ECE 220 Computer Systems & Programming

Pointers

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What is Pointer?

Pointer

- Address of a variable in memory
- Allows us to indirectly access variables (in other words, we can talk about its **address** rather than its **value**)

Pointers in C

Declaring Pointer Variables

```
int *ptr;
char *cptr;
double *dptr;
```

& - address operator: &x evaluates to the address of variable x

*** - indirection (dereference) operator: *ptr evaluates to value pointed to by ptr**

```
int object;
int *ptr;
object = 4;
ptr = &object;
*ptr = *ptr + 1;
```

More on Pointers

NULL pointer - a pointer that points to nothing

```
int *ptr;
ptr = NULL;
```

Syntax for Pointer operators

1. Declaring a pointer

```
type *var_ptr;
type* var_ptr;
```

2. Creating a pointer

```
&var
```

3. Dereferencing

```
*var_ptr
**var_pptr
```

Pointer Fun on YouTube:
https://www.youtube.com/watch?v=i49_SNt4yfk

ECE 220 Computer Systems & Programming

Arrays

Arrays

Array

- A list of values of **uniform type** arranged sequentially in memory
- Example: a list of telephone numbers
- Expression `a[4]` refers to the 5th element of the array `a`

Arrays

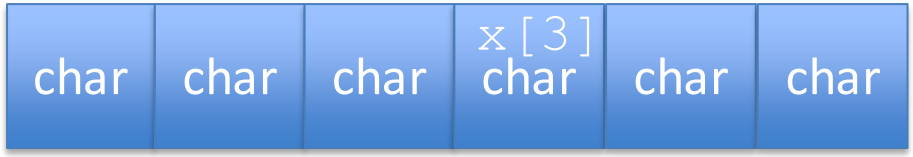
- **Allocate a group of memory locations: character string, table of numbers**

- **Declaring and using Arrays**

```
int grid[10] = {0,1,2,3,4,5,6,7,8,9};
grid[6] = grid[3] + 1;
int i;
for(i=0;i<2;i++)
{
   grid[i+1] = grid[i] + 2;
}
```

Array Layout

`char x[6]`



`int arr[3]`

Pointer Review

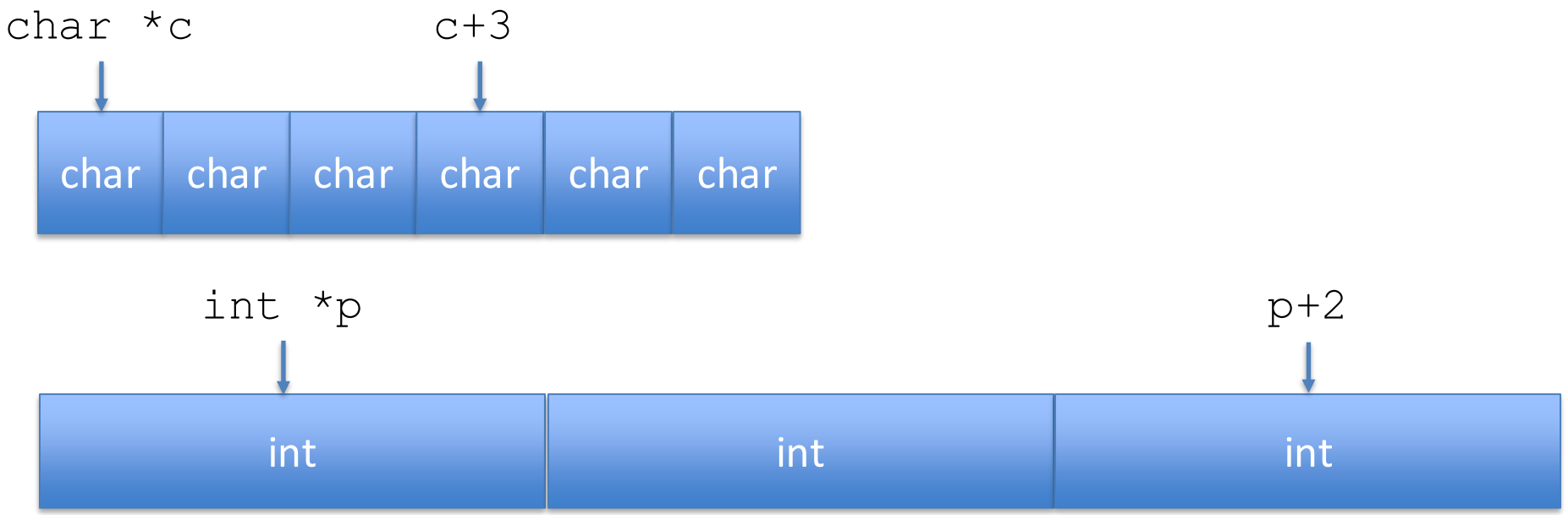
Pointer

- Address of a variable in memory
- Allows us to indirectly access variables (in other words, we can talk about its **address** rather than its **value**)
- Pointers carry type information

