Structures in Assembly

Adalbert **Gerald** Soosai Raj

C

```
#define N 2

int func()
{
    struct point {
        int x;
        int y;
    };

    struct point p[N];
    int i;

    for (i = 0; i < N; ++i)
    {
        p[i].x = 0;
        p[i].y = 1;
    }
}
```

	x	y
p[0]		
p[1]		

```
#define N 2

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    struct point {
        int x;
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    {
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}
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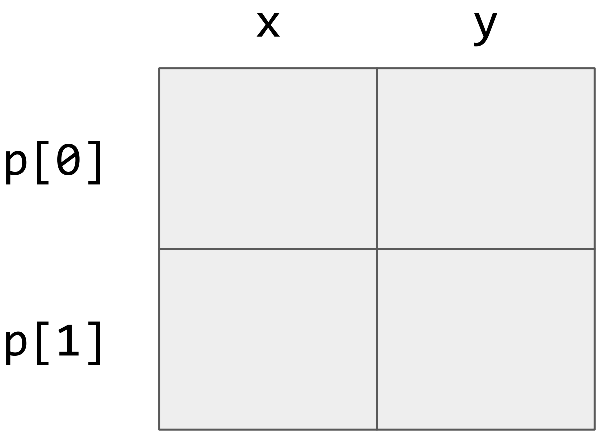

	x	y
p[0]		
p[1]		

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int func()
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	x	y
p[0]	0	
p[1]		

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int func()
{
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    struct point p[N];
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    {
        p[i].x = 0;
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}
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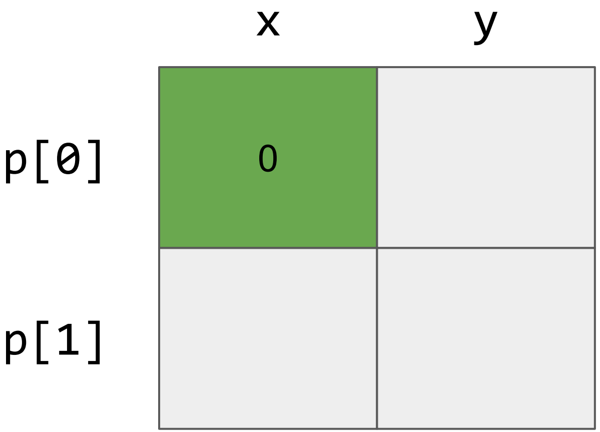

	x	y
p[0]	0	
p[1]		

```c
#define N 2

int func()
{
    struct point {
        int x;
        int y;
    };

    struct point p[N];
    int i;

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    {
        p[i].x = 0;
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    }
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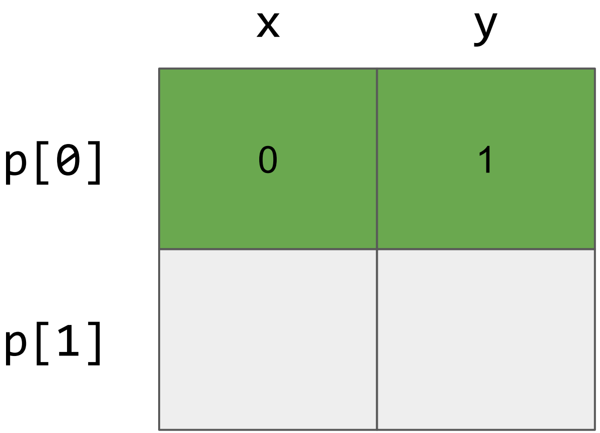

	x	y
p[0]	0	1
p[1]		

```
#define N 2

int func()
{
    struct point {
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    };

    struct point p[N];
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    for (i = 0; i < N; ++i)
    {
        p[i].x = 0;
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}
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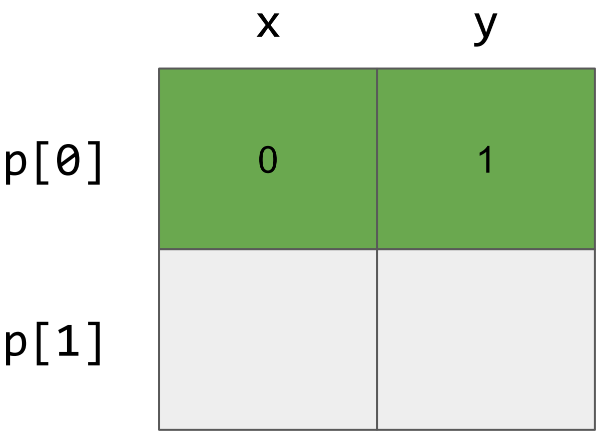

	x	y
p[0]	0	1
p[1]		

```
#define N 2

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{
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    struct point p[N];
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    {
        p[i].x = 0;
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    }
}
```

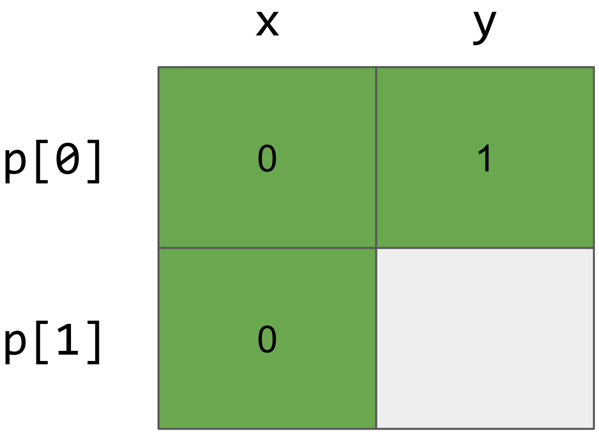

	x	y
p[0]	0	1
p[1]	0	

```
#define N 2

int func()
{
    struct point {
        int x;
        int y;
    };

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	x	y
p[0]	0	1
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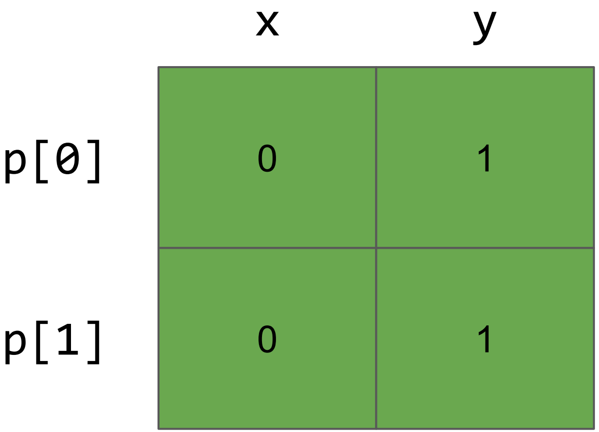
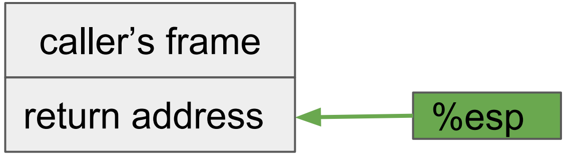
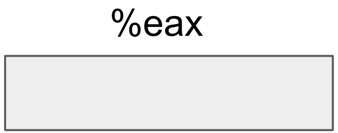


	x	y
p[0]	0	1
p[1]	0	1

Assembly

```
func:
    pushl   %ebp
    movl    %esp, %ebp
    subl    $32, %esp
    movl    $0, -4(%ebp)
    jmp .L2
.L3:
    movl    -4(%ebp), %eax
    movl    $0, -20(%ebp,%eax,8)
    movl    -4(%ebp), %eax
    movl    $1, -16(%ebp,%eax,8)
    addl    $1, -4(%ebp)
.L2:
    cmpl    $1, -4(%ebp)
    jle .L3
    leave
    ret
```





```
func:
    pushl   %ebp
    movl    %esp, %ebp
    subl    $32, %esp
    movl    $0, -4(%ebp)
    jmp .L2
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    movl    $1, -16(%ebp,%eax,8)
    addl    $1, -4(%ebp)
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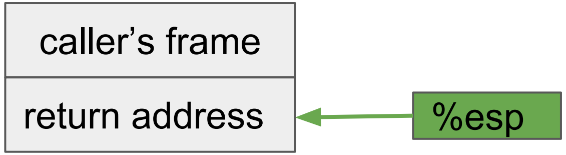
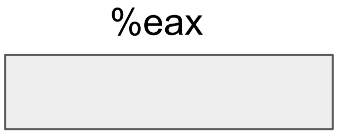
    cmpl    $1, -4(%ebp)
    jle .L3
    leave
    ret
```





```
func:
    pushl   %ebp
    movl    %esp, %ebp
    subl    $32, %esp
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    cmpl    $1, -4(%ebp)
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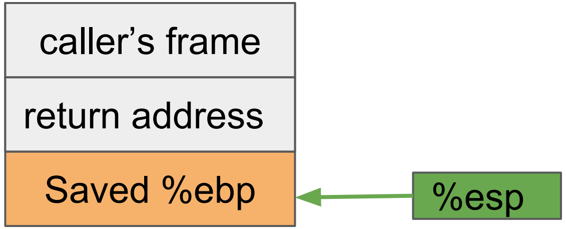
```

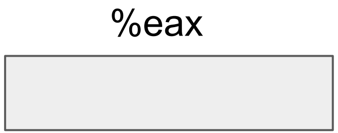


caller’s frame

return address

Saved %ebp

%esp



%eax

```
func:
    pushl   %ebp
    movl    %esp, %ebp
    subl    $32, %esp
    movl    $0, -4(%ebp)
    jmp .L2
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    movl    -4(%ebp), %eax
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.L2:
    cmpl    $1, -4(%ebp)
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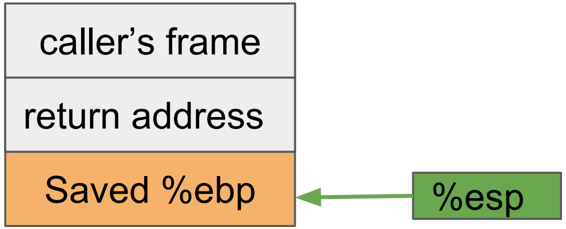
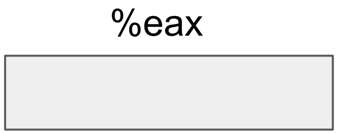
    ret
```





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func:
    pushl   %ebp
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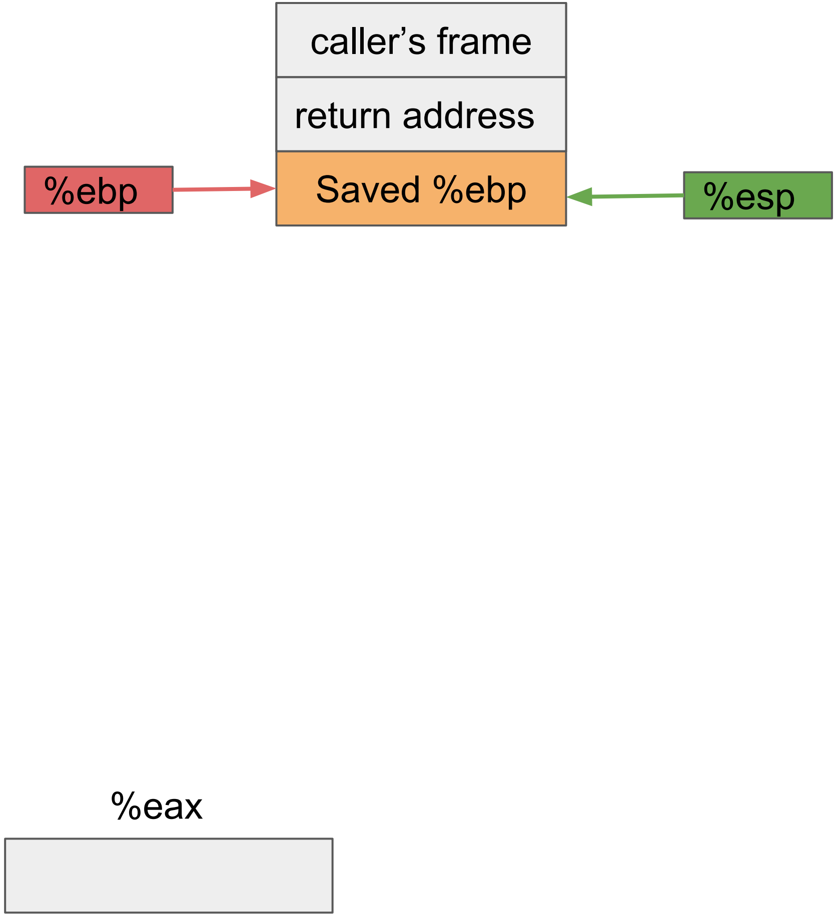

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func:
    pushl   %ebp
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.L2:
    cmpl    $1, -4(%ebp)
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    leave
    ret
```

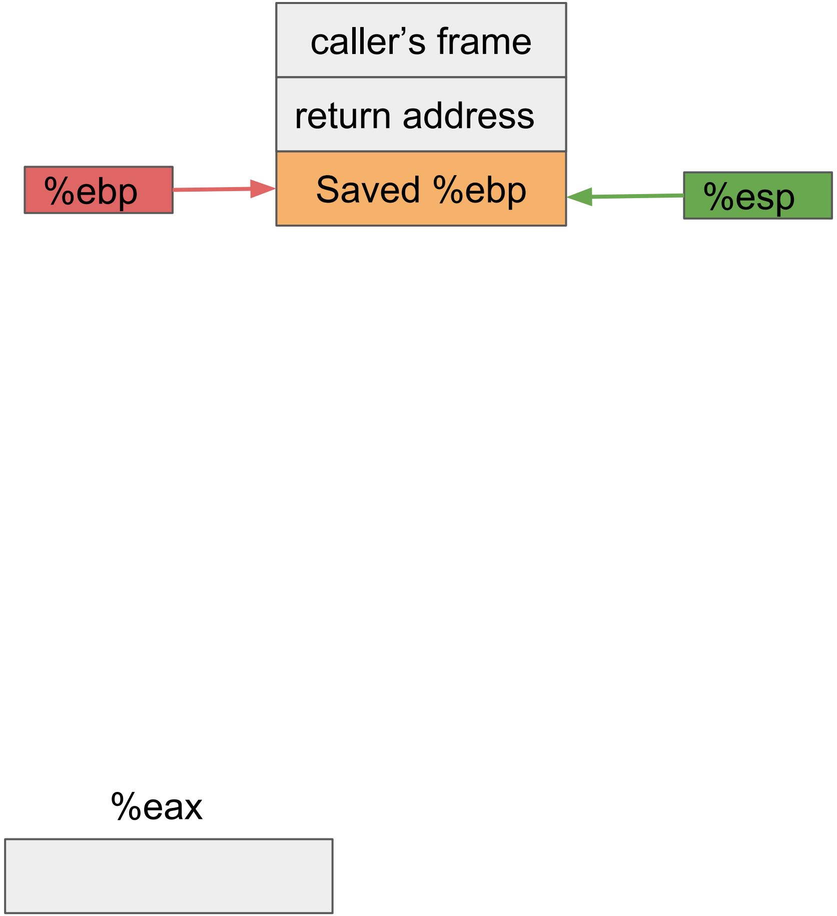

caller’s frame

return address

%ebp

Saved %ebp

%esp

%eax

