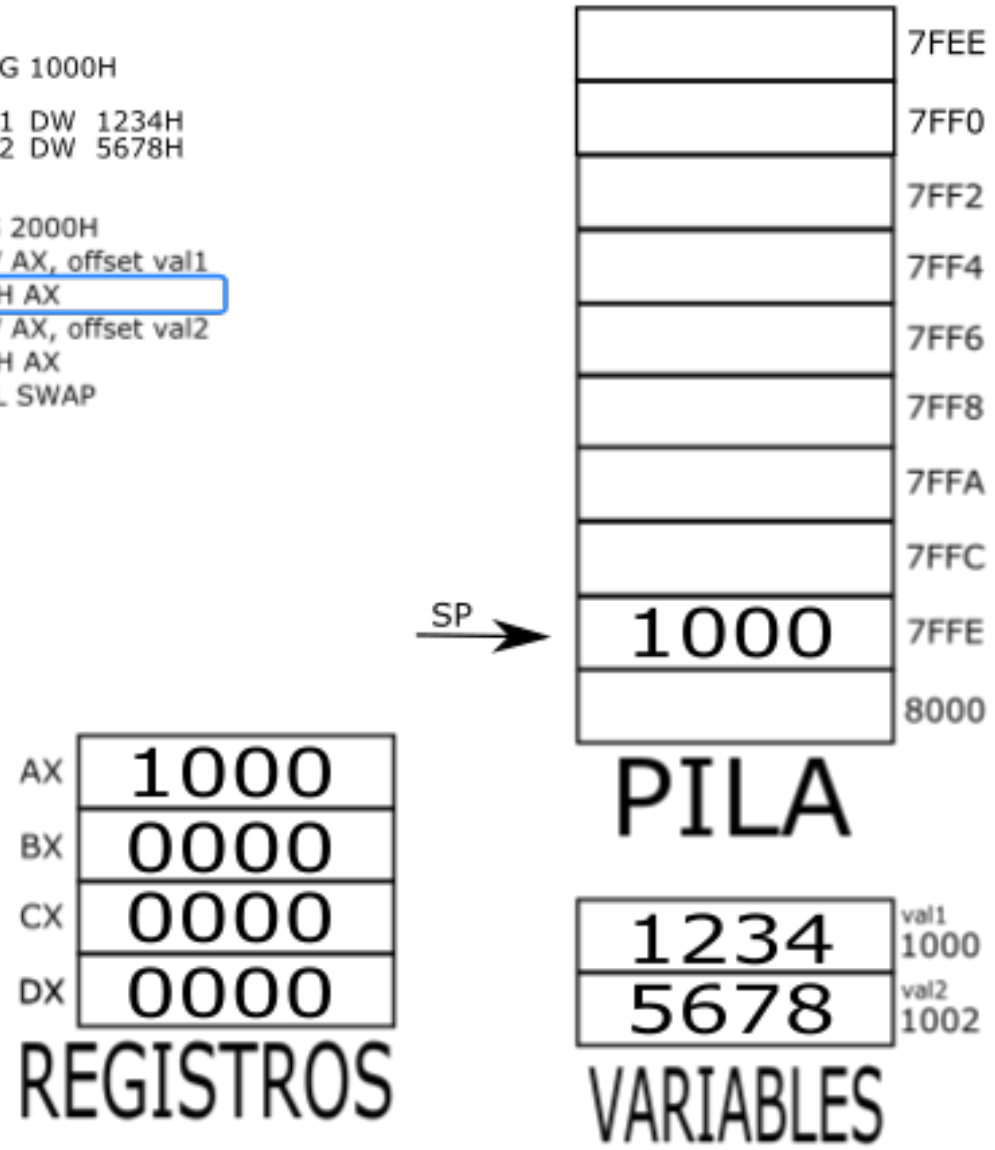

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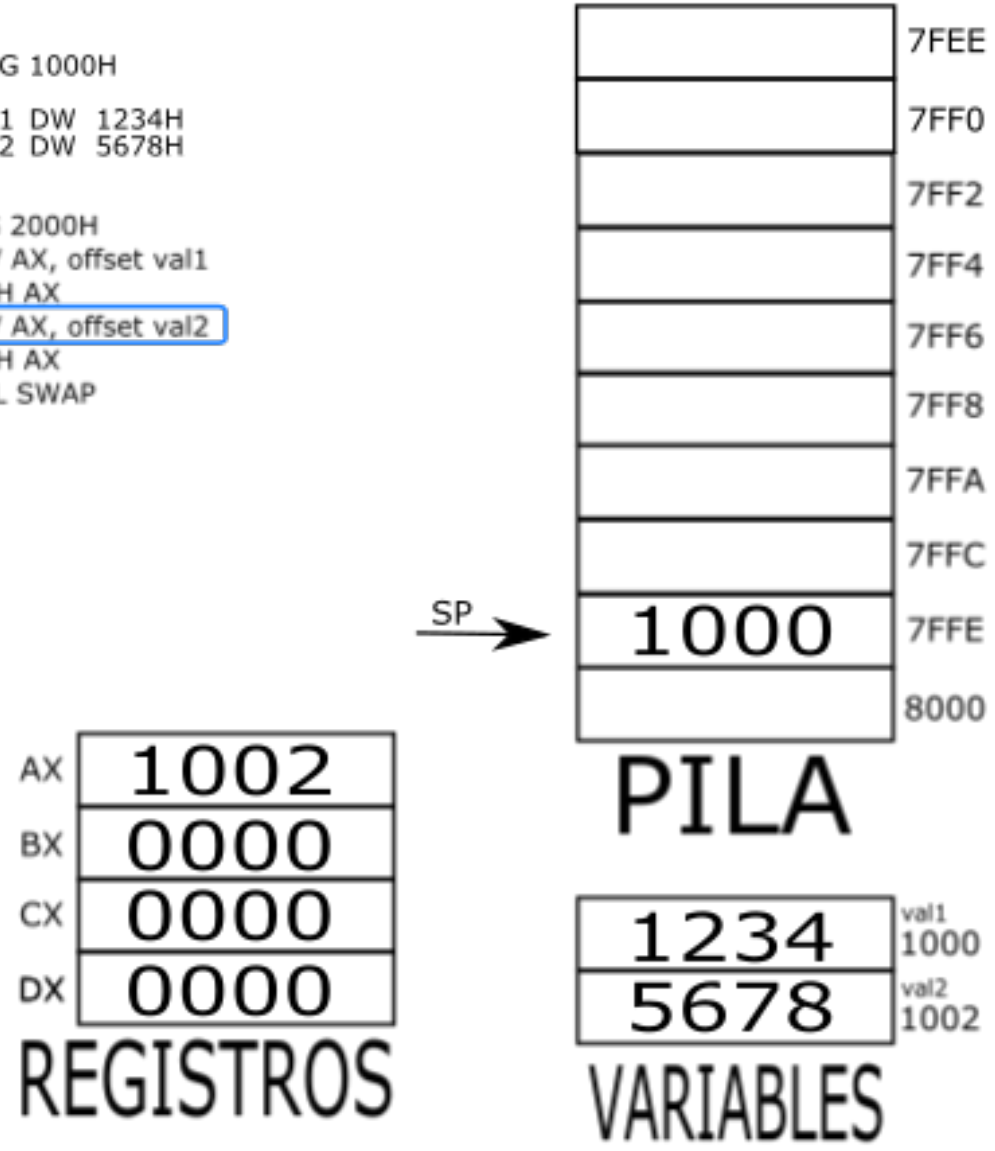