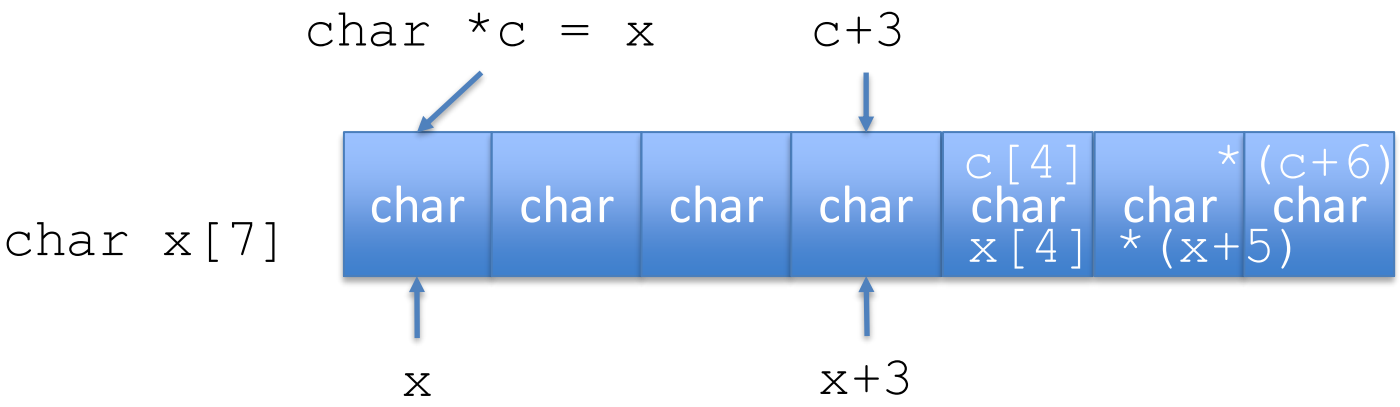
& - address operator: ‘&x’ returns the address of variable x

*** - indirection (dereference) operator: ‘*ptr’ returns the value pointed to by ptr**

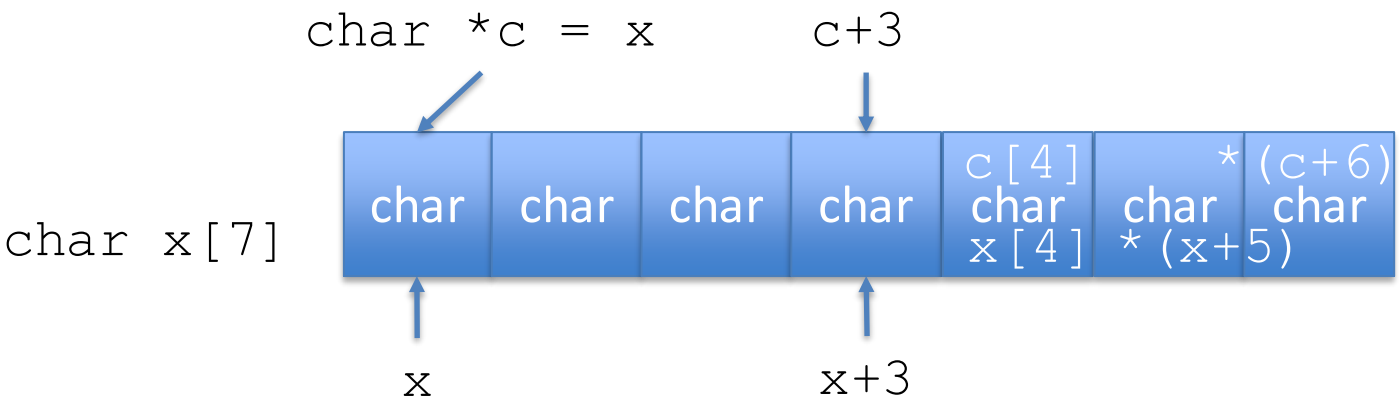
Pointer Arithmetic

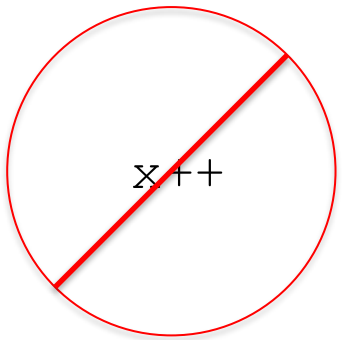


Pointer/Array Duality



Duality Limits





Array identifiers are not l-values

Passing Array as Arguments

C passes arrays by reference

- the address of the array (i.e., address of the first element) is written to the function's activation record
- otherwise, would have to copy each element

```
int main(){
   int array[10];
   int result;
   result = average(array);
   return 0;
}

int average(int array[10]);
/* int average(int array[]); */
/* int average(int *array); */
```