```
func:
    pushl    %ebp
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    movl     $0, -4(%ebp)
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    addl     $1, -4(%ebp)
.L2:
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    ret
```

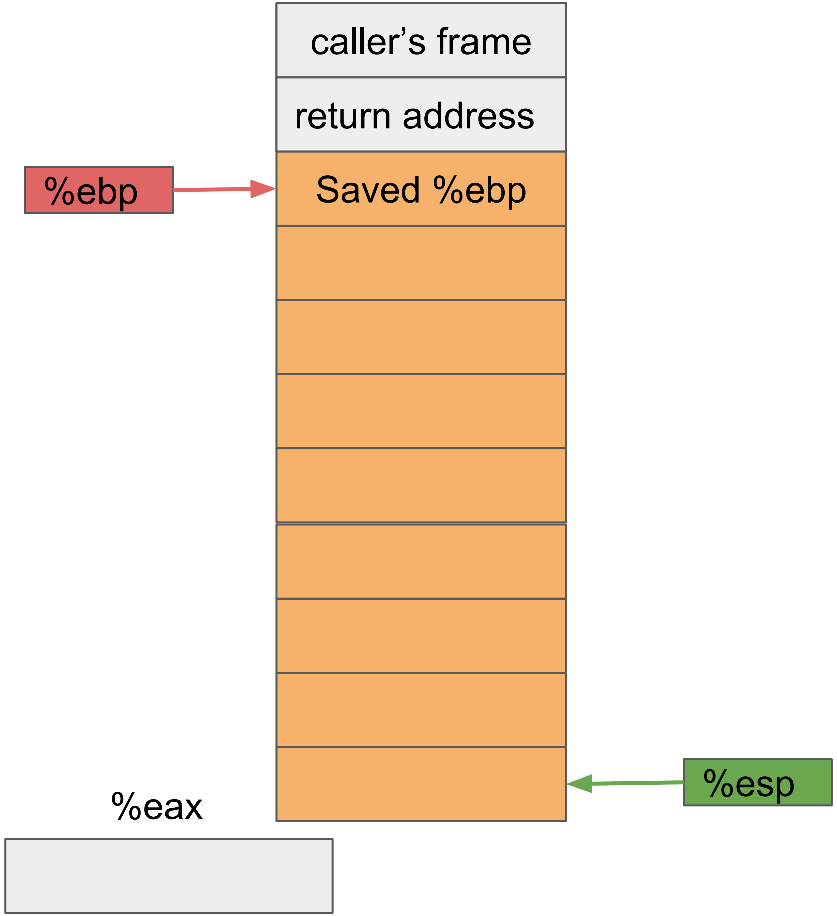

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func:
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    cmpl    $1, -4(%ebp)
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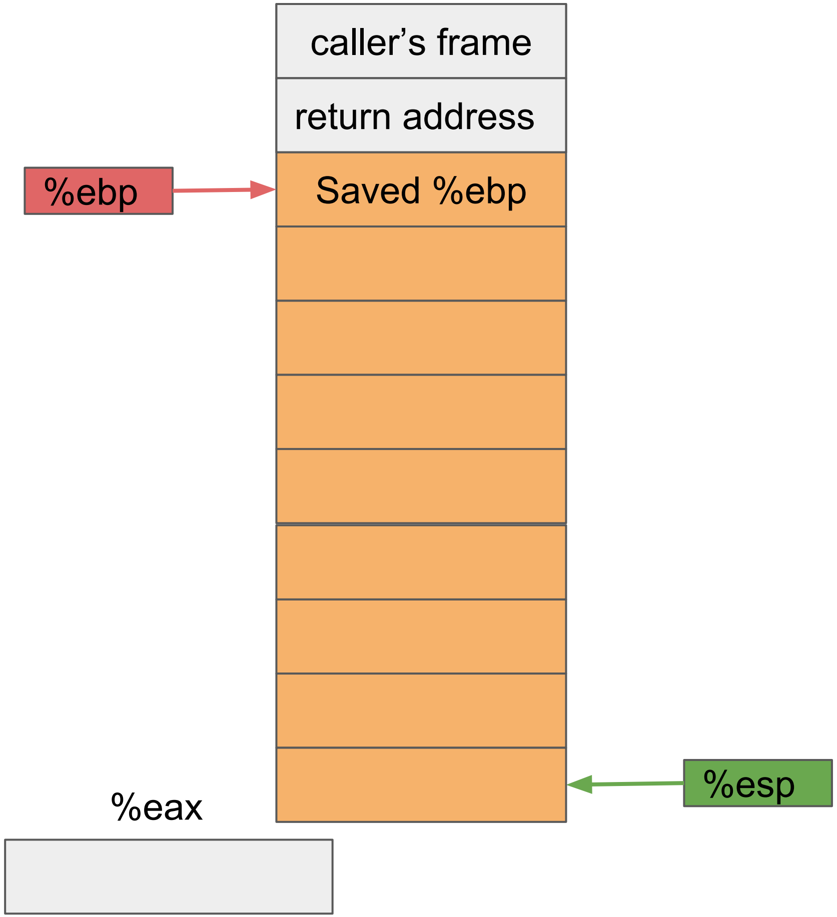

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    cmpl    $1, -4(%ebp)
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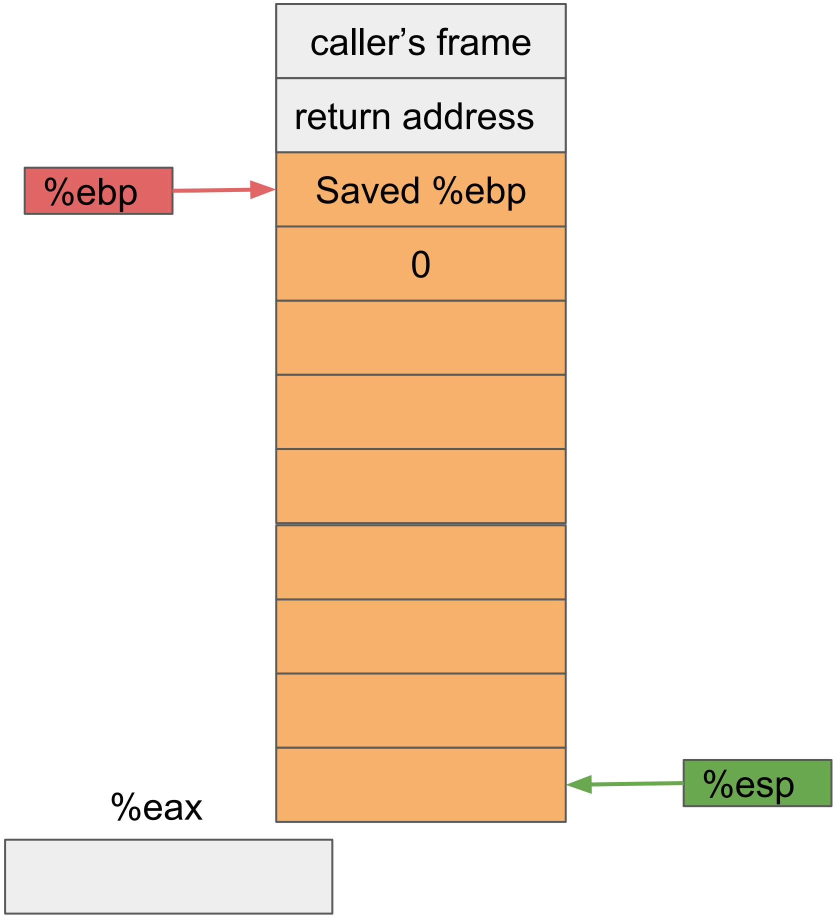

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func:
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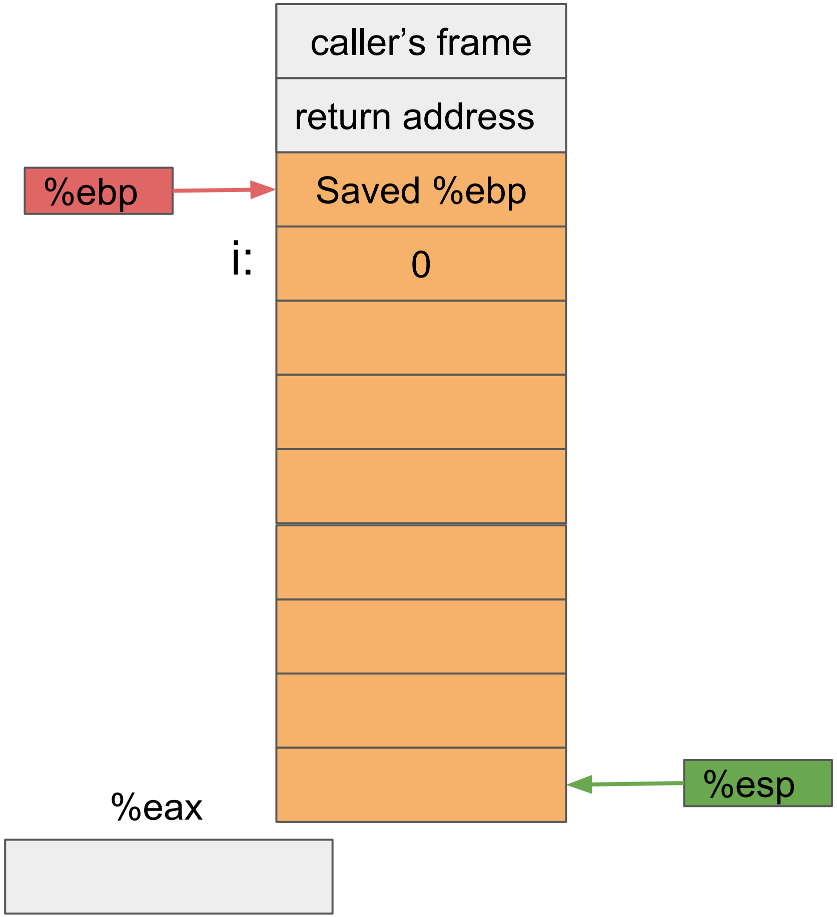

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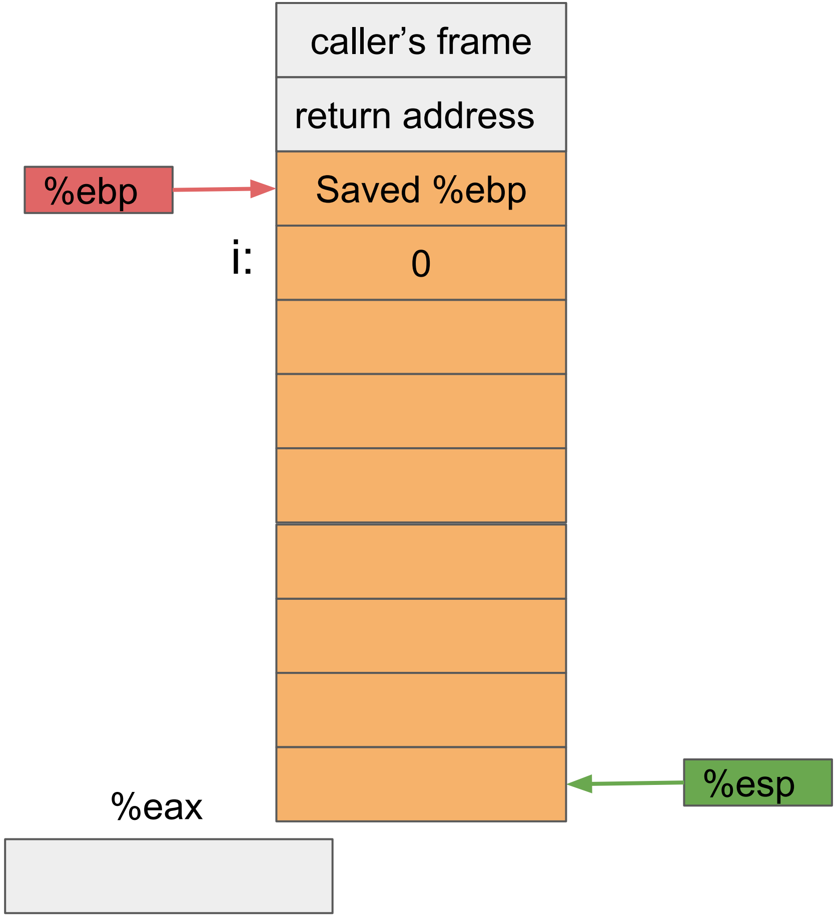

```
func:
    pushl   %ebp
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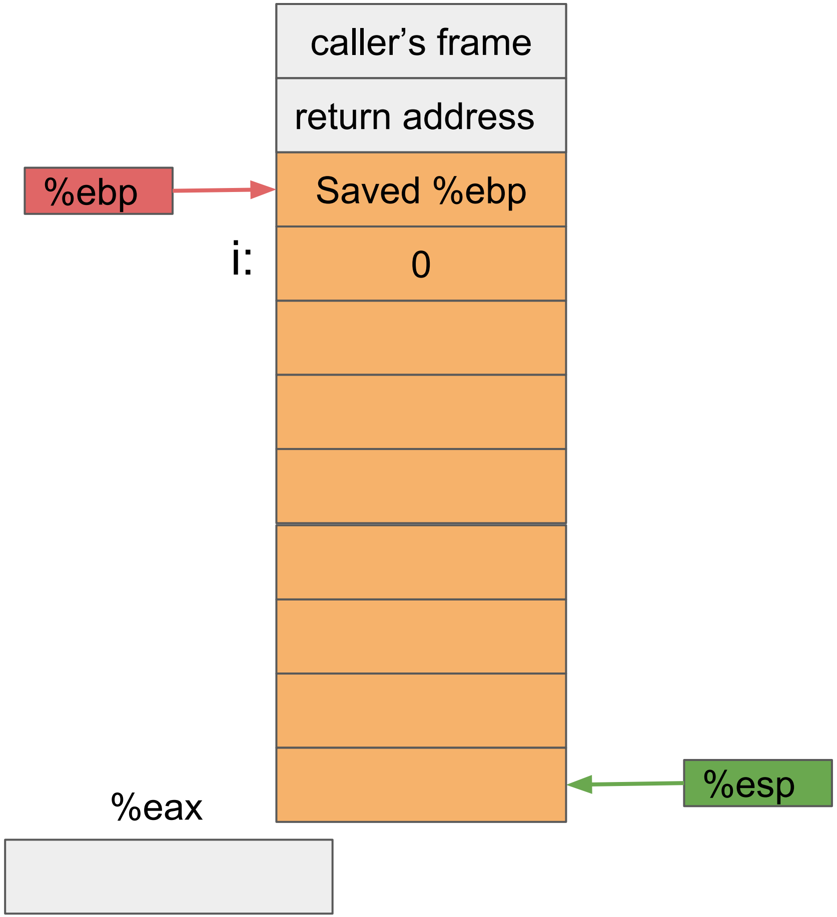