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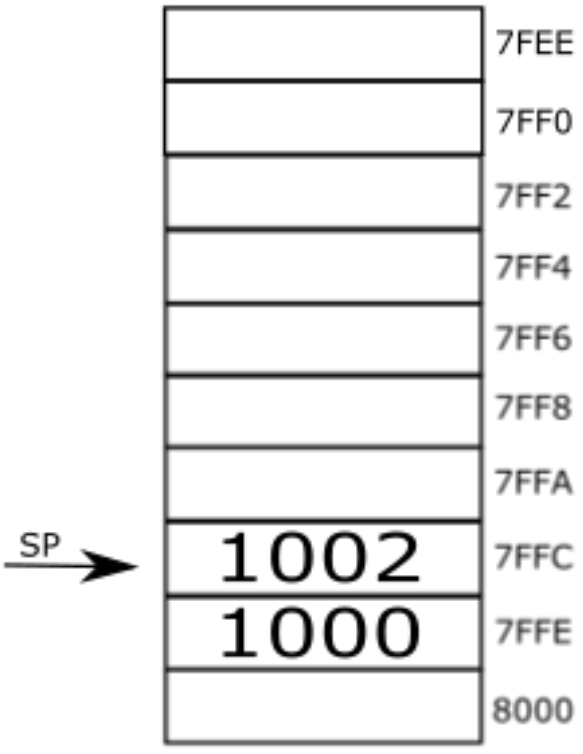
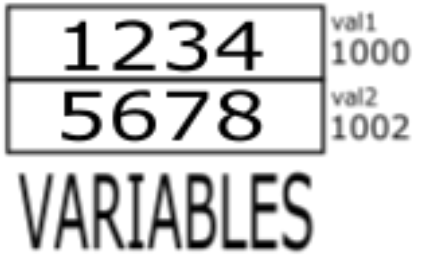
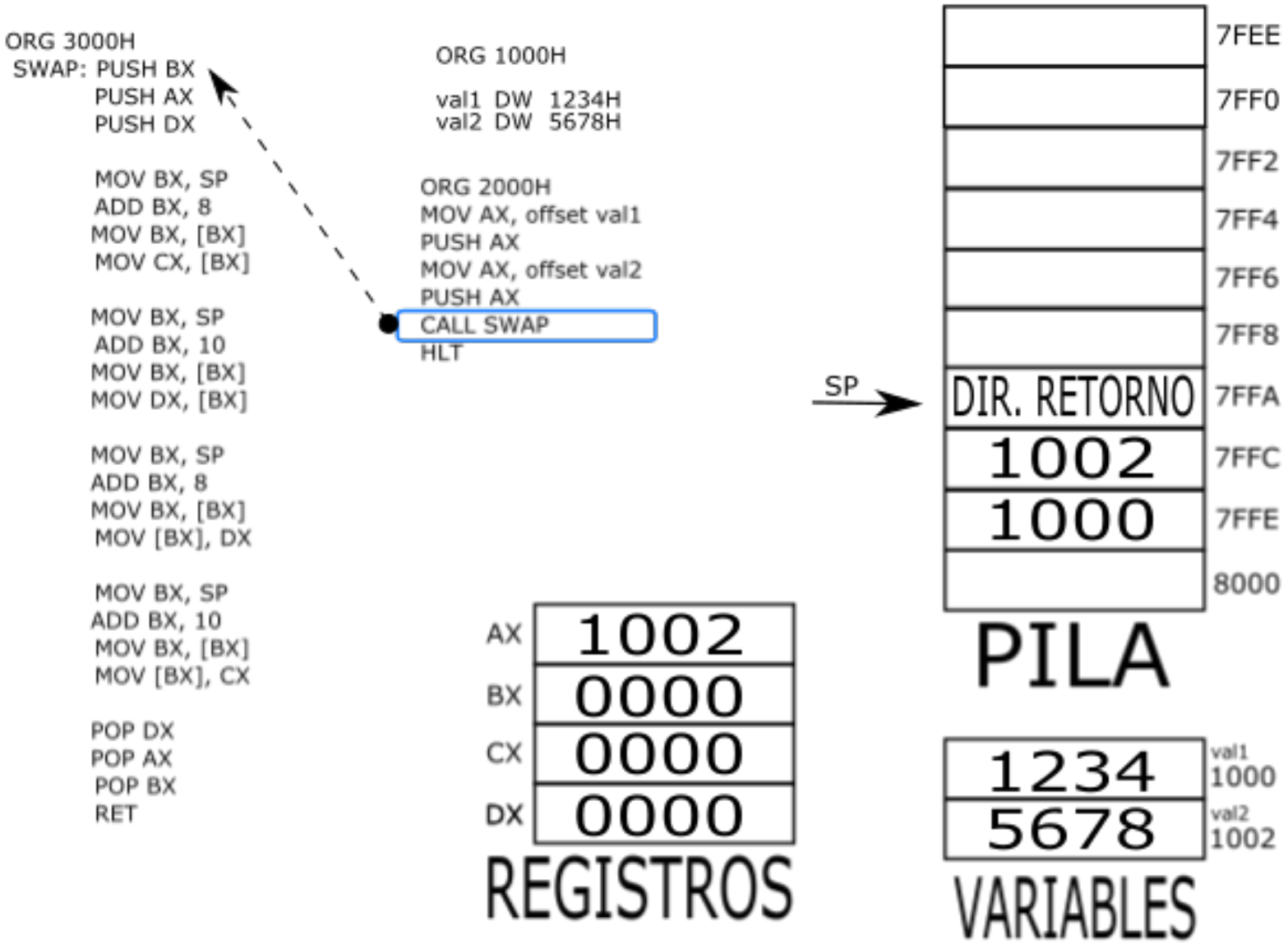
```





Ejercicio 10 - SWAP



Ejercicio 10 - SWAP

```
ORG 3000H
SWAP: PUSH BX
      PUSH AX
      PUSH DX

      MOV BX, SP
      ADD BX, 8
      MOV BX, [BX]
      MOV CX, [BX]

      MOV BX, SP
      ADD BX, 10
      MOV BX, [BX]
      MOV DX, [BX]

      MOV BX, SP
      ADD BX, 8
      MOV BX, [BX]
      MOV [BX], DX

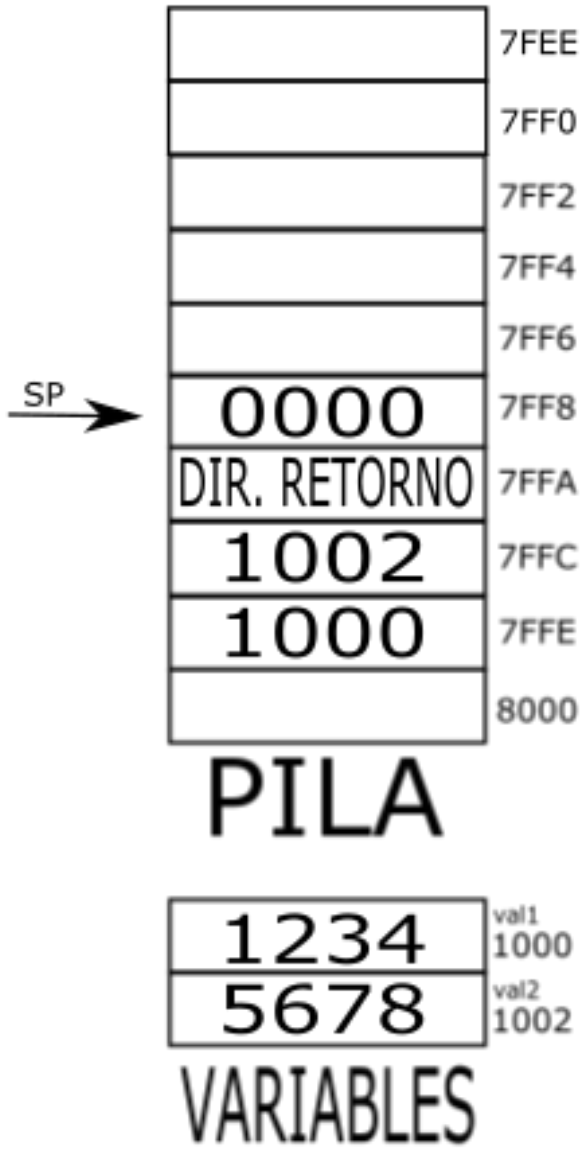
      MOV BX, SP
      ADD BX, 10
      MOV BX, [BX]
      MOV [BX], CX

      POP DX
      POP AX
      POP BX
      RET
```

```
ORG 1000H

val1 DW 1234H
val2 DW 5678H

ORG 2000H
MOV AX, offset val1
PUSH AX
MOV AX, offset val2
PUSH AX
CALL SWAP
HLT
```



Ejercicio 10 - SWAP

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SWAP: PUSH BX
      PUSH AX
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      MOV [BX], DX

      MOV BX, SP
      ADD BX, 10
      MOV BX, [BX]
      MOV [BX], CX

      POP DX
      POP AX
      POP BX
      RET
```

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ORG 1000H

val1 DW  1234H
val2 DW  5678H

ORG 2000H
MOV AX, offset val1
PUSH AX
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HLT
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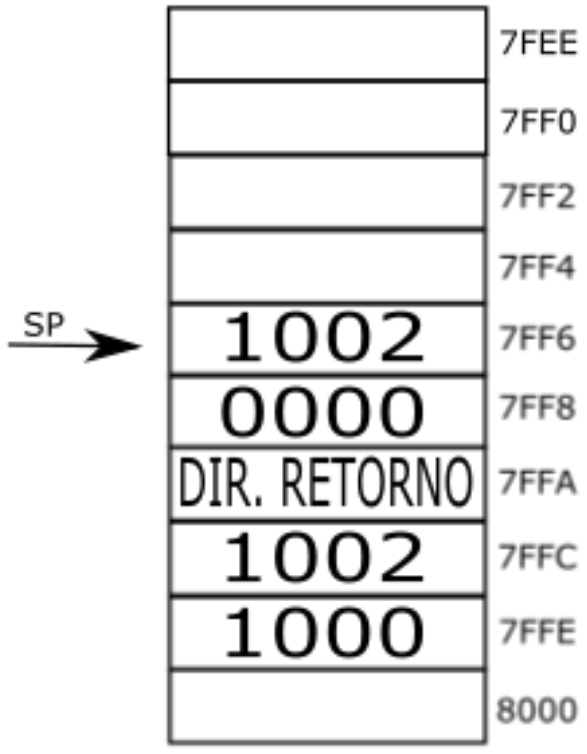

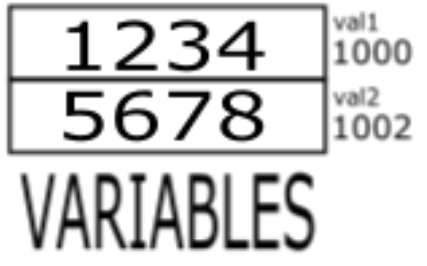

Ejercicio 10 - SWAP

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      POP AX
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      RET
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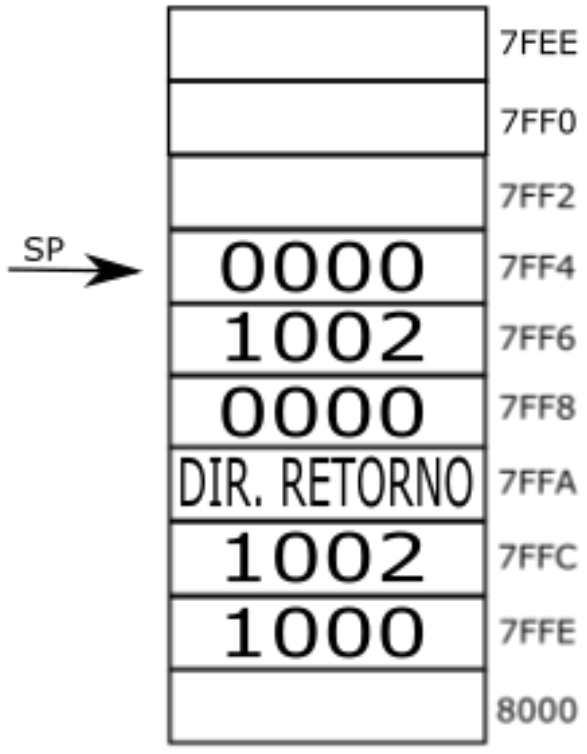

