Pointer Basics

Last Updated 10/29/20

Pointer Basics

- These slides introduce Pointers
- Upon completion: You should understand the operation of pointers

Pointer Basics

- Pointer
  - Review variables in memory (stack)

  - address for myVar1

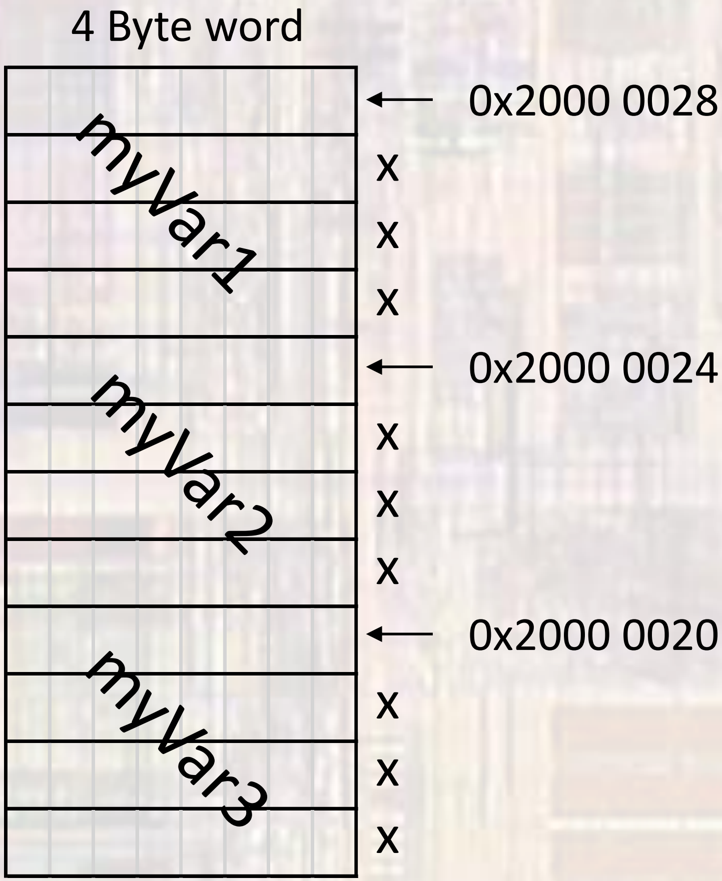
    0x2000 0028

  - address for myVar2

    0x2000 0024

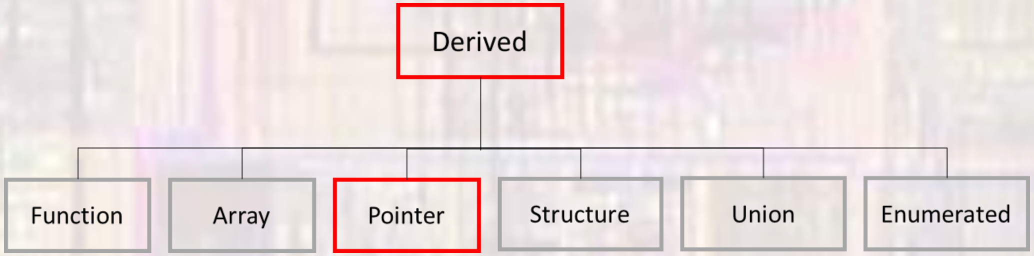
  - address for myVar3

    0x2000 0020



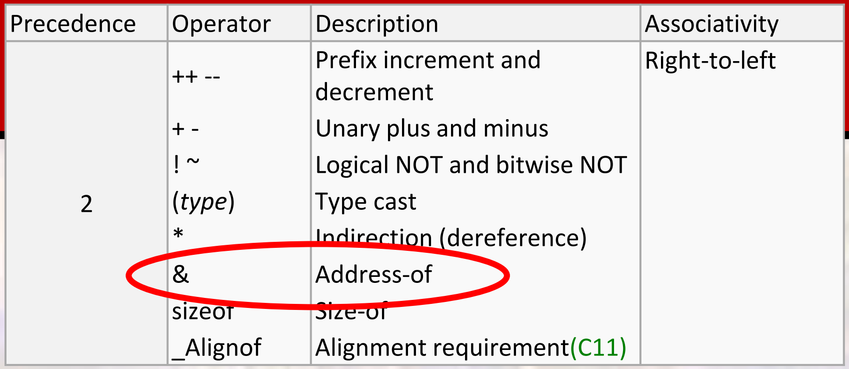
Pointer Basics

- Pointer



  - A special Type
  - A variable that holds the memory location of another variable
  - Holds an address – in our case 32 bits
  - Each pointer must be tied to a specific data type
    - int, float, char, …

Pointer Basics



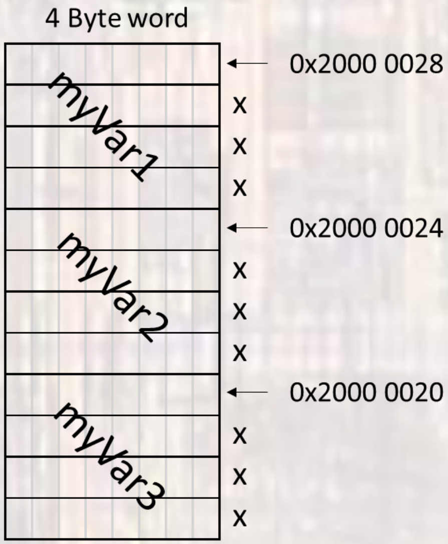
Precedence	Operator	Description	Associativity
2	++ --	Prefix increment and decrement	Right-to-left
	+ -	Unary plus and minus	
	! ~	Logical NOT and bitwise NOT	
	(*type*)	Type cast	