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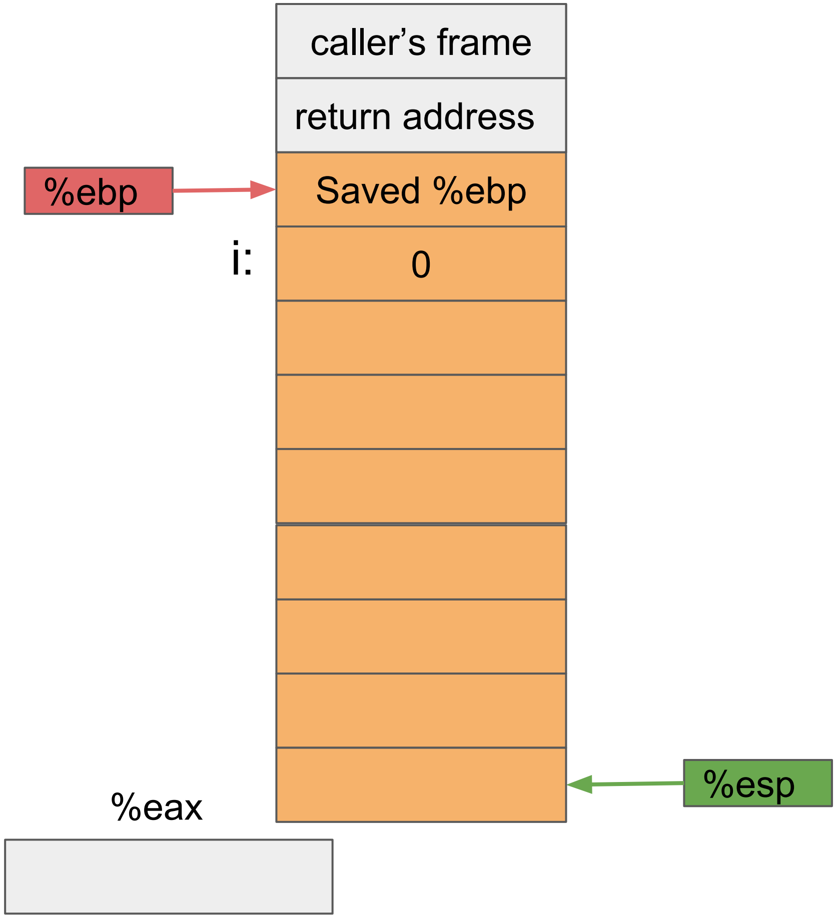

Jump if 0 <= 1

```
func:
    pushl   %ebp
    movl    %esp, %ebp
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    movl    $0, -4(%ebp)
    jmp .L2
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    movl    $0, -20(%ebp,%eax,8)
    movl    -4(%ebp), %eax
    movl    $1, -16(%ebp,%eax,8)
    addl    $1, -4(%ebp)
.L2:
    cmpl    $1, -4(%ebp)
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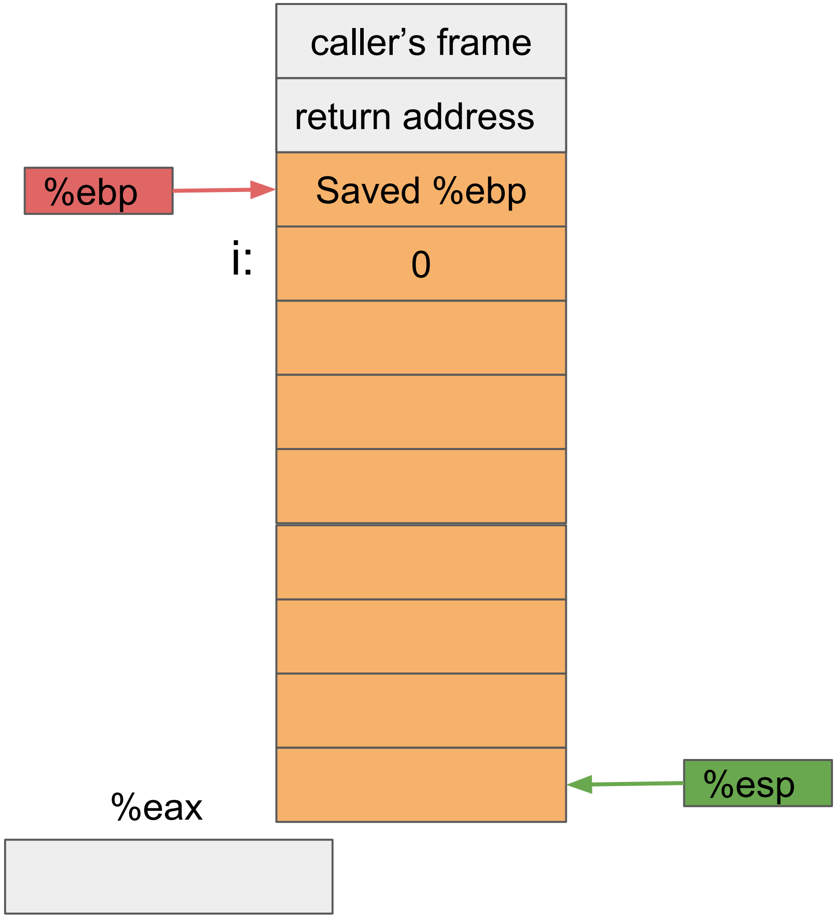
    leave
    ret
```



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func:
    pushl   %ebp
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    subl    $32, %esp
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    movl    $1, -16(%ebp,%eax,8)
    addl    $1, -4(%ebp)
.L2:
    cmpl    $1, -4(%ebp)
    jle .L3
    leave
    ret
```

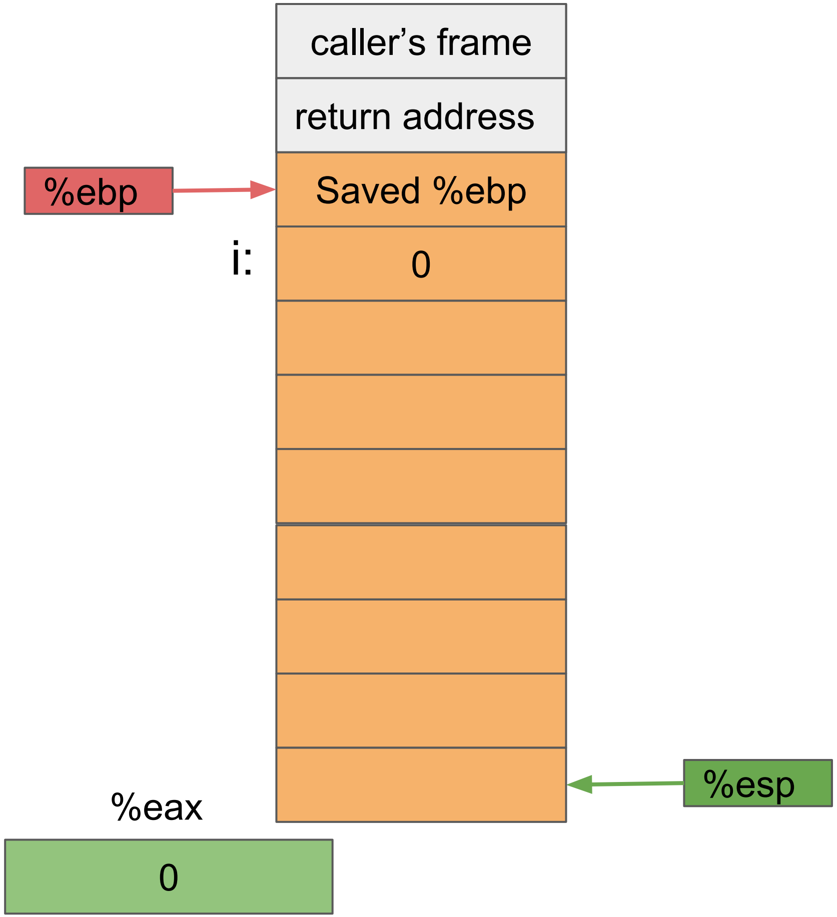

```
func:
    pushl   %ebp
    movl    %esp, %ebp
    subl    $32, %esp
    movl    $0, -4(%ebp)
    jmp .L2
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    leave
    ret
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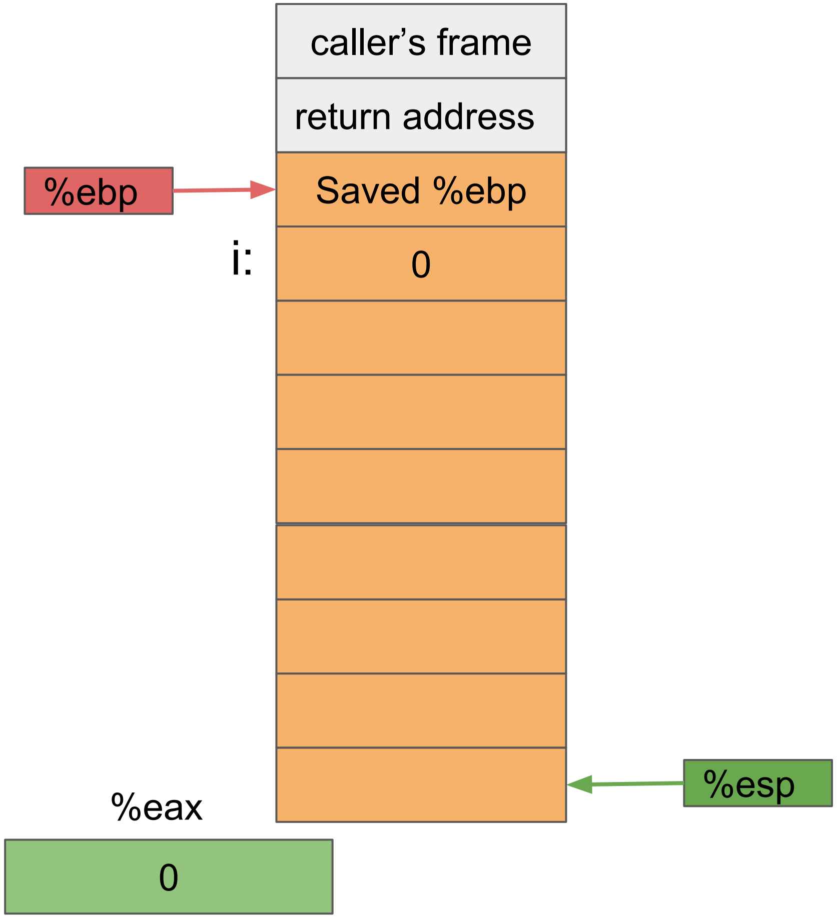

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func:
    pushl   %ebp
    movl    %esp, %ebp
    subl    $32, %esp
    movl    $0, -4(%ebp)
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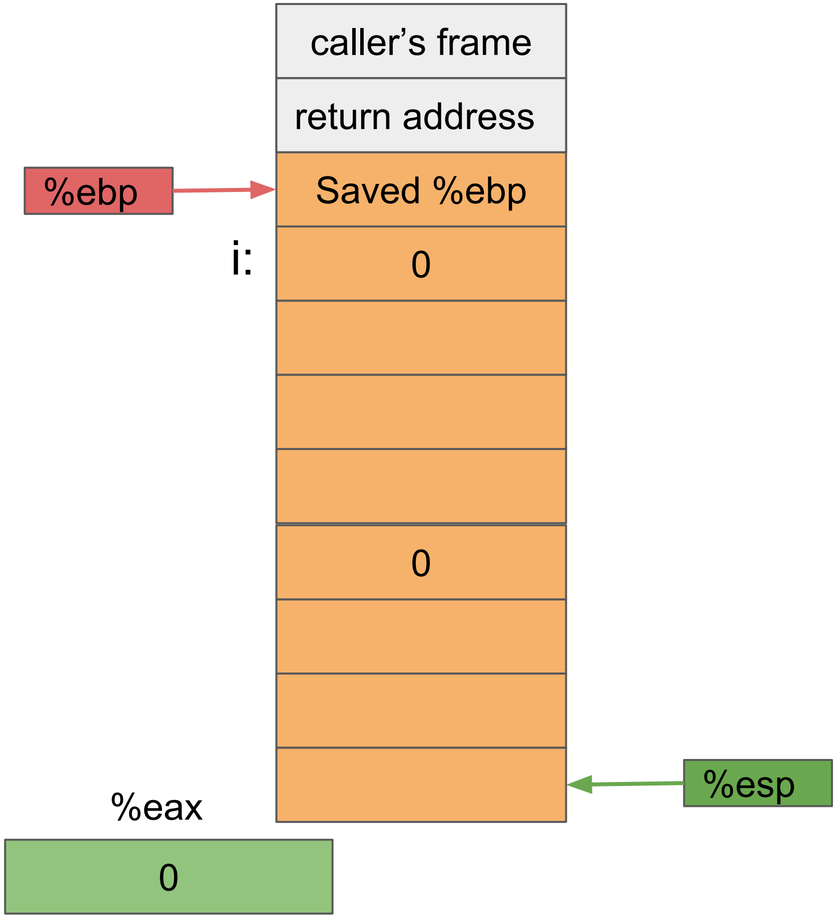

```
func:
    pushl   %ebp
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    subl    $32, %esp
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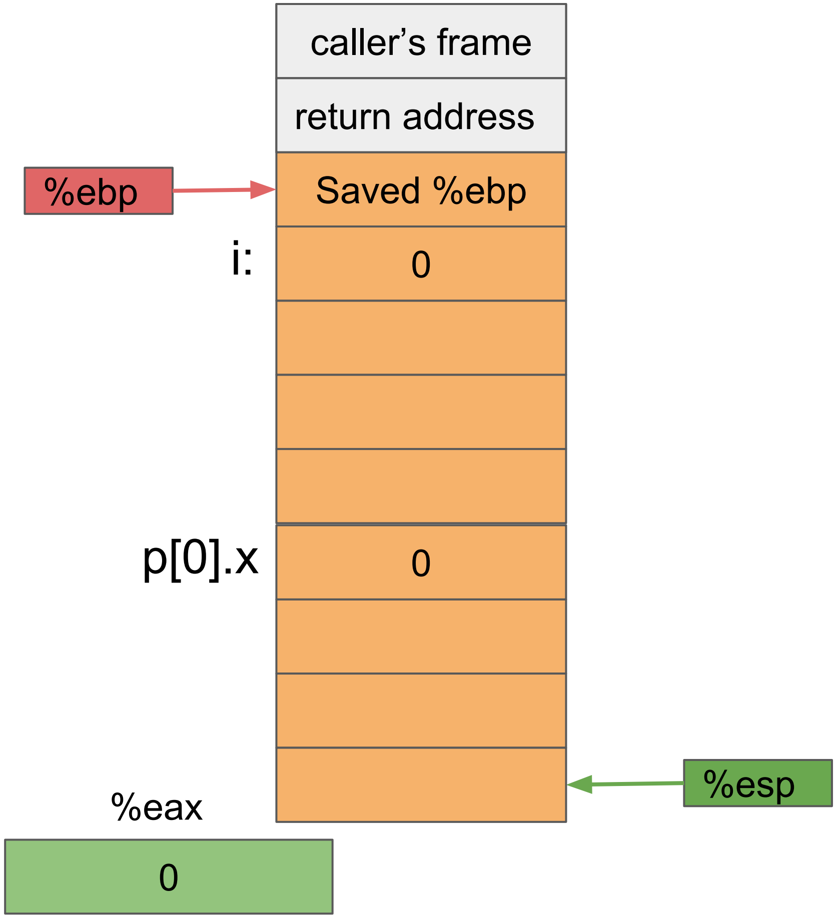

caller’s frame

return address

%ebp

Saved %ebp

i:

0

p[0].x

0

%esp

%eax

0