AX	1002
BX	0000
CX	0000
DX	0000

REGISTROS

1234	val1 1000
5678	val2 1002

VARIABLES

Ejercicio 10 - SWAP

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      POP DX
      POP AX
      POP BX
      RET
```

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ORG 1000H

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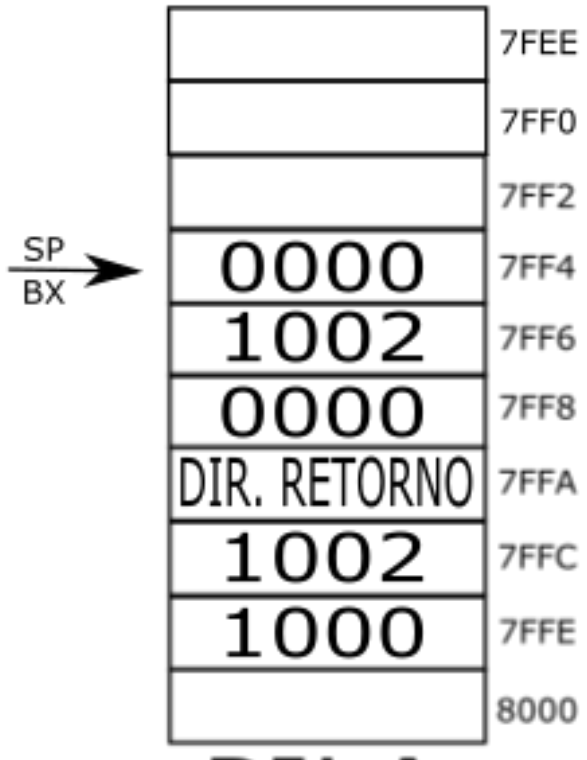

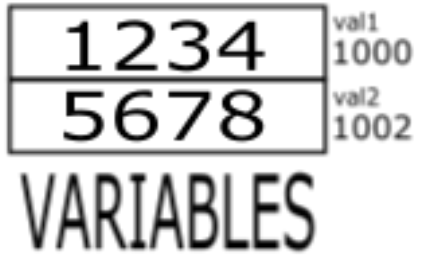

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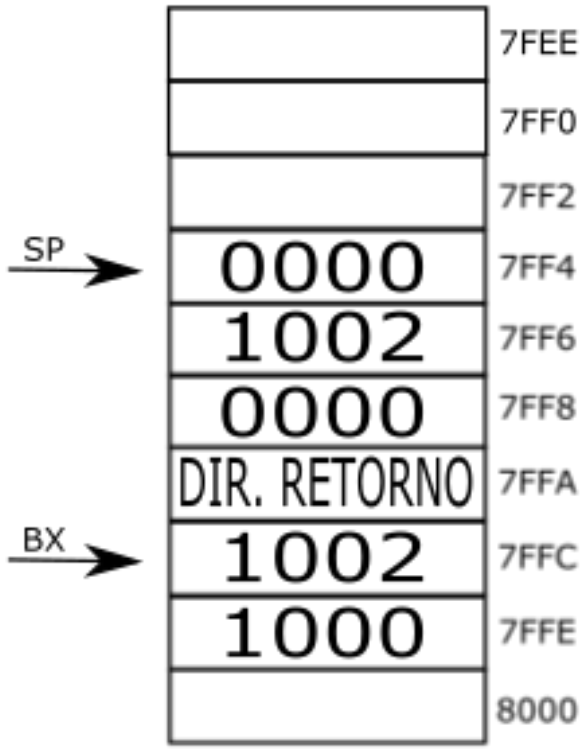

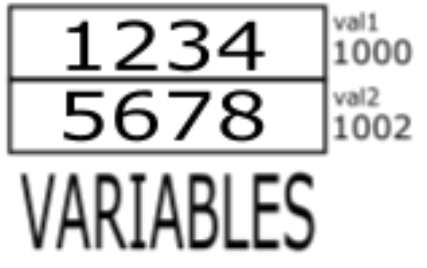

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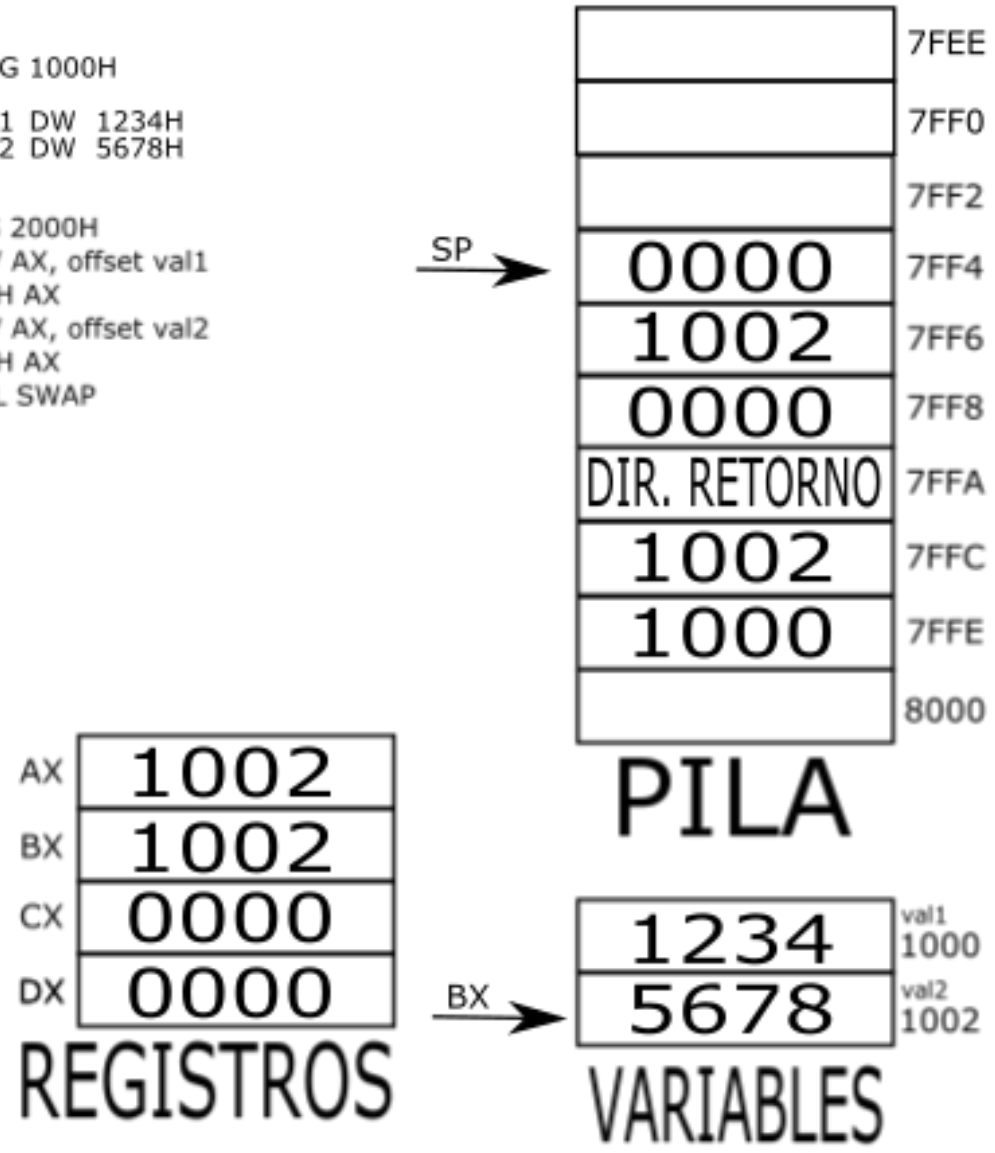

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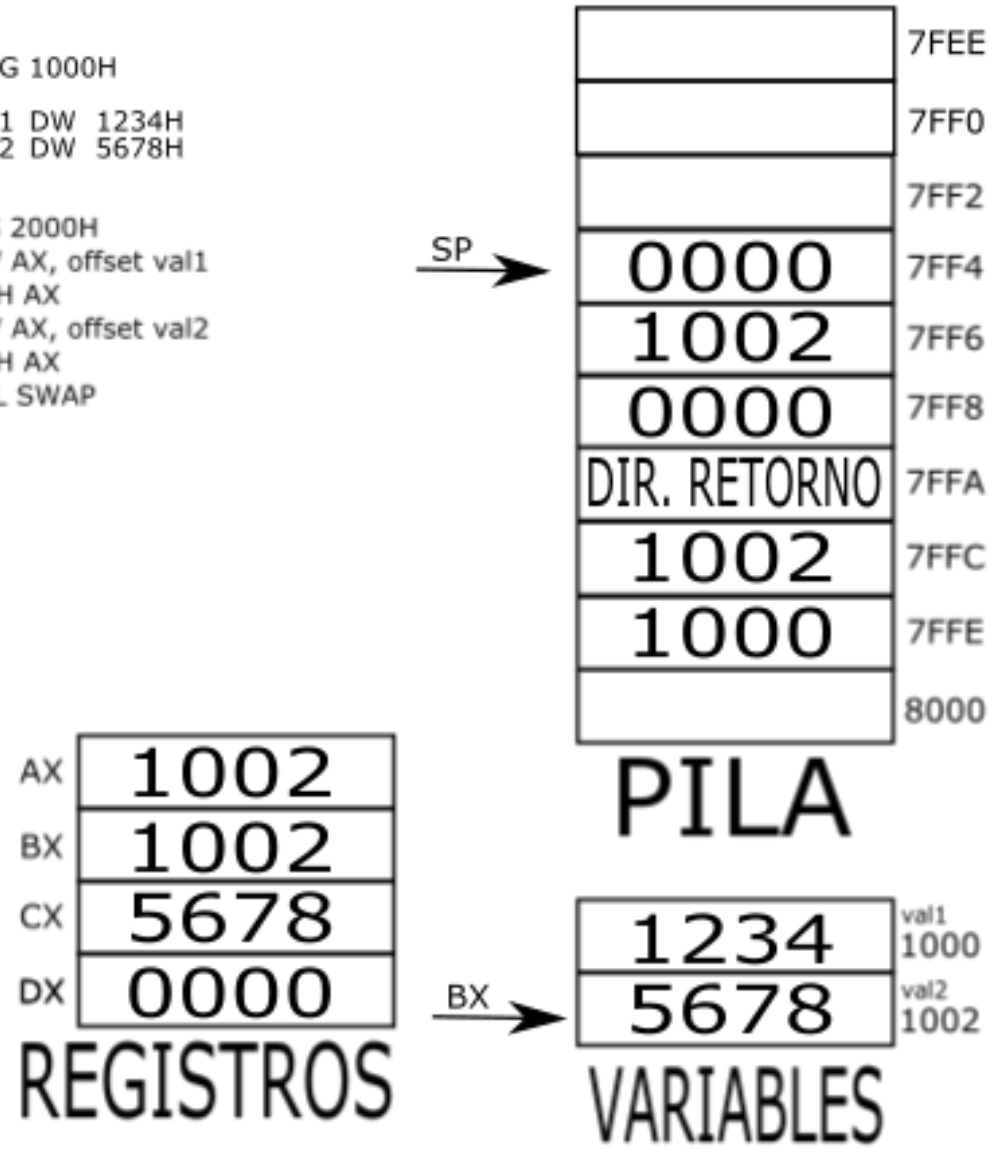

