Lecture 9: Pointers

CSE 29: Systems Programming and Software Tools

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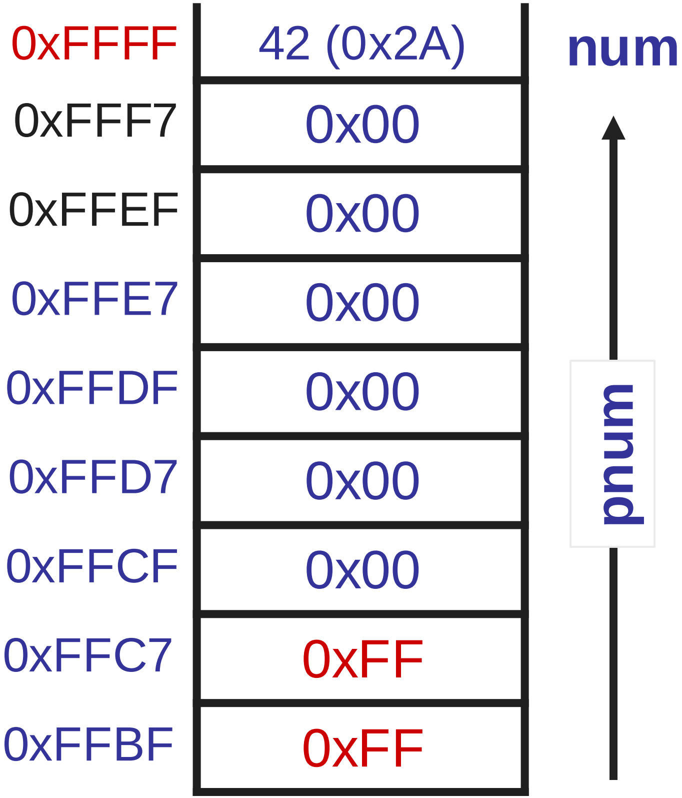
FOR SYSNET
NEAREST CSE BUILDING

Introducing pointers in C

```
char num[] = { 42 }
char* pnum = num;
assert(pnum[0] == 42);
```



0xFFFF	42 (0x2A)
0xFFF7	0x00
0xFFEF	0x00
0xFFE7	0x00
0xFFDF	0x00
0xFFD7	0x00
0xFFCF	0x00
0xFFC7	0xFF
0xFFBF	0xFF

Pointer: A variable in C that can store the address of another variable (or function)

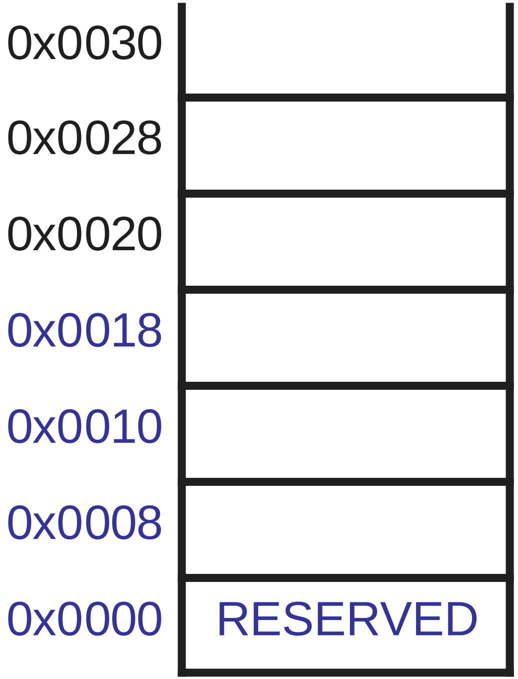
How do you point to “nothing”

```
int *p = NULL;

// C always has this
#define NULL 0

*p = 5;
```

SEGMENTATION FAULT!!!!