```
func:
    pushl   %ebp
    movl    %esp, %ebp
    subl    $32, %esp
    movl    $0, -4(%ebp)
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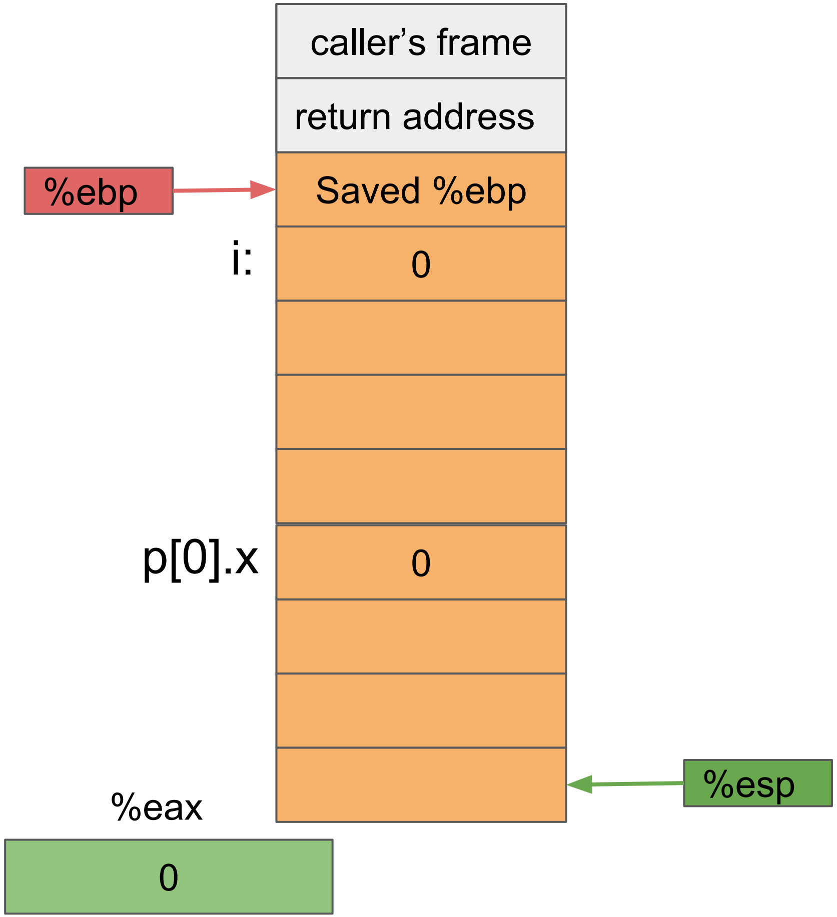

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    ret
```
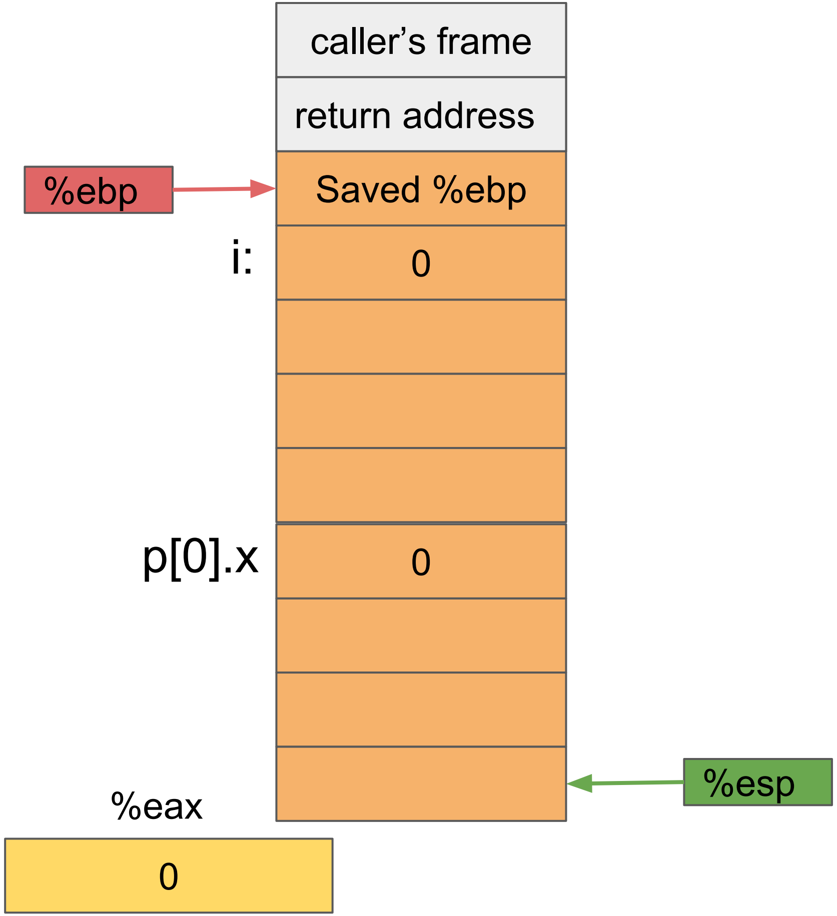



caller’s frame

return address

%ebp

Saved %ebp

i:

0

p[0].x

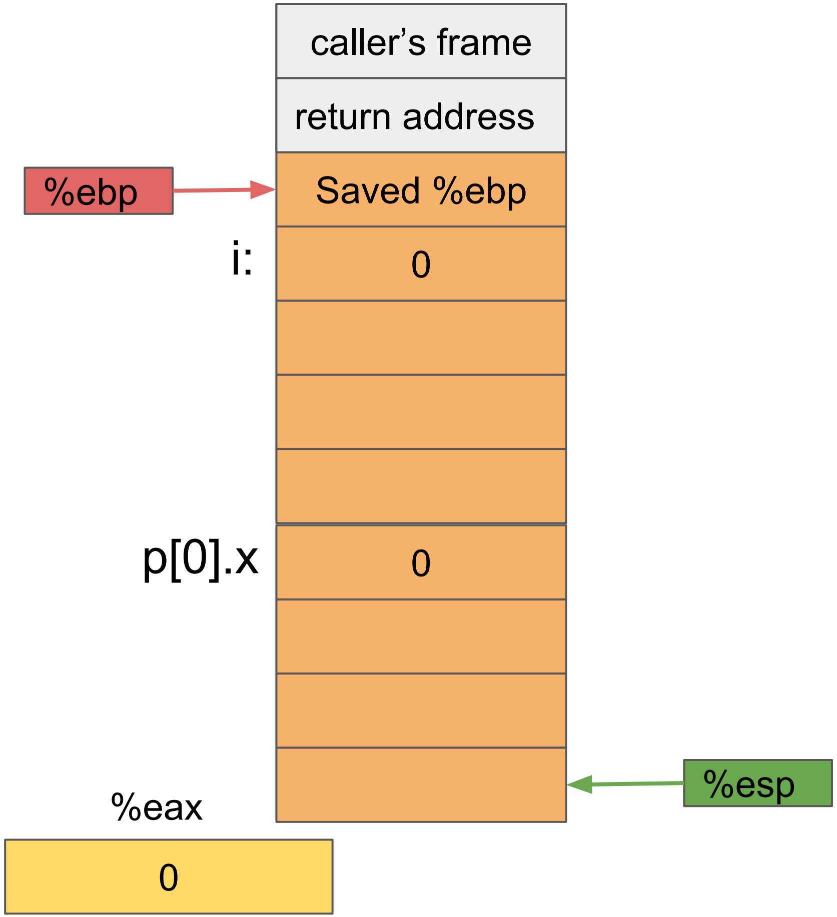
0

%esp

%eax

0

```
func:
    pushl   %ebp
    movl    %esp, %ebp
    subl    $32, %esp
    movl    $0, -4(%ebp)
    jmp .L2
.L3:
    movl    -4(%ebp), %eax
    movl    $0, -20(%ebp,%eax,8)
    movl    -4(%ebp), %eax
    movl    $1, -16(%ebp,%eax,8)
    addl    $1, -4(%ebp)
.L2:
    cmpl    $1, -4(%ebp)
    jle .L3
    leave
    ret
```



caller’s frame

return address

%ebp

Saved %ebp

i:

0

p[0].x

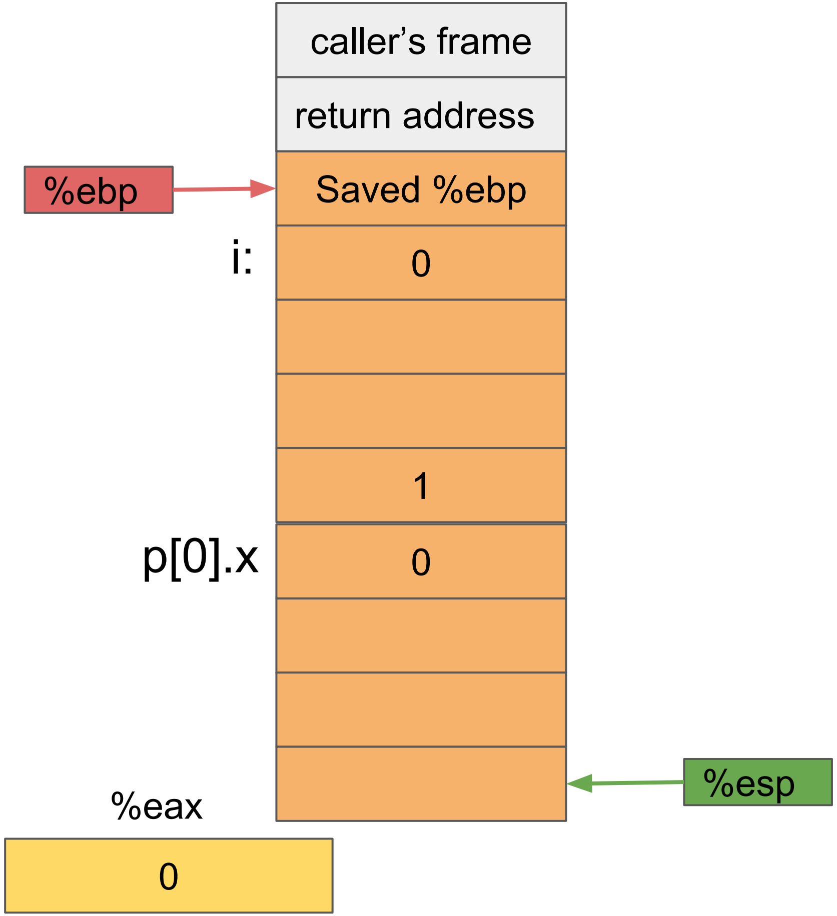
0

%esp

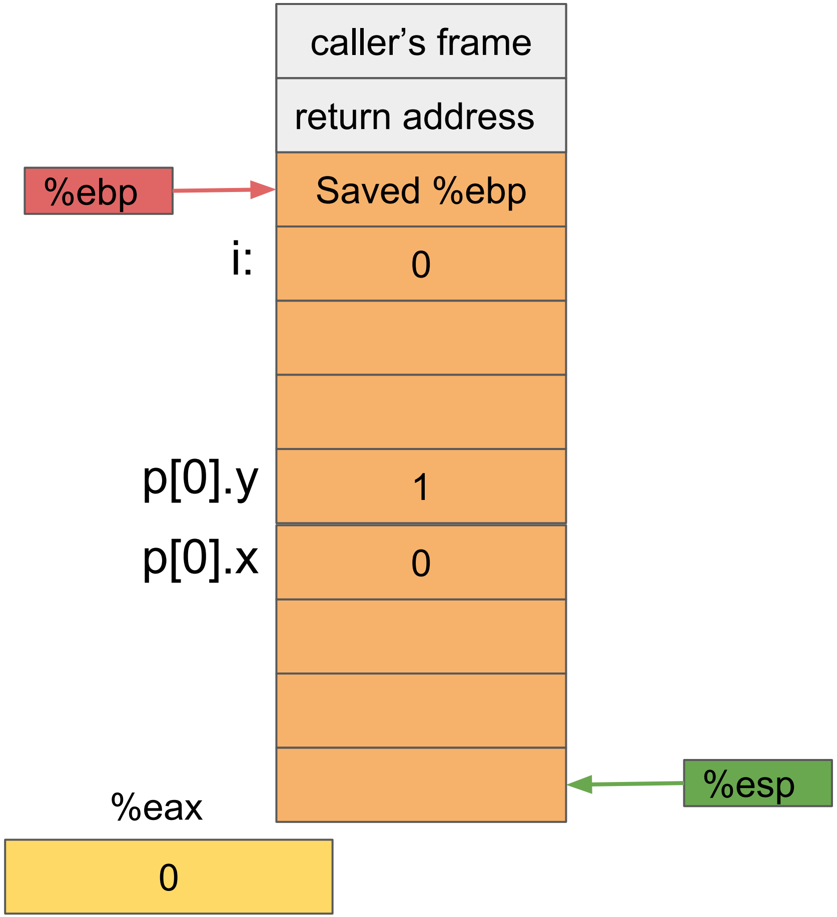
%eax

0

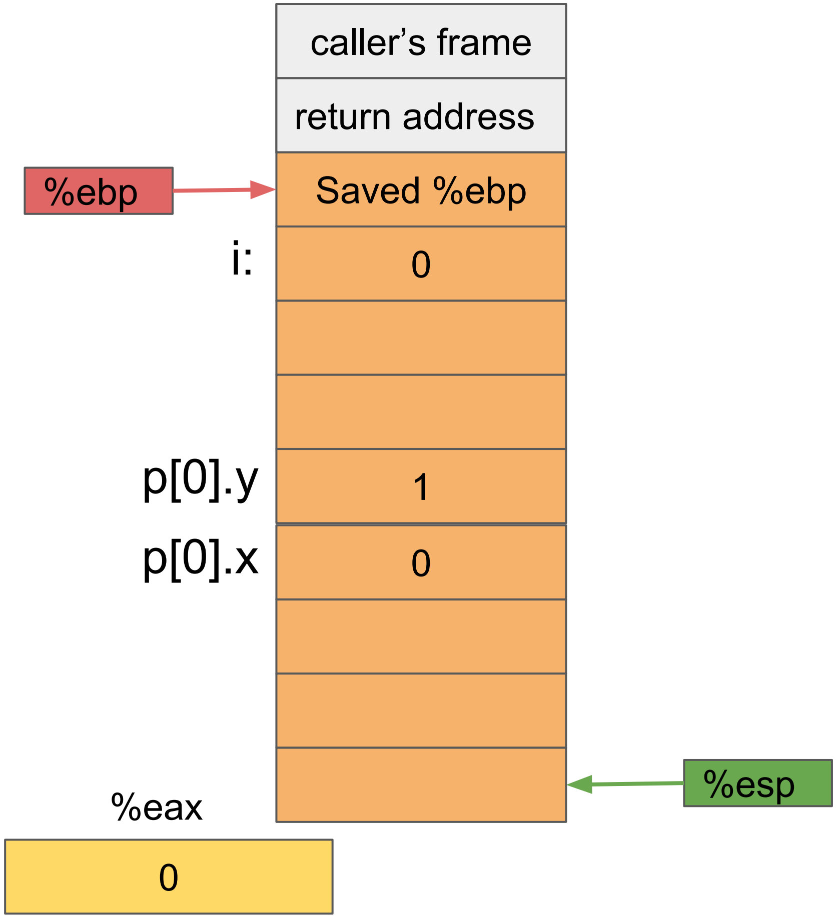
```
func:
    pushl   %ebp
    movl    %esp, %ebp
    subl    $32, %esp
    movl    $0, -4(%ebp)
    jmp .L2
.L3:
    movl    -4(%ebp), %eax
    movl    $0, -20(%ebp,%eax,8)
    movl    -4(%ebp), %eax
    movl    $1, -16(%ebp,%eax,8)
    addl    $1, -4(%ebp)
.L2:
    cmpl    $1, -4(%ebp)
    jle .L3
    leave
    ret
```



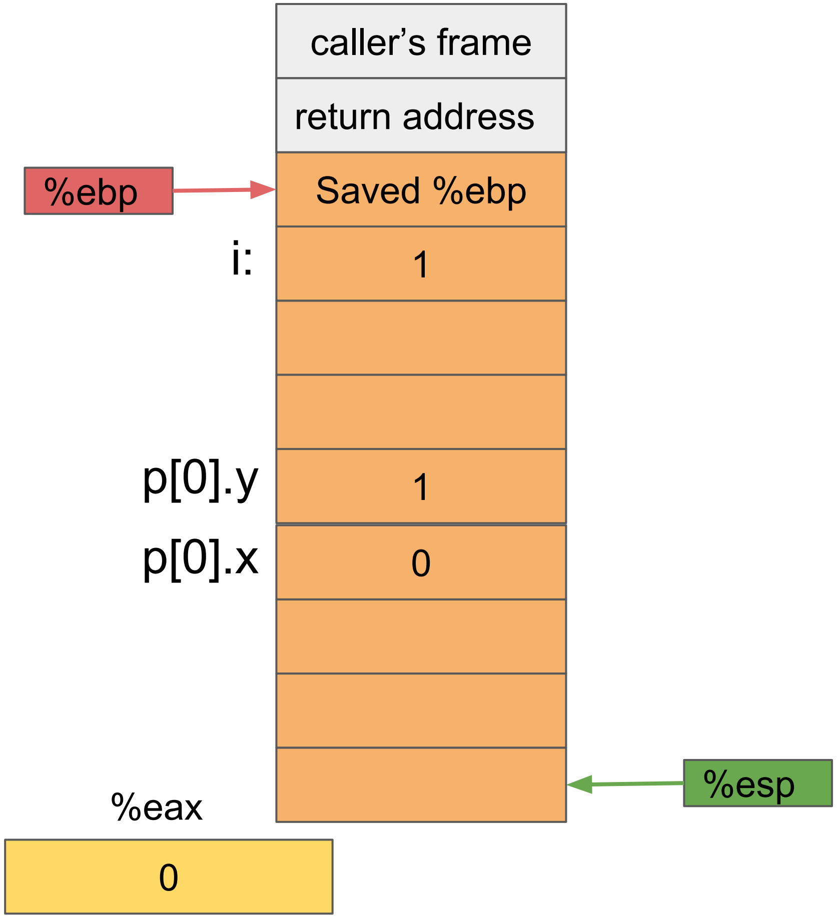
```
func:
    pushl   %ebp
    movl    %esp, %ebp
    subl    $32, %esp
    movl    $0, -4(%ebp)
    jmp .L2
.L3:
    movl    -4(%ebp), %eax
    movl    $0, -20(%ebp,%eax,8)
    movl    -4(%ebp), %eax
    movl    $1, -16(%ebp,%eax,8)
    addl    $1, -4(%ebp)
.L2:
    cmpl    $1, -4(%ebp)
    jle .L3
    leave
    ret
```