Ejercicio 10 - SWAP

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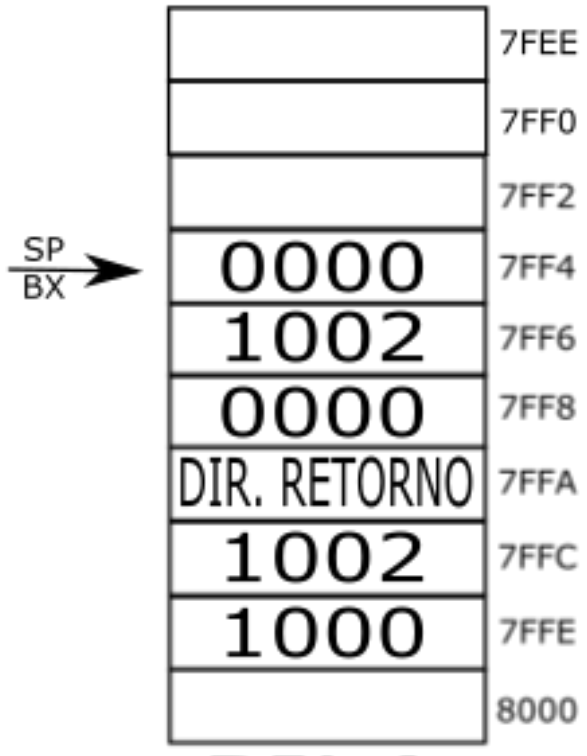

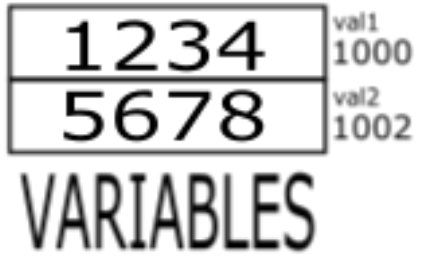

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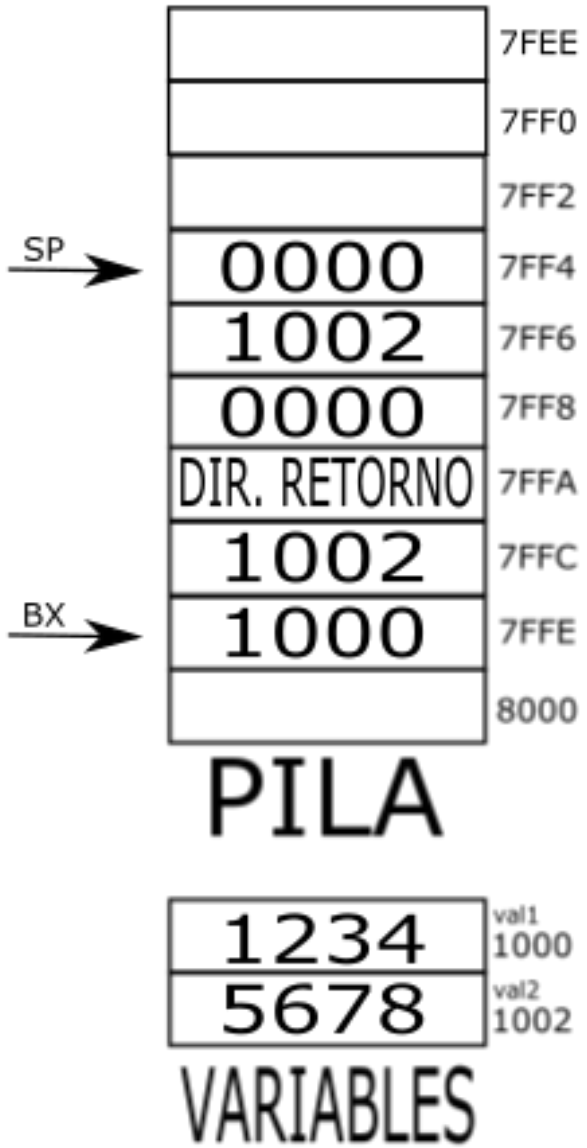

Ejercicio 10 - SWAP

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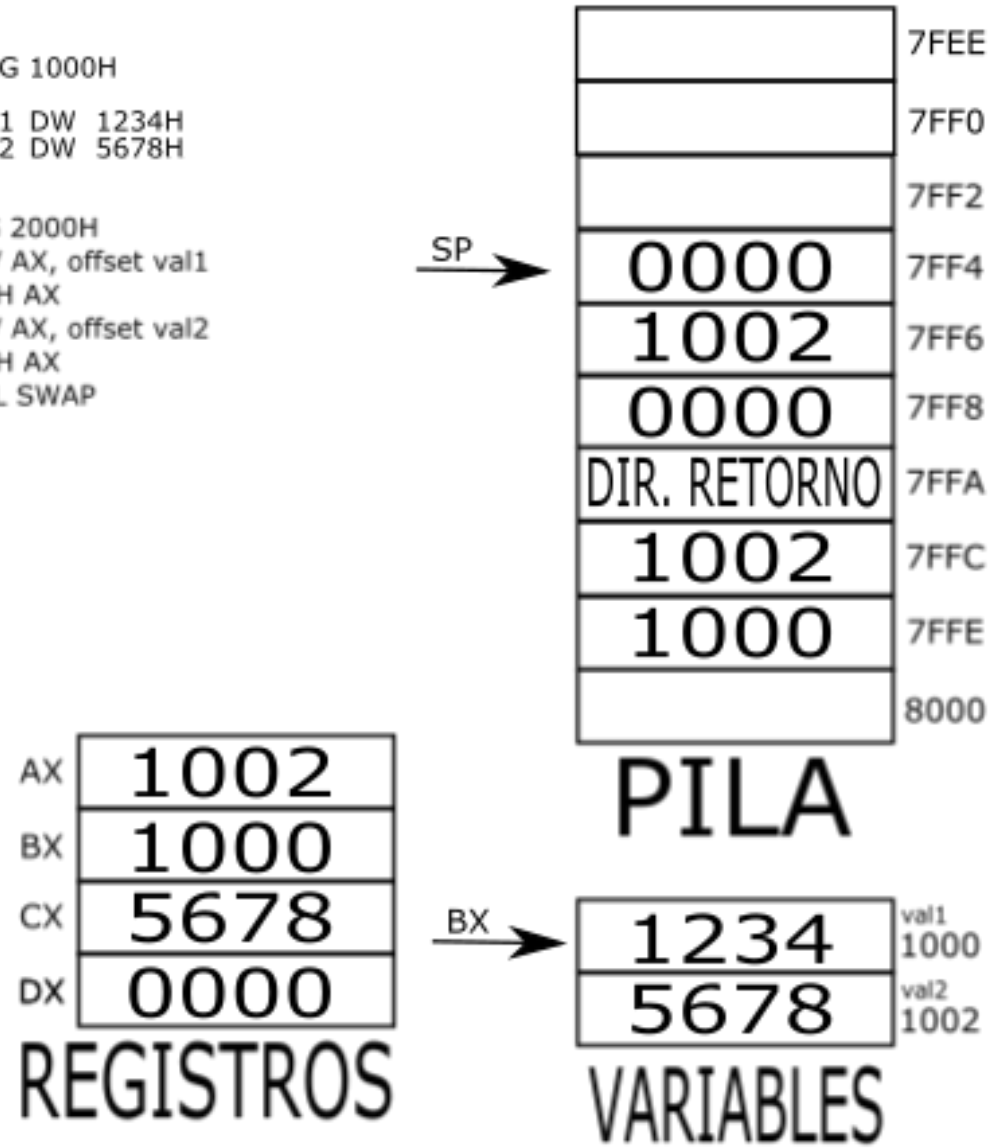

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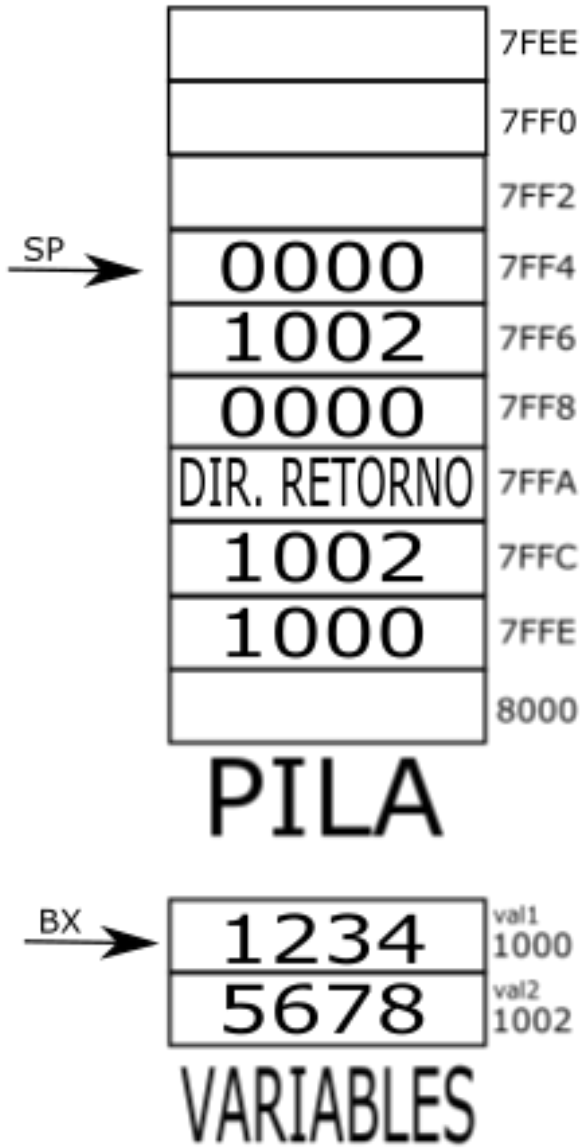

Ejercicio 10 - SWAP

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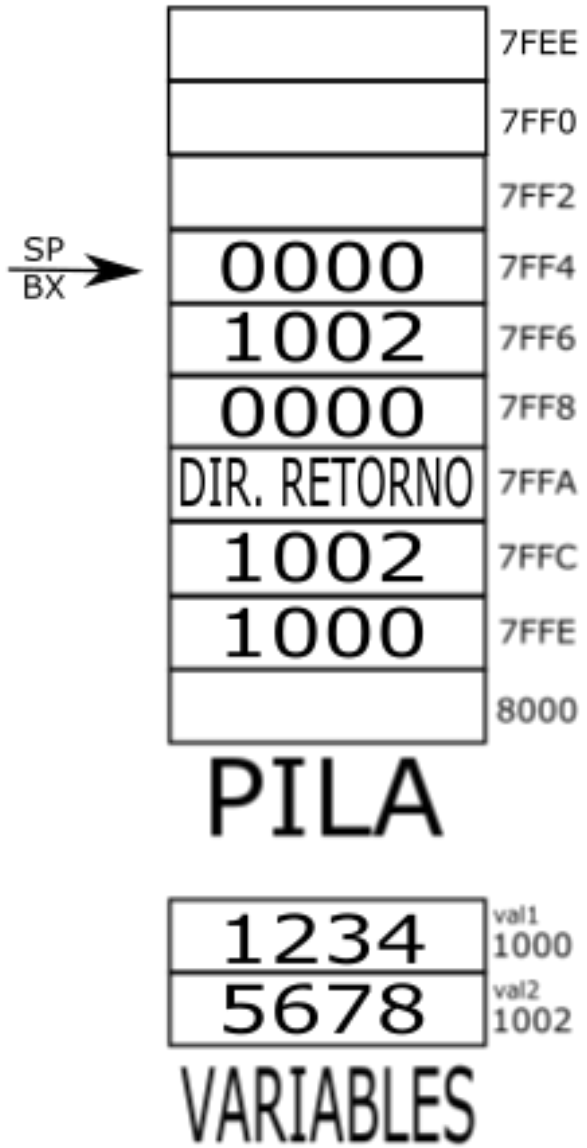

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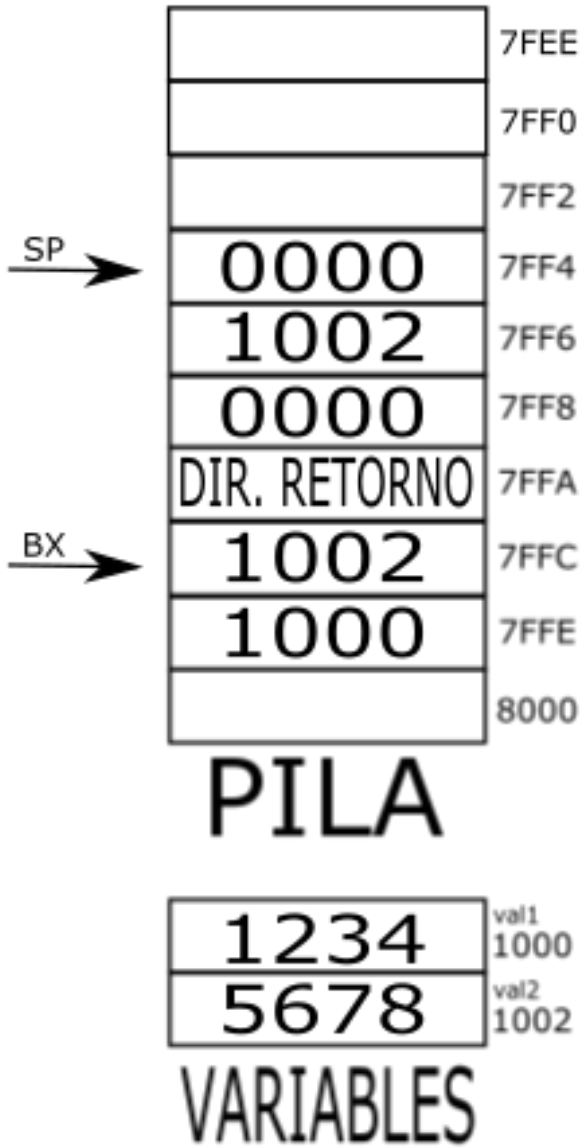