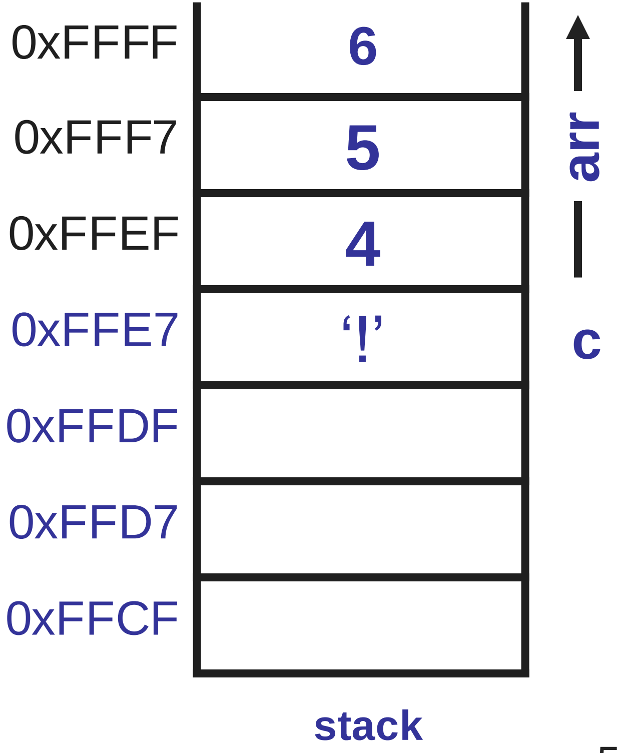
0x0030	
0x0028	
0x0020	
0x0018	
0x0010	
0x0008	
0x0000	RESERVED

stack
(strachpad memory)

Arrays in memory

```
char arr[] = {4,5,6};
char c = '!'
```

Array: A region of memory allocated to a set of values of a specific data type



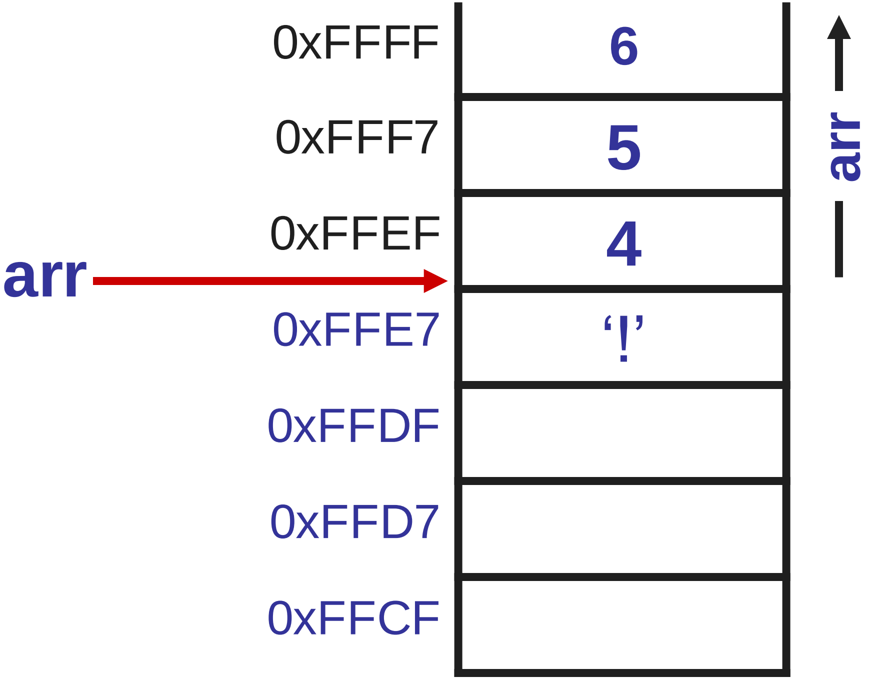
0xFFFF	6	arr
0xFFF7	5	
0xFFEF	4	
0xFFE7	'!'	c
0xFFDF		
0xFFD7		
0xFFCF		

stack

Array variables are also pointers

```
char arr[3] = {4,5,6};
printf(”arr=%p\n”, arr);
```

```
arr=0xFFEF
```



0xFFFF	6
0xFFF7	5
0xFFEF	4
0xFFE7	‘!’
0xFFDF	
0xFFD7	
0xFFCF	

Why is an array variable a pointer?

- An array is a *contiguous region* of memory
  - The array variable points to the start of this region

- We add to the pointer to do indexing in the array
  - Array variable points to the start, to index into the array we **add** to this start address

- When you do an array index (e.g., arr[3]) the compiler will do pointer math
  - arr[3] will turn into arr + (3 * sizeof(long int))

- Pointers let us directly read and modify arrays “in place”

Special C syntax for pointers

& - Address of variable (get addr of var)

```
char* pnum = &num;
```

* - *d*ereference address (get var at addr)

```
char num2 = *pnum;
```