```
func:
    pushl   %ebp
    movl    %esp, %ebp
    subl    $32, %esp
    movl    $0, -4(%ebp)
    jmp .L2
.L3:
    movl    -4(%ebp), %eax
    movl    $0, -20(%ebp,%eax,8)
    movl    -4(%ebp), %eax
    movl    $1, -16(%ebp,%eax,8)
    addl    $1, -4(%ebp)
.L2:
    cmpl    $1, -4(%ebp)
    jle .L3
    leave
    ret
```



```
func:
    pushl   %ebp
    movl    %esp, %ebp
    subl    $32, %esp
    movl    $0, -4(%ebp)
    jmp .L2
.L3:
    movl    -4(%ebp), %eax
    movl    $0, -20(%ebp,%eax,8)
    movl    -4(%ebp), %eax
    movl    $1, -16(%ebp,%eax,8)
    addl    $1, -4(%ebp)
.L2:
    cmpl    $1, -4(%ebp)
    jle .L3
    leave
    ret
```



caller’s frame

return address

%ebp

Saved %ebp

i: 1

p[0].y 1

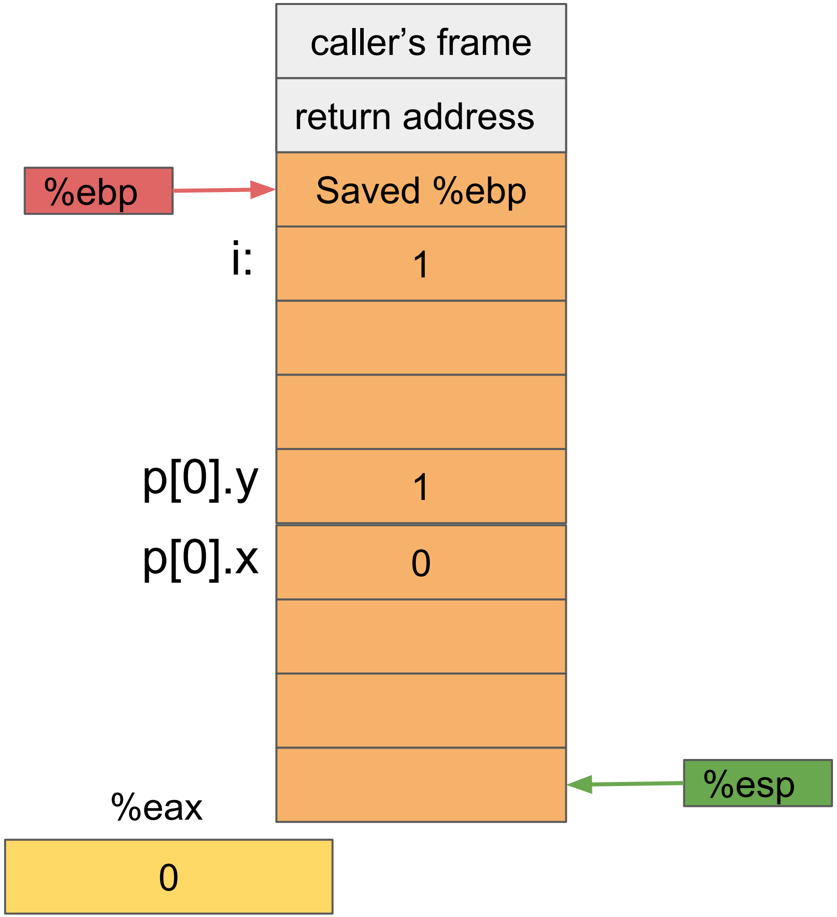
p[0].x 0

%esp

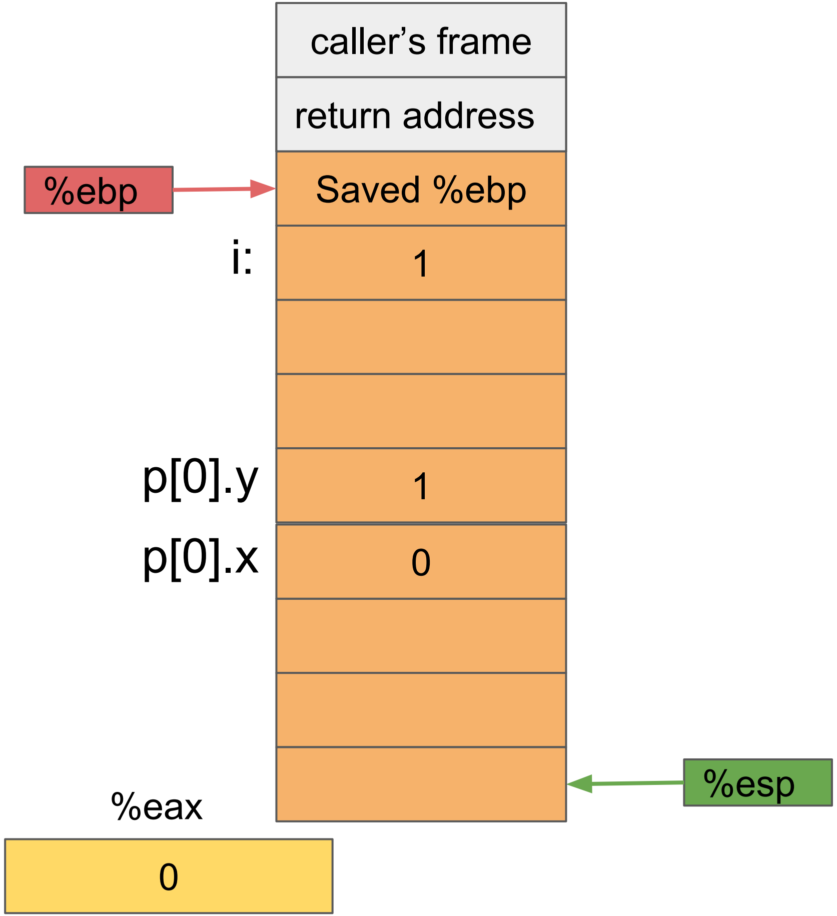
%eax

0

```
func:
    pushl   %ebp
    movl    %esp, %ebp
    subl    $32, %esp
    movl    $0, -4(%ebp)
    jmp .L2
.L3:
    movl    -4(%ebp), %eax
    movl    $0, -20(%ebp,%eax,8)
    movl    -4(%ebp), %eax
    movl    $1, -16(%ebp,%eax,8)
    addl    $1, -4(%ebp)
.L2:
    cmpl    $1, -4(%ebp)
    jle .L3
    leave
    ret
```

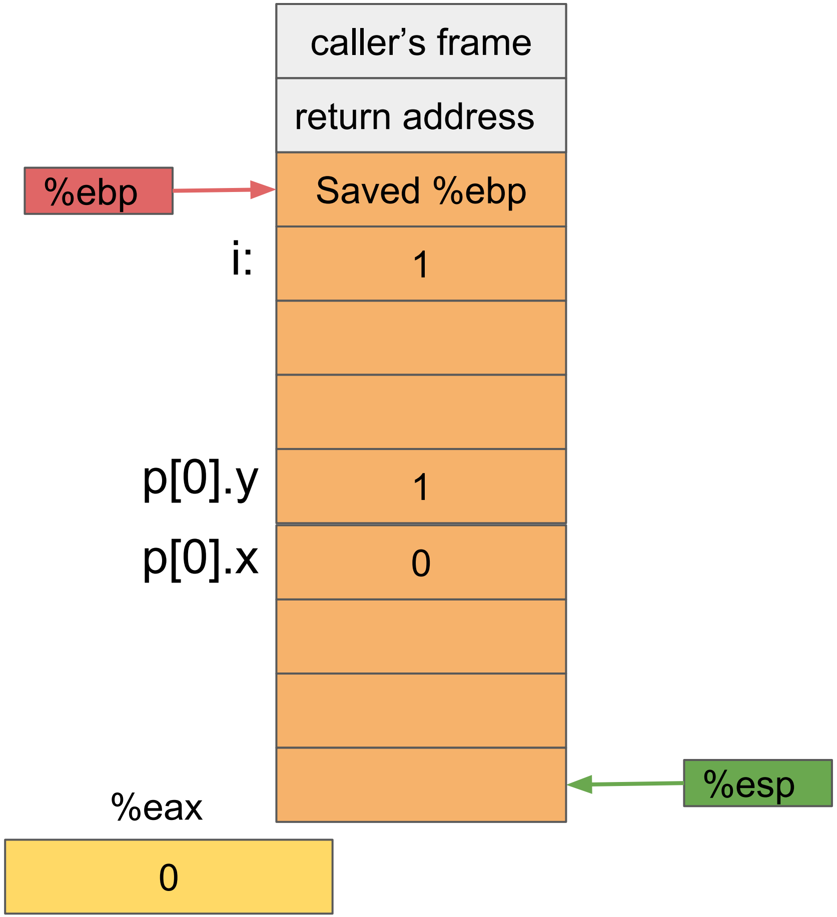


```
func:
    pushl   %ebp
    movl    %esp, %ebp
    subl    $32, %esp
    movl    $0, -4(%ebp)
    jmp .L2
.L3:
    movl    -4(%ebp), %eax
    movl    $0, -20(%ebp,%eax,8)
    movl    -4(%ebp), %eax
    movl    $1, -16(%ebp,%eax,8)
    addl    $1, -4(%ebp)
.L2:
    cmpl    $1, -4(%ebp)
    jle .L3
    leave
    ret
```



Jump if 1 <= 1

```
func:
    pushl   %ebp
    movl    %esp, %ebp
    subl    $32, %esp
    movl    $0, -4(%ebp)
    jmp .L2
.L3:
    movl    -4(%ebp), %eax
    movl    $0, -20(%ebp,%eax,8)
    movl    -4(%ebp), %eax
    movl    $1, -16(%ebp,%eax,8)
    addl    $1, -4(%ebp)
.L2:
    cmpl    $1, -4(%ebp)
    jle .L3
    leave
    ret
```



caller's frame

return address

%ebp

Saved %ebp

i: 1

p[0].y 1

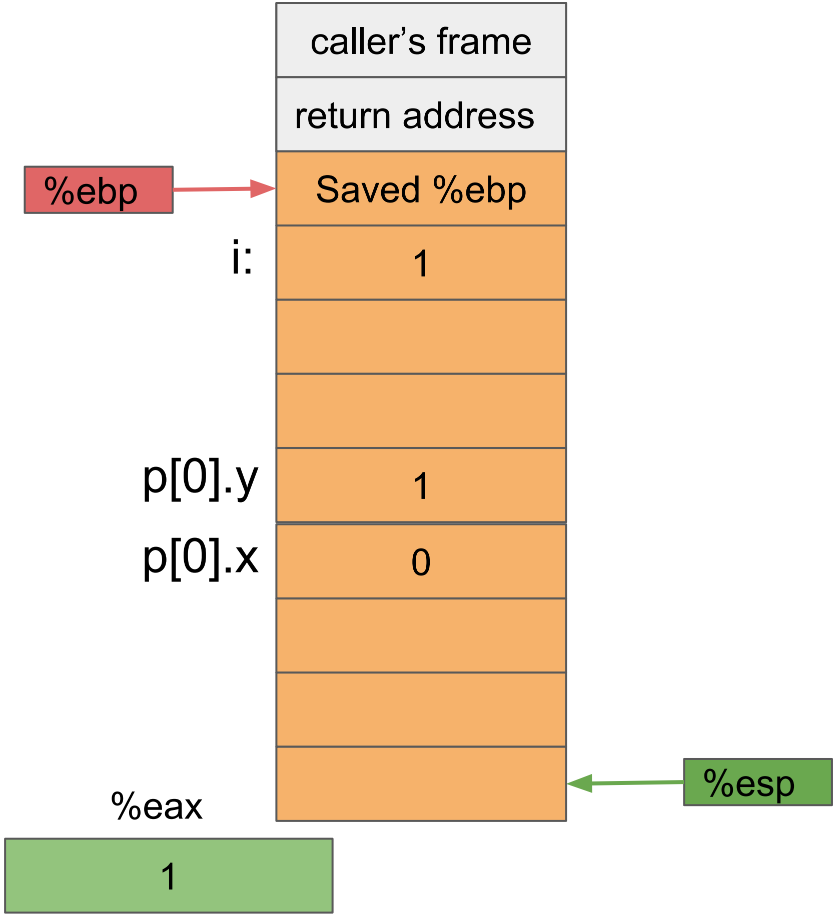
p[0].x 0

%esp

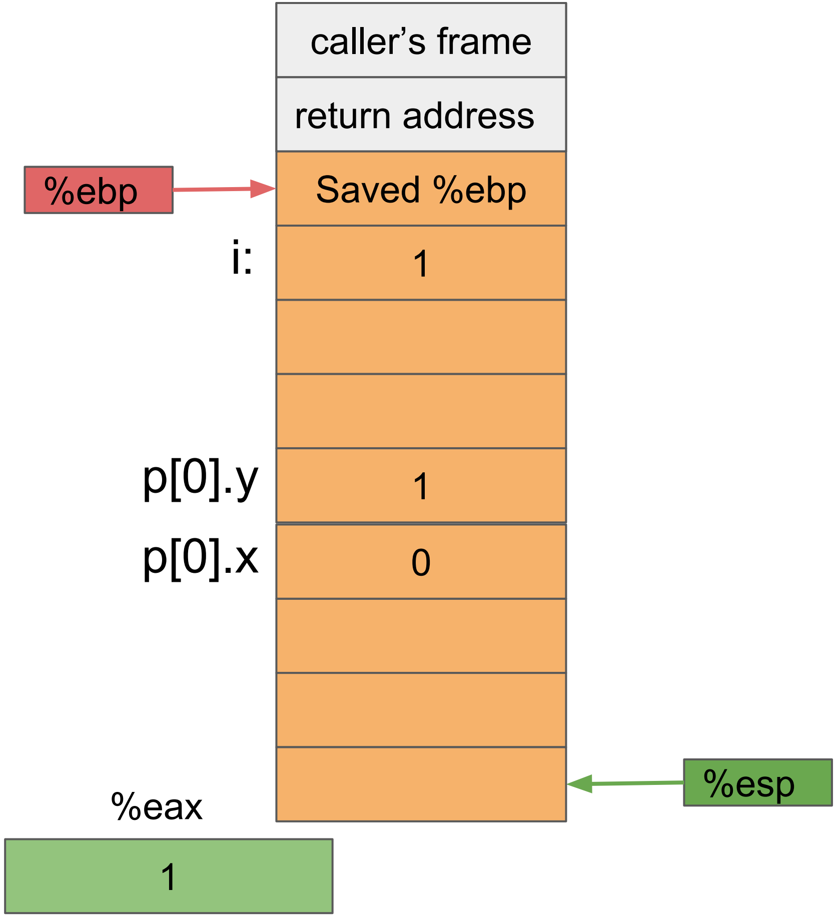
%eax

0