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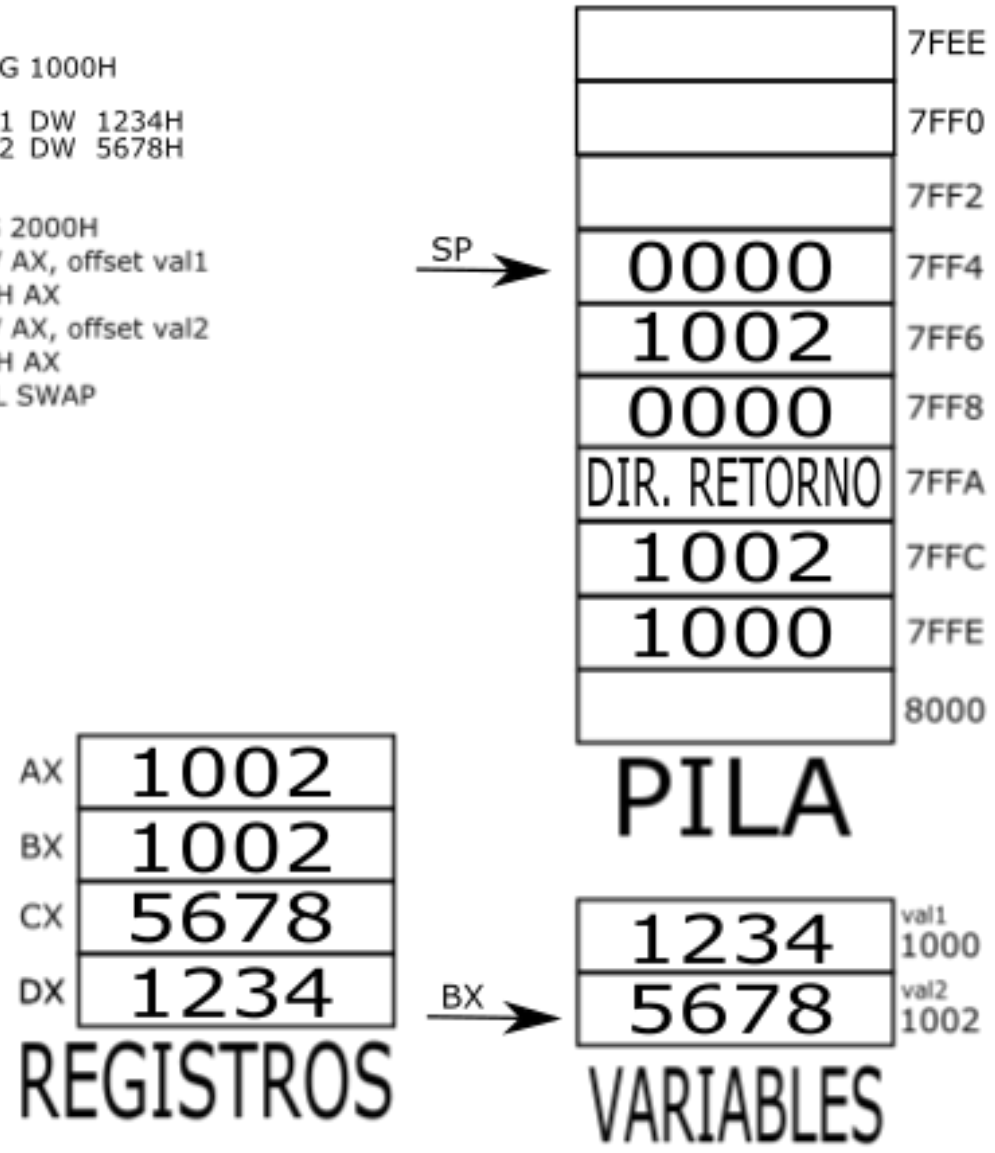

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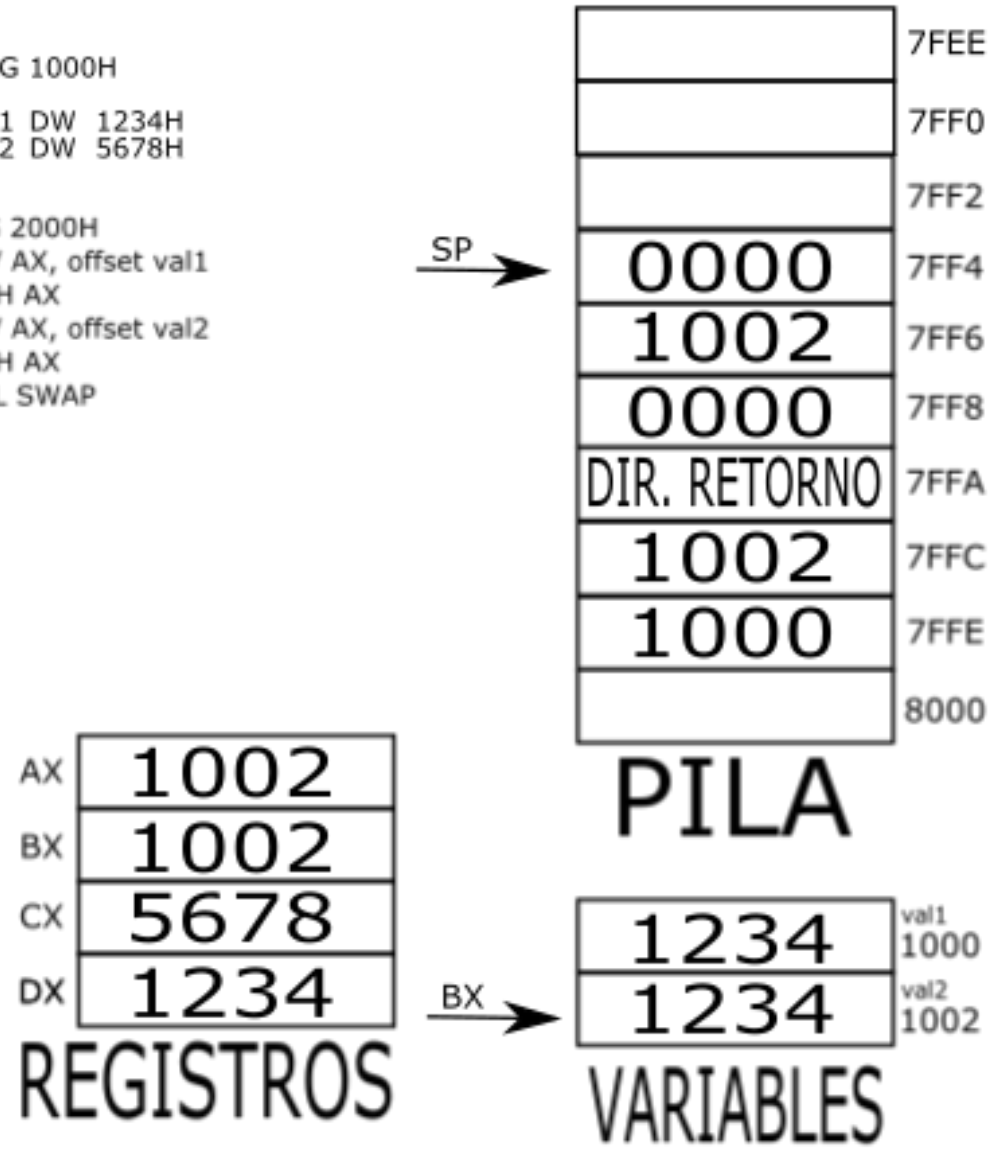

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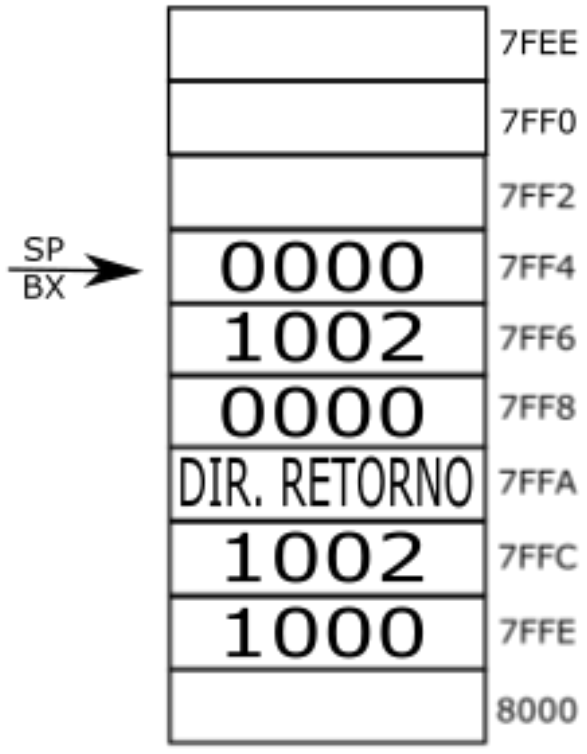

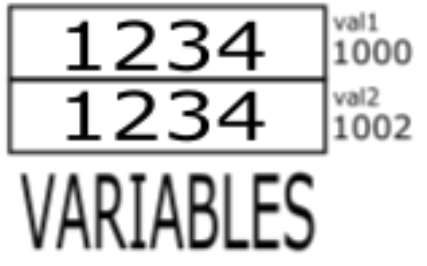

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      MOV [BX], DX

      MOV BX, SP
      ADD BX, 10
      MOV BX, [BX]
      MOV [BX], CX

      POP DX
      POP AX
      POP BX
      RET
```
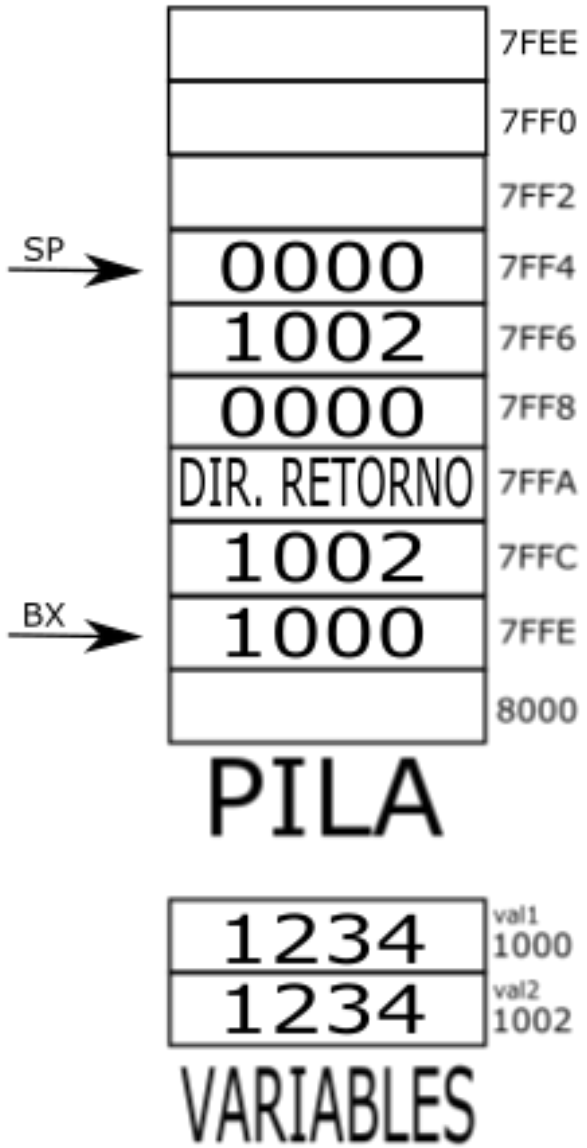

```
ORG 1000H

val1 DW  1234H
val2 DW  5678H

ORG 2000H
MOV AX, offset val1
PUSH AX
MOV AX, offset val2
PUSH AX
CALL SWAP
HLT
```



Ejercicio 10 - SWAP

```
ORG 3000H
SWAP: PUSH BX
      PUSH AX
      PUSH DX

      MOV BX, SP
      ADD BX, 8
      MOV BX, [BX]
      MOV CX, [BX]

      MOV BX, SP
      ADD BX, 10
      MOV BX, [BX]
      MOV DX, [BX]

      MOV BX, SP
      ADD BX, 8
      MOV BX, [BX]
      MOV [BX], DX

      MOV BX, SP
      ADD BX, 10
      MOV BX, [BX]
      MOV [BX], CX

      POP DX
      POP AX
      POP BX
      RET
```

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ORG 1000H

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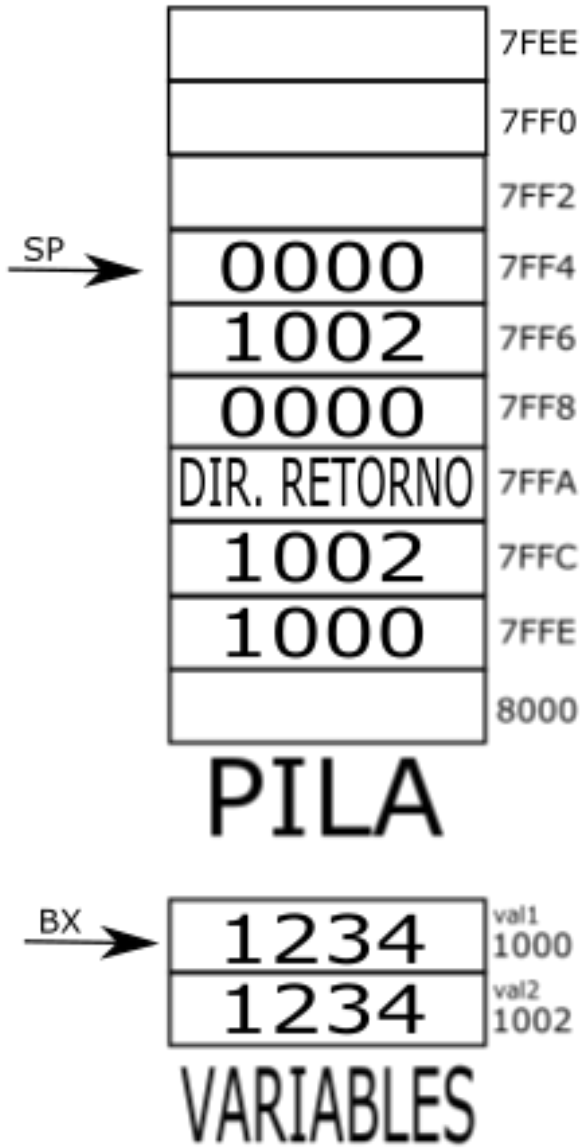