```
func:
    pushl   %ebp
    movl    %esp, %ebp
    subl    $32, %esp
    movl    $0, -4(%ebp)
    jmp .L2
.L3:
    movl    -4(%ebp), %eax
    movl    $0, -20(%ebp,%eax,8)
    movl    -4(%ebp), %eax
    movl    $1, -16(%ebp,%eax,8)
    addl    $1, -4(%ebp)
.L2:
    cmpl    $1, -4(%ebp)
    jle .L3
    leave
    ret
```



```
func:
    pushl   %ebp
    movl    %esp, %ebp
    subl    $32, %esp
    movl    $0, -4(%ebp)
    jmp .L2
.L3:
    movl    -4(%ebp), %eax
    movl    $0, -20(%ebp,%eax,8)
    movl    -4(%ebp), %eax
    movl    $1, -16(%ebp,%eax,8)
    addl    $1, -4(%ebp)
.L2:
    cmpl    $1, -4(%ebp)
    jle .L3
    leave
    ret
```



caller’s frame

return address

%ebp → Saved %ebp

i: 1

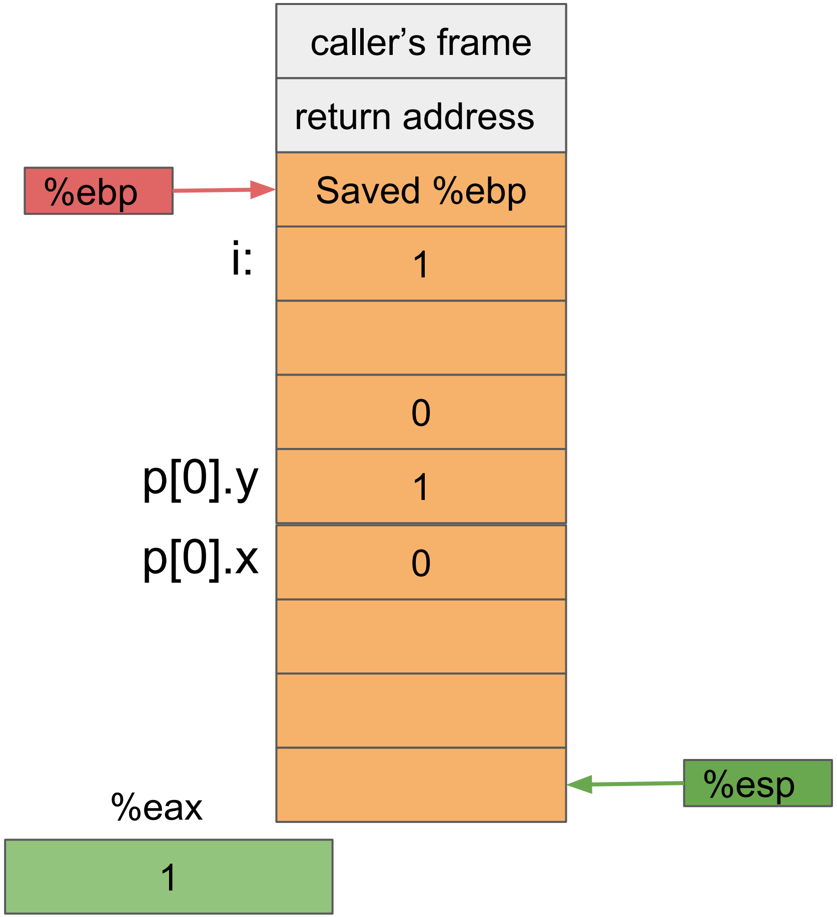
p[0].y 1

p[0].x 0

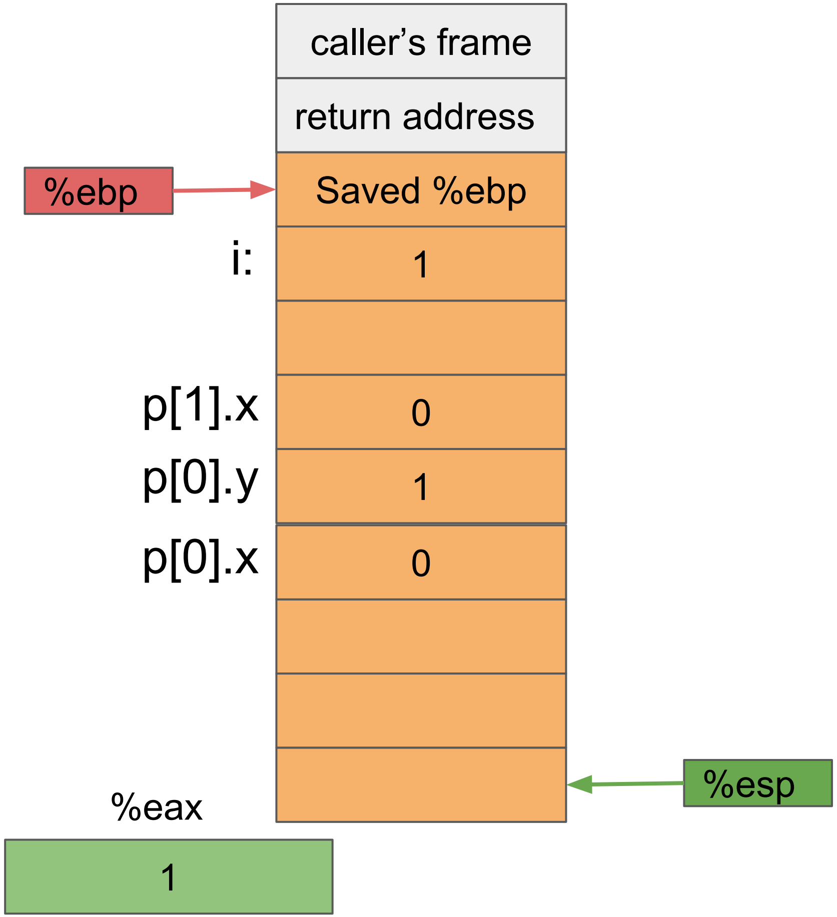
%esp

%eax 1

```
func:
    pushl   %ebp
    movl    %esp, %ebp
    subl    $32, %esp
    movl    $0, -4(%ebp)
    jmp .L2
.L3:
    movl    -4(%ebp), %eax
    movl    $0, -20(%ebp,%eax,8)
    movl    -4(%ebp), %eax
    movl    $1, -16(%ebp,%eax,8)
    addl    $1, -4(%ebp)
.L2:
    cmpl    $1, -4(%ebp)
    jle .L3
    leave
    ret
```



```
func:
    pushl   %ebp
    movl    %esp, %ebp
    subl    $32, %esp
    movl    $0, -4(%ebp)
    jmp .L2
.L3:
    movl    -4(%ebp), %eax
    movl    $0, -20(%ebp,%eax,8)
    movl    -4(%ebp), %eax
    movl    $1, -16(%ebp,%eax,8)
    addl    $1, -4(%ebp)
.L2:
    cmpl    $1, -4(%ebp)
    jle .L3
    leave
    ret
```



caller’s frame

return address

%ebp

Saved %ebp

i: 1

p[1].x 0

p[0].y 1

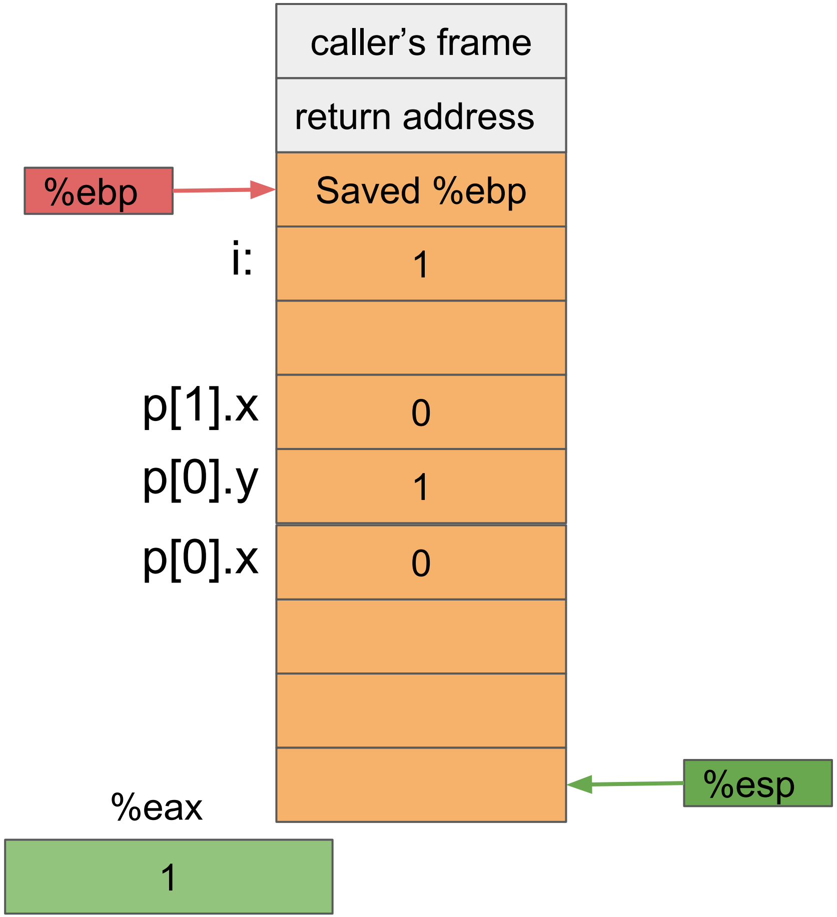
p[0].x 0

%esp

%eax

1

```
func:
    pushl   %ebp
    movl    %esp, %ebp
    subl    $32, %esp
    movl    $0, -4(%ebp)
    jmp .L2
.L3:
    movl    -4(%ebp), %eax
    movl    $0, -20(%ebp,%eax,8)
    movl    -4(%ebp), %eax
    movl    $1, -16(%ebp,%eax,8)
    addl    $1, -4(%ebp)
.L2:
    cmpl    $1, -4(%ebp)
    jle .L3
    leave
    ret
```



caller's frame

return address

%ebp

Saved %ebp

i: 1

p[1].x 0

p[0].y 1

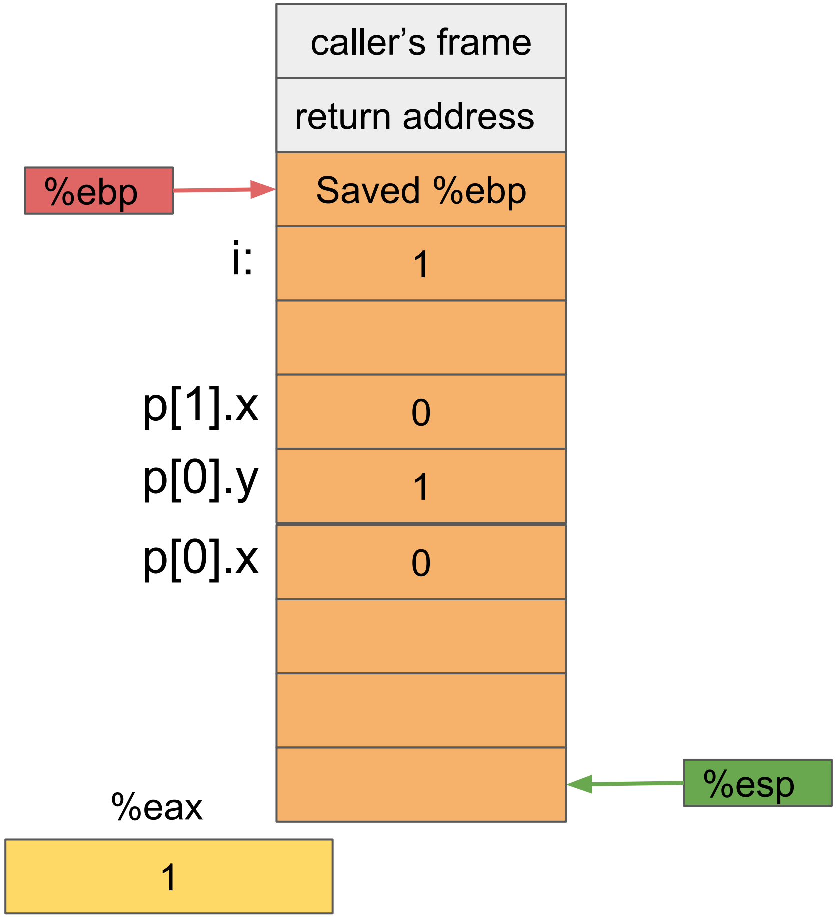
p[0].x 0

%esp

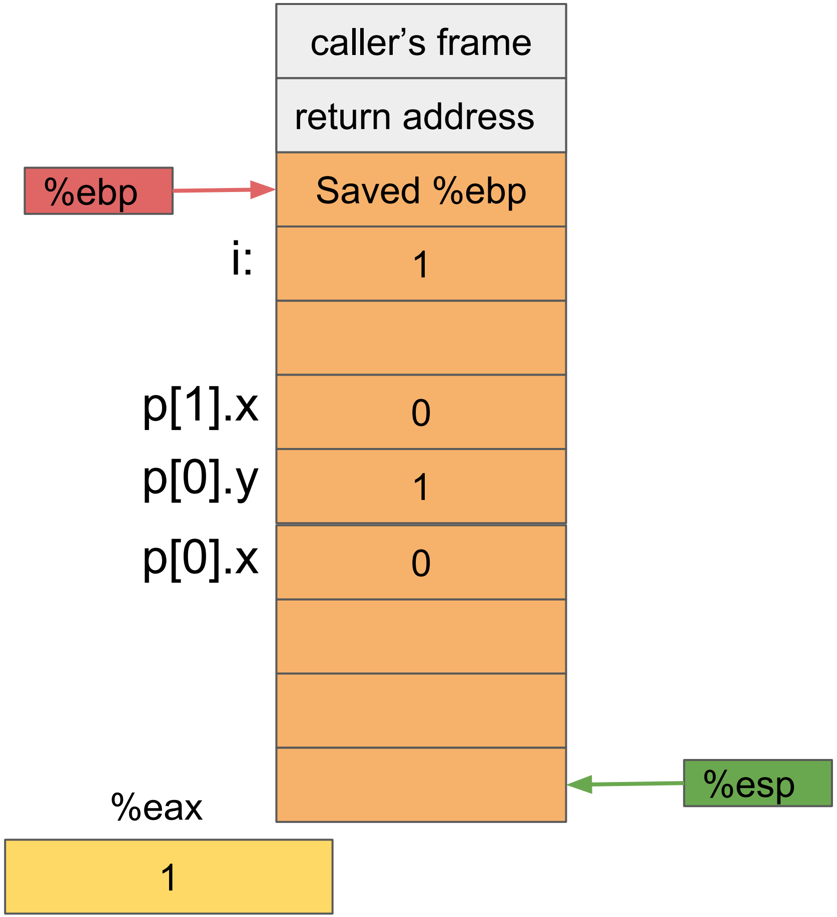
%eax

1

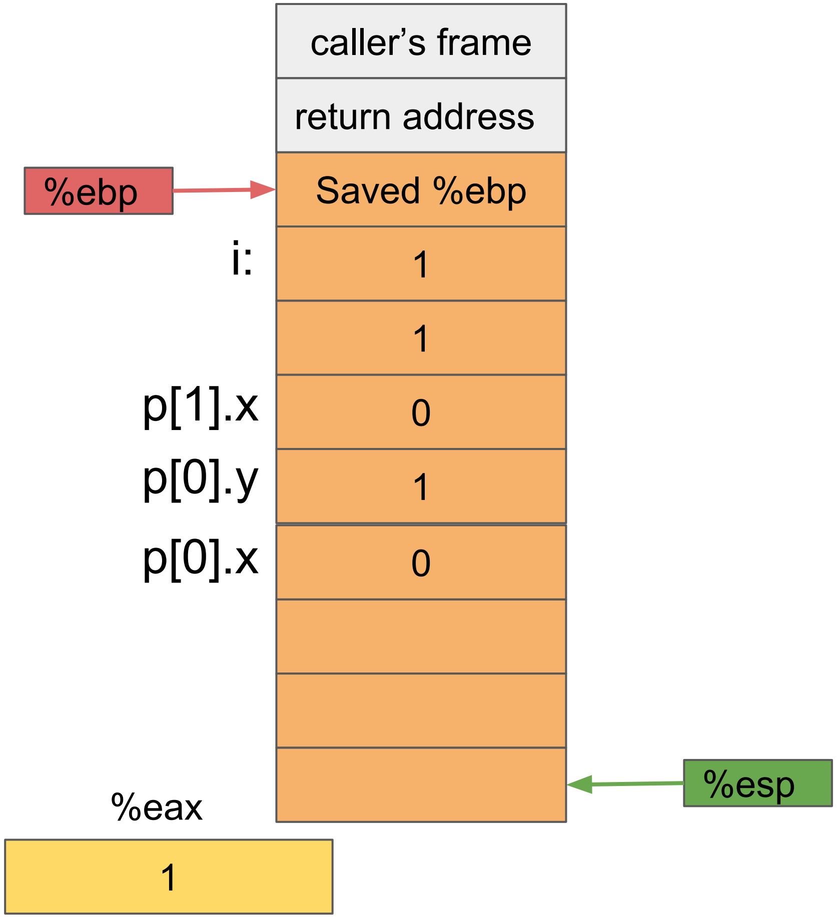
```
func:
    pushl   %ebp
    movl    %esp, %ebp
    subl    $32, %esp
    movl    $0, -4(%ebp)
    jmp .L2
.L3:
    movl    -4(%ebp), %eax
    movl    $0, -20(%ebp,%eax,8)
    movl    -4(%ebp), %eax
    movl    $1, -16(%ebp,%eax,8)
    addl    $1, -4(%ebp)
.L2:
    cmpl    $1, -4(%ebp)
    jle .L3
    leave
    ret
```



```
func:
    pushl   %ebp
    movl    %esp, %ebp
    subl    $32, %esp
    movl    $0, -4(%ebp)
    jmp .L2
.L3:
    movl    -4(%ebp), %eax
    movl    $0, -20(%ebp,%eax,8)
    movl    -4(%ebp), %eax
    movl    $1, -16(%ebp,%eax,8)
    addl    $1, -4(%ebp)
.L2:
    cmpl    $1, -4(%ebp)
    jle .L3
    leave
    ret
```



```
func:
    pushl   %ebp
    movl    %esp, %ebp
    subl    $32, %esp
    movl    $0, -4(%ebp)
    jmp .L2
.L3:
    movl    -4(%ebp), %eax
    movl    $0, -20(%ebp,%eax,8)
    movl    -4(%ebp), %eax
    movl    $1, -16(%ebp,%eax,8)
    addl    $1, -4(%ebp)
.L2:
    cmpl    $1, -4(%ebp)
    jle .L3
    leave
    ret
```



caller's frame

return address

%ebp → Saved %ebp

i: 1

1

p[1].x 0

p[0].y 1

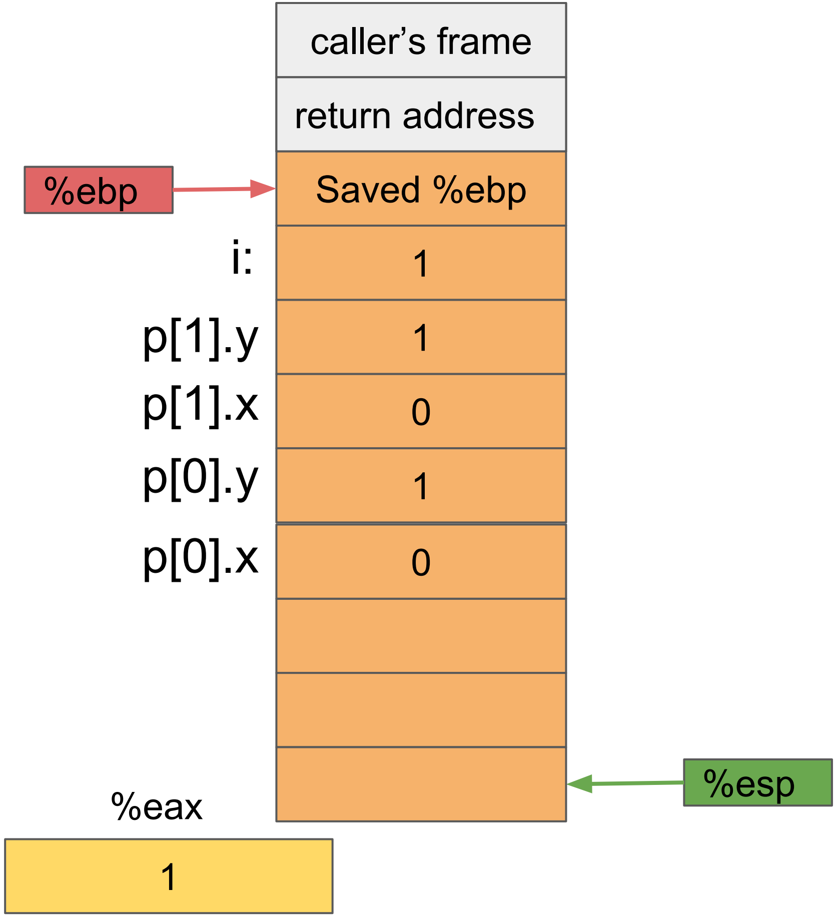
p[0].x 0

%esp →

%eax

1

```
func:
    pushl   %ebp
    movl    %esp, %ebp
    subl    $32, %esp
    movl    $0, -4(%ebp)
    jmp .L2
.L3:
    movl    -4(%ebp), %eax
    movl    $0, -20(%ebp,%eax,8)
    movl    -4(%ebp), %eax
    movl    $1, -16(%ebp,%eax,8)
    addl    $1, -4(%ebp)
.L2:
    cmpl    $1, -4(%ebp)
    jle .L3
    leave
    ret
```



caller’s frame

return address

%ebp → Saved %ebp

i: 1

p[1].y 1

p[1].x 0

p[0].y 1

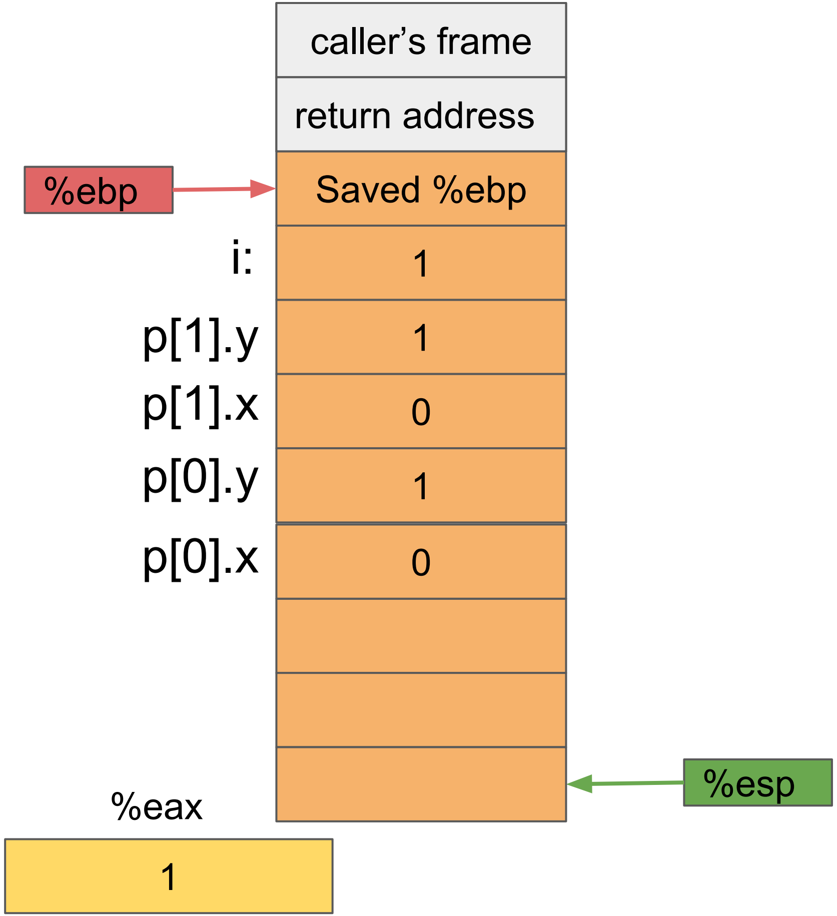
p[0].x 0

%esp

%eax

1

```
func:
    pushl   %ebp
    movl    %esp, %ebp
    subl    $32, %esp
    movl    $0, -4(%ebp)
    jmp .L2
.L3:
    movl    -4(%ebp), %eax
    movl    $0, -20(%ebp,%eax,8)
    movl    -4(%ebp), %eax
    movl    $1, -16(%ebp,%eax,8)
    addl    $1, -4(%ebp)
.L2:
    cmpl    $1, -4(%ebp)
    jle .L3
    leave
    ret
```



caller's frame

return address

%ebp

Saved %ebp

i: 1

p[1].y 1

p[1].x 0

p[0].y 1

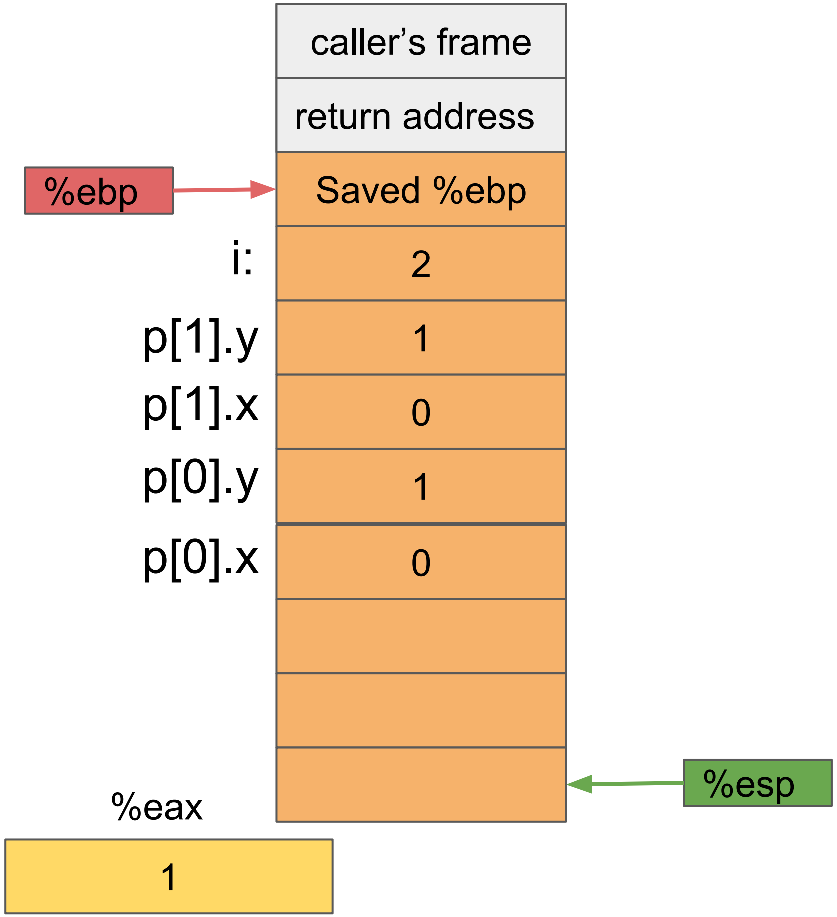
p[0].x 0

%esp

%eax

1