Ejercicio 10 - SWAP

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ORG 3000H
SWAP: PUSH BX
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      PUSH DX

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      MOV BX, [BX]
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      ADD BX, 10
      MOV BX, [BX]
      MOV DX, [BX]

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      MOV [BX], DX

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      ADD BX, 10
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      MOV [BX], CX

      POP DX
      POP AX
      POP BX
      RET
```

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ORG 1000H

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HLT
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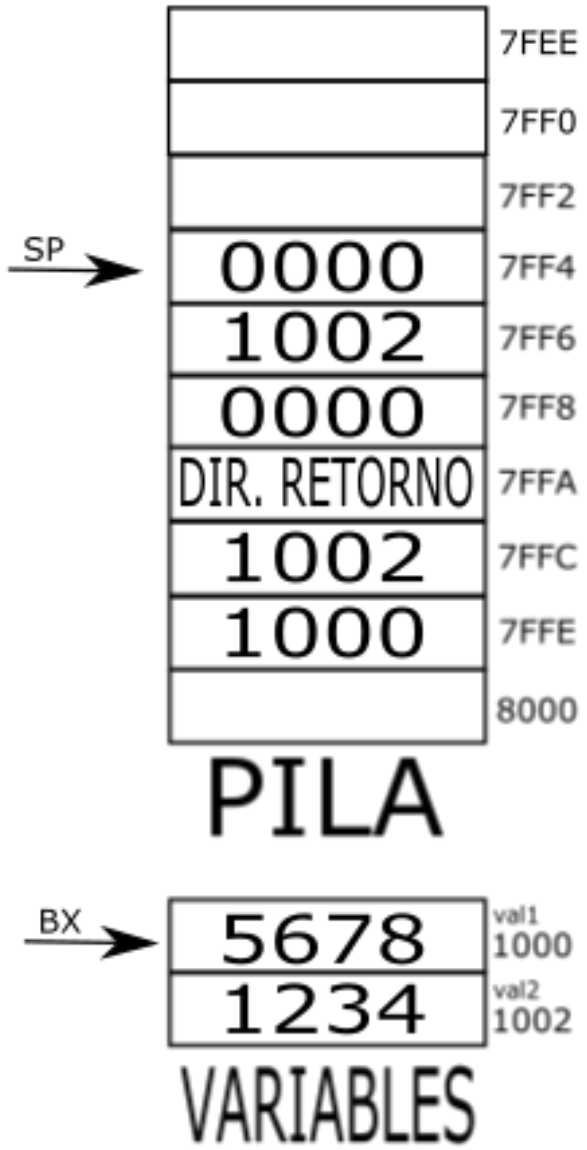

Ejercicio 10 - SWAP

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ORG 3000H
SWAP: PUSH BX
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      MOV [BX], CX

      POP DX
      POP AX
      POP BX
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ORG 1000H

val1 DW  1234H
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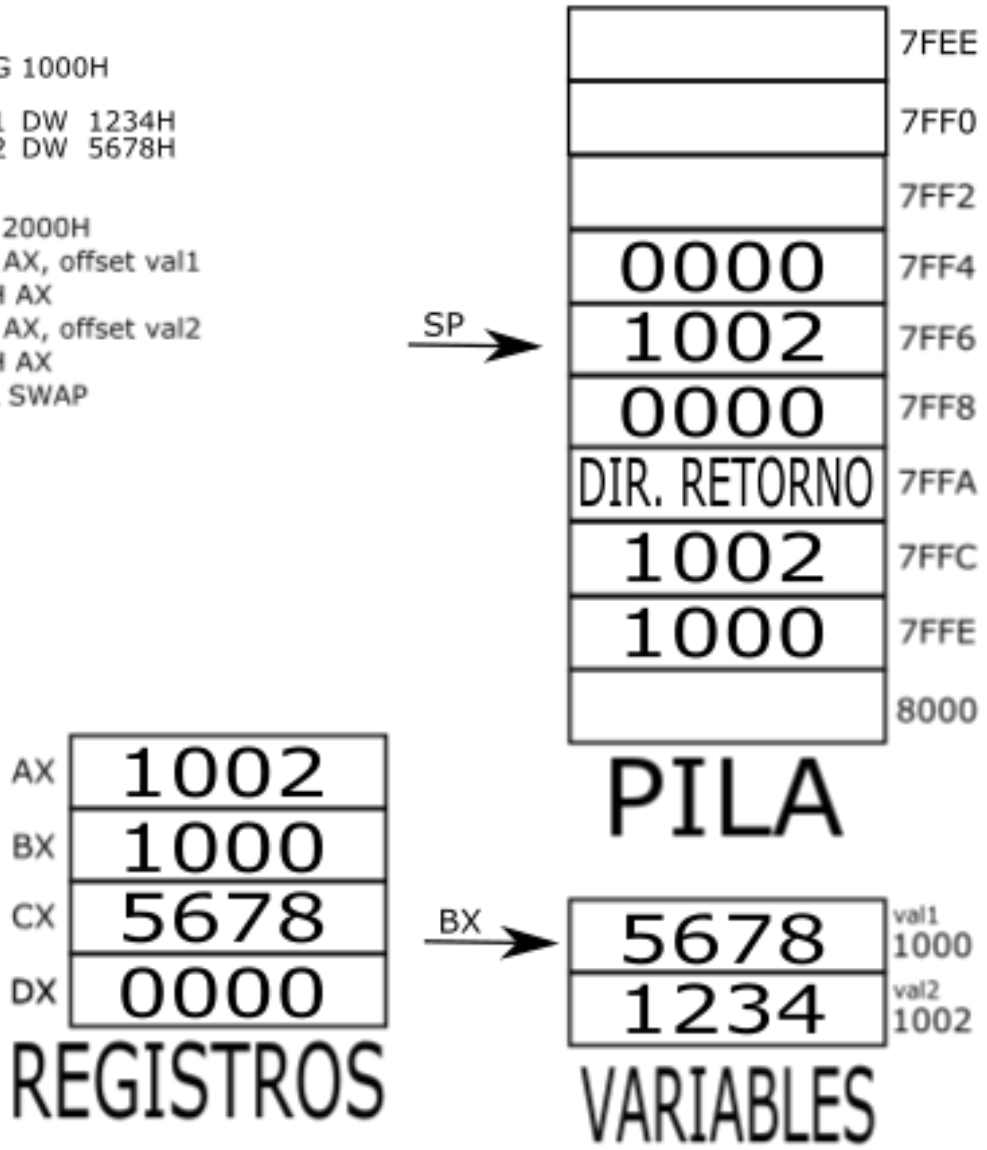

Ejercicio 10 - SWAP

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ORG 3000H
SWAP: PUSH BX
      PUSH AX
      PUSH DX

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      ADD BX, 10
      MOV BX, [BX]
      MOV DX, [BX]

      MOV BX, SP
      ADD BX, 8
      MOV BX, [BX]
      MOV [BX], DX

      MOV BX, SP
      ADD BX, 10
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      MOV [BX], CX

      POP DX
      POP AX
      POP BX
      RET
```

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ORG 1000H

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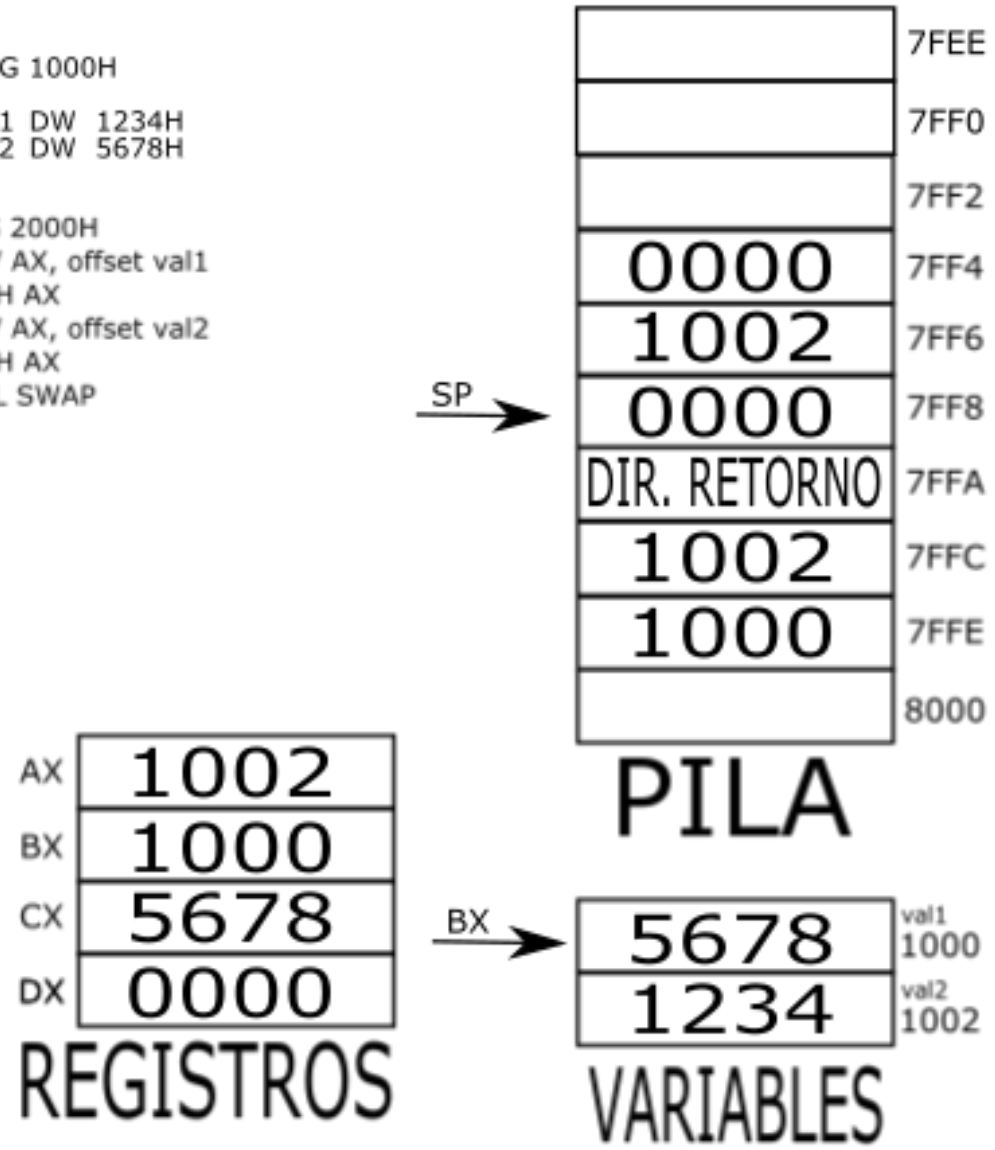
CALL SWAP
HLT
```



Ejercicio 10 - SWAP