```
func:
    pushl   %ebp
    movl    %esp, %ebp
    subl    $32, %esp
    movl    $0, -4(%ebp)
    jmp .L2
.L3:
    movl    -4(%ebp), %eax
    movl    $0, -20(%ebp,%eax,8)
    movl    -4(%ebp), %eax
    movl    $1, -16(%ebp,%eax,8)
    addl    $1, -4(%ebp)
.L2:
    cmpl    $1, -4(%ebp)
    jle .L3
    leave
    ret
```



caller's frame

return address

%ebp → Saved %ebp

i: 2

p[1].y 1

p[1].x 0

p[0].y 1

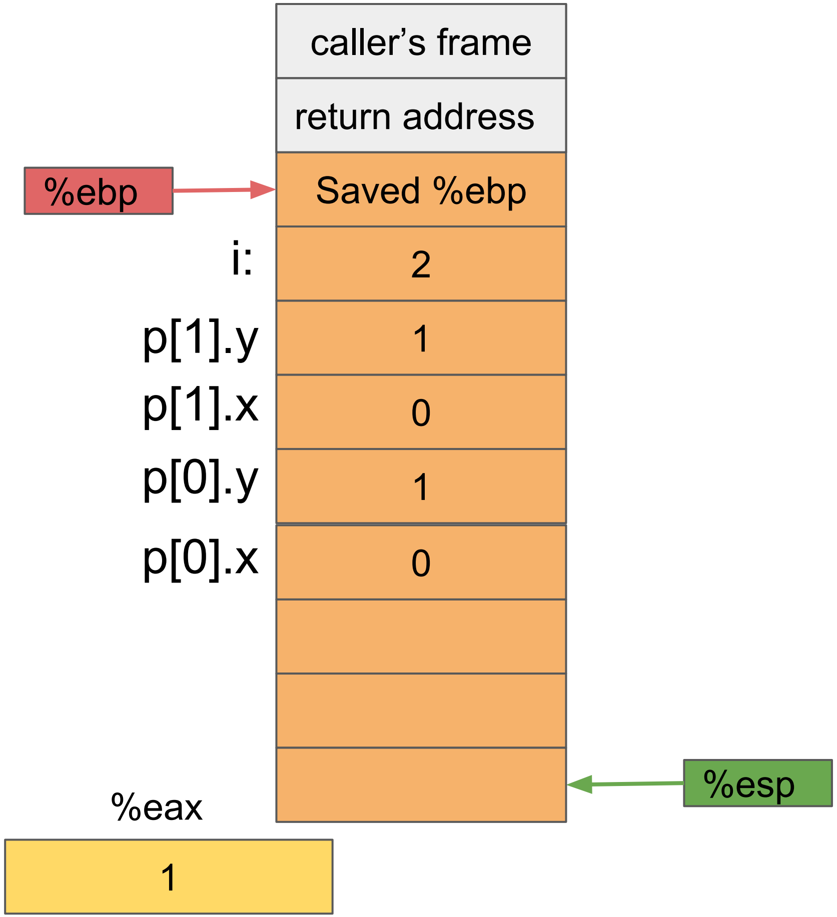
p[0].x 0

%esp →

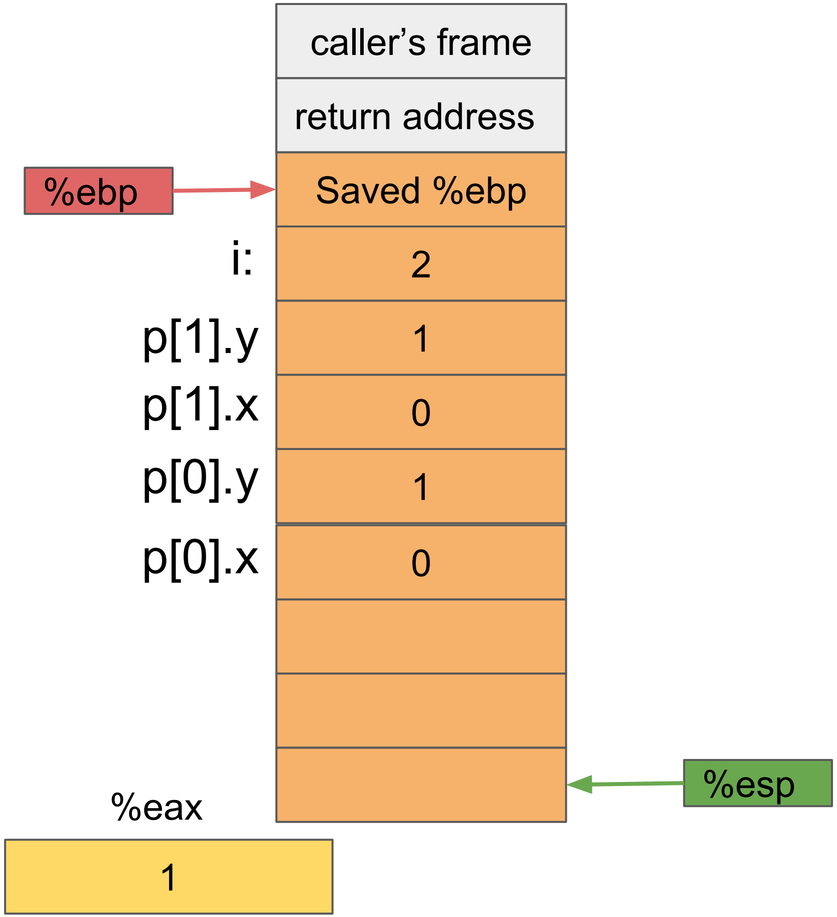
%eax

1

```
func:
    pushl   %ebp
    movl    %esp, %ebp
    subl    $32, %esp
    movl    $0, -4(%ebp)
    jmp .L2
.L3:
    movl    -4(%ebp), %eax
    movl    $0, -20(%ebp,%eax,8)
    movl    -4(%ebp), %eax
    movl    $1, -16(%ebp,%eax,8)
    addl    $1, -4(%ebp)
.L2:
    cmpl    $1, -4(%ebp)
    jle .L3
    leave
    ret
```

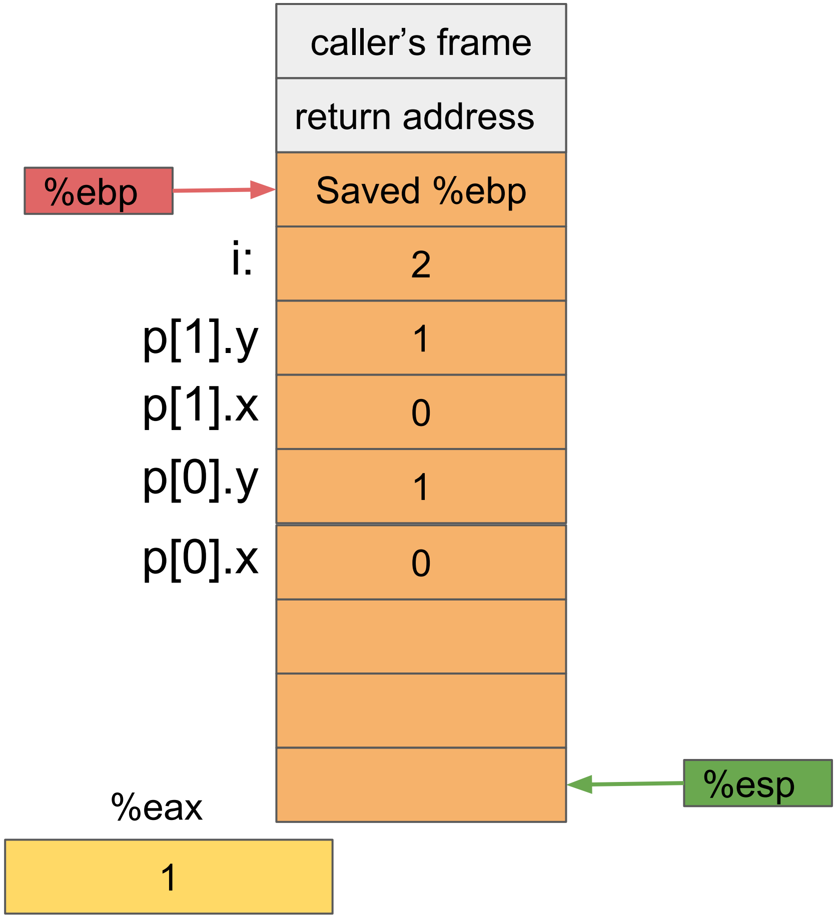


```
func:
    pushl   %ebp
    movl    %esp, %ebp
    subl    $32, %esp
    movl    $0, -4(%ebp)
    jmp .L2
.L3:
    movl    -4(%ebp), %eax
    movl    $0, -20(%ebp,%eax,8)
    movl    -4(%ebp), %eax
    movl    $1, -16(%ebp,%eax,8)
    addl    $1, -4(%ebp)
.L2:
    cmpl    $1, -4(%ebp)
    jle .L3
    leave
    ret
```



Jump if 2 <= 1

```
func:
    pushl   %ebp
    movl    %esp, %ebp
    subl    $32, %esp
    movl    $0, -4(%ebp)
    jmp .L2
.L3:
    movl    -4(%ebp), %eax
    movl    $0, -20(%ebp,%eax,8)
    movl    -4(%ebp), %eax
    movl    $1, -16(%ebp,%eax,8)
    addl    $1, -4(%ebp)
.L2:
    cmpl    $1, -4(%ebp)
    jle .L3
    leave
    ret
```



caller's frame

return address

%ebp → Saved %ebp

i: 2

p[1].y 1

p[1].x 0

p[0].y 1

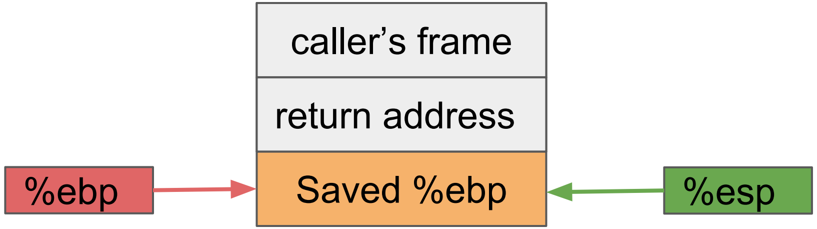
p[0].x 0

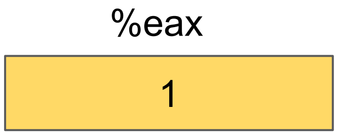
%esp

%eax

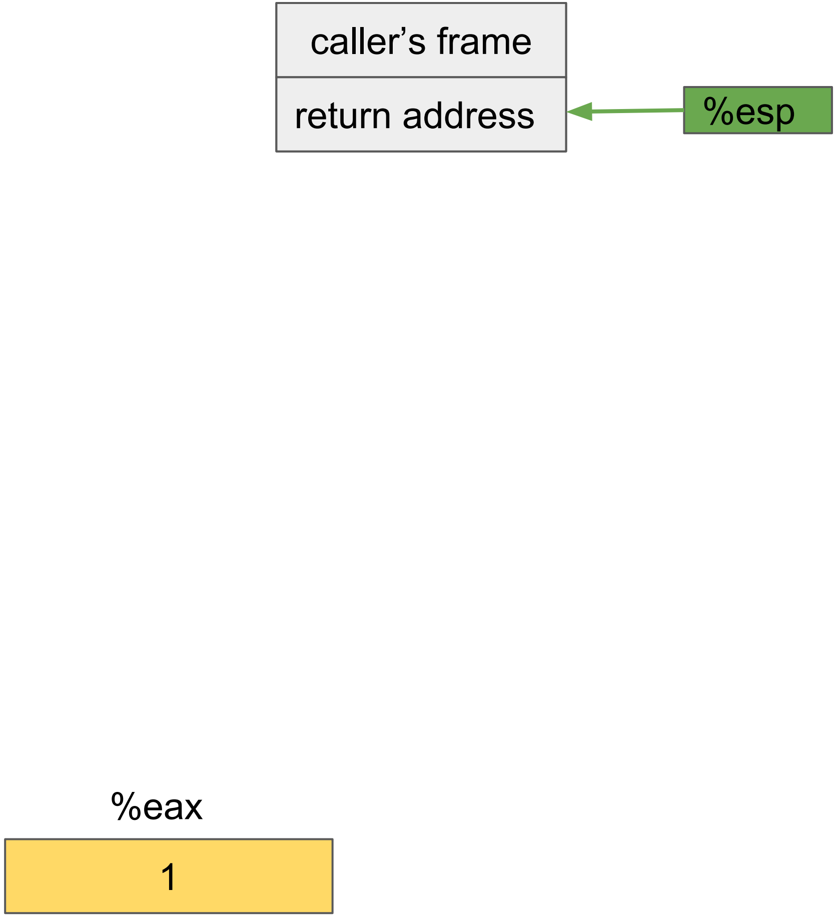
1

```
func:
    pushl   %ebp
    movl    %esp, %ebp
    subl    $32, %esp
    movl    $0, -4(%ebp)
    jmp .L2
.L3:
    movl    -4(%ebp), %eax
    movl    $0, -20(%ebp,%eax,8)
    movl    -4(%ebp), %eax
    movl    $1, -16(%ebp,%eax,8)
    addl    $1, -4(%ebp)
.L2:
    cmpl    $1, -4(%ebp)
    jle .L3
    leave
    ret
```

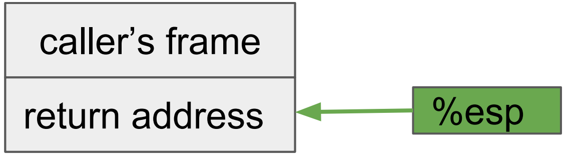




```
func:
    pushl   %ebp
    movl    %esp, %ebp
    subl    $32, %esp
    movl    $0, -4(%ebp)
    jmp .L2
.L3:
    movl    -4(%ebp), %eax
    movl    $0, -20(%ebp,%eax,8)
    movl    -4(%ebp), %eax
    movl    $1, -16(%ebp,%eax,8)
    addl    $1, -4(%ebp)
.L2:
    cmpl    $1, -4(%ebp)
    jle .L3
    leave
    ret
```



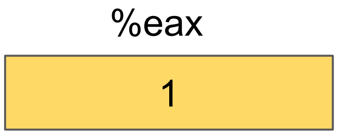
```
func:
    pushl   %ebp
    movl    %esp, %ebp
    subl    $32, %esp
    movl    $0, -4(%ebp)
    jmp .L2
.L3:
    movl    -4(%ebp), %eax
    movl    $0, -20(%ebp,%eax,8)
    movl    -4(%ebp), %eax
    movl    $1, -16(%ebp,%eax,8)
    addl    $1, -4(%ebp)
.L2:
    cmpl    $1, -4(%ebp)
    jle .L3
    leave
    ret
```



caller’s frame

return address

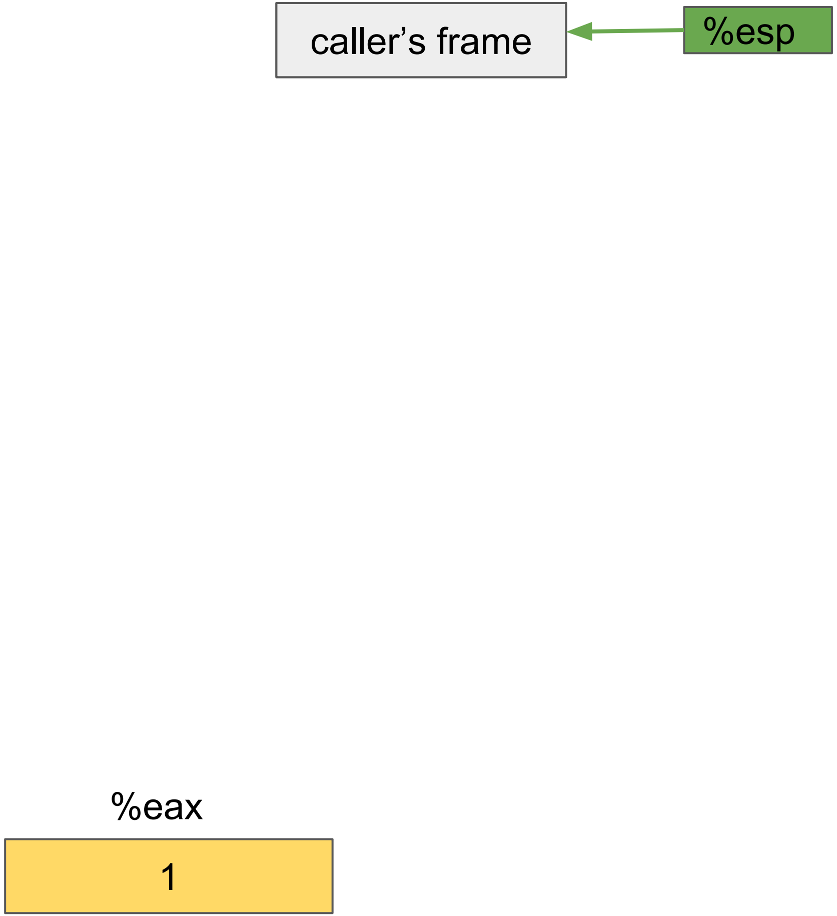
%esp



%eax

1

```
func:
    pushl   %ebp
    movl    %esp, %ebp
    subl    $32, %esp
    movl    $0, -4(%ebp)
    jmp .L2
.L3:
    movl    -4(%ebp), %eax
    movl    $0, -20(%ebp,%eax,8)
    movl    -4(%ebp), %eax
    movl    $1, -16(%ebp,%eax,8)
    addl    $1, -4(%ebp)
.L2:
    cmpl    $1, -4(%ebp)
    jle .L3
    leave
    ret
```



Questions?