```
ORG 3000H
SWAP: PUSH BX
      PUSH AX
      PUSH DX

      MOV BX, SP
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      MOV BX, [BX]
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      ADD BX, 10
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      MOV DX, [BX]

      MOV BX, SP
      ADD BX, 8
      MOV BX, [BX]
      MOV [BX], DX

      MOV BX, SP
      ADD BX, 10
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      MOV [BX], CX

      POP DX
      POP AX
      POP BX
      RET
```

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ORG 1000H

val1 DW  1234H
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ORG 2000H
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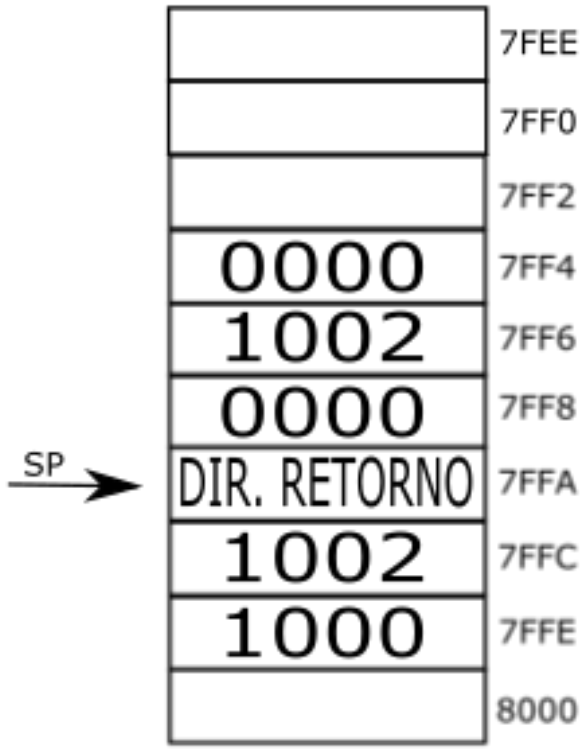

AX	1002
BX	0000
CX	5678
DX	0000

REGISTROS

5678	val1 1000
1234	val2 1002

VARIABLES

Ejercicio 10 - SWAP

```
ORG 3000H
SWAP: PUSH BX
      PUSH AX
      PUSH DX

      MOV BX, SP
      ADD BX, 8
      MOV BX, [BX]
      MOV CX, [BX]

      MOV BX, SP
      ADD BX, 10
      MOV BX, [BX]
      MOV DX, [BX]

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      MOV [BX], DX

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      POP DX
      POP AX
      POP BX
      RET
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ORG 1000H

val1 DW  1234H
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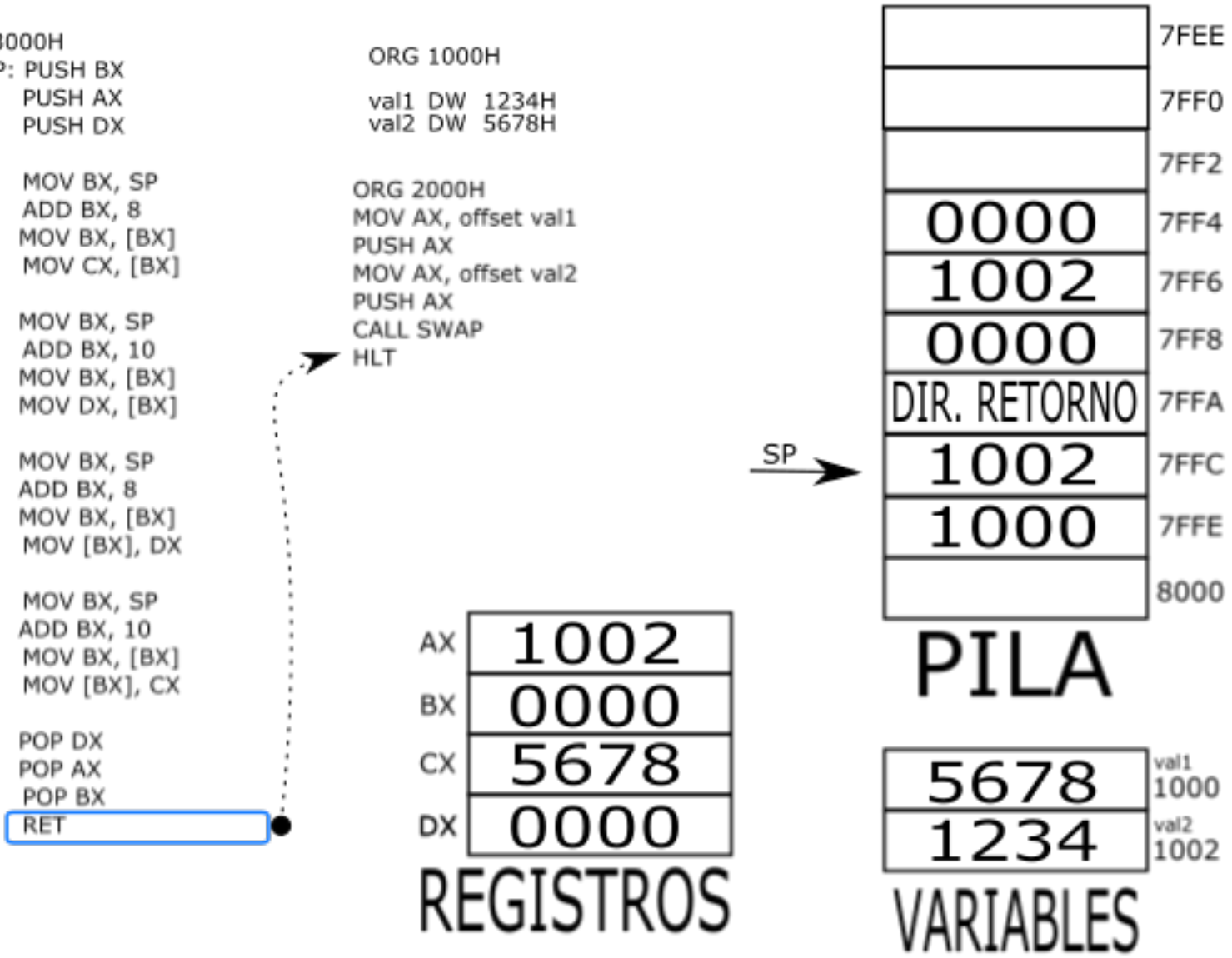

Ejercicio 10 - SWAP

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ORG 3000H
SWAP: PUSH BX
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      PUSH DX

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      POP DX
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      POP BX
      RET
```

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ORG 1000H

val1 DW 1234H
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```

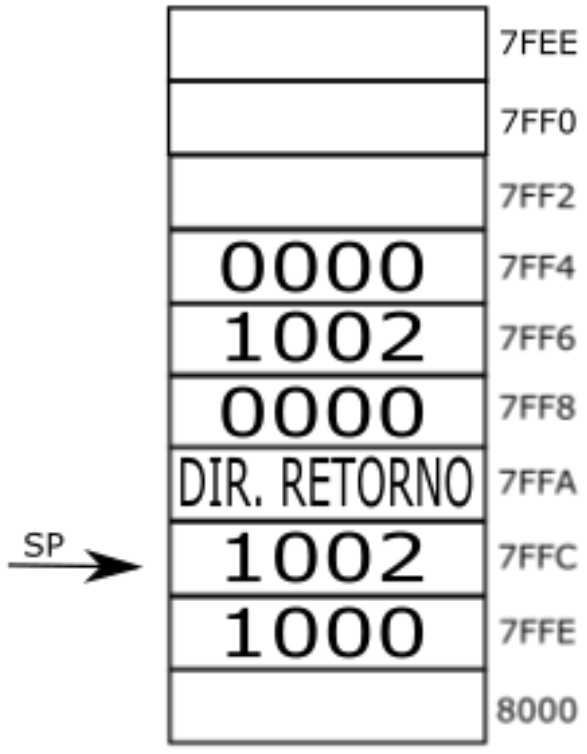

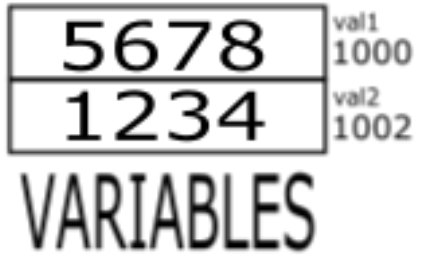

Ejercicio 10 - SWAP (intercambio)

El programa cumple con el enunciado, pero...

- No desapila los dos parámetros de la pila
- La subrutina preserva los registros AX, BX y DX. Pero modifica los registro BX, CX y DX. No es necesario preservar AX, CX si.