	*	Indirection (dereference)	
	&	Address-of	
	sizeof	Size-of	
	_Alignof	Alignment requirement(C11)	

- Pointer
  - To find the memory location of a variable use the “address of” operator: &

&myVar1 → 0x2000 0028

&myVar2 → 0x2000 0024

&myVar3 → 0x2000 0020

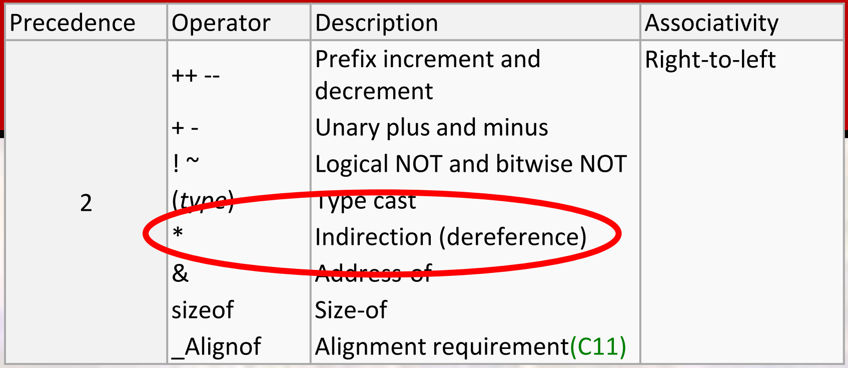


Pointer Basics

- Pointer
  - To declare a pointer variable
    - follow the type declaration with a *

```
int* myVar1_ptr;
// declare a pointer variable with name myVar1_ptr
// that holds the memory location of an integer variable

float* myVar2_ptr;
// declare a pointer variable with name myVar2_ptr
// that holds the memory location of a float variable
```

Pointer Basics



Precedence	Operator	Description	Associativity
2	++ --	Prefix increment and decrement	Right-to-left
	+ -	Unary plus and minus	
	! ~	Logical NOT and bitwise NOT	
	(type)	Type cast	
	*	Indirection (dereference)	
	&	Address-of	
	sizeof	Size-of	
	_Alignof	Alignment requirement(C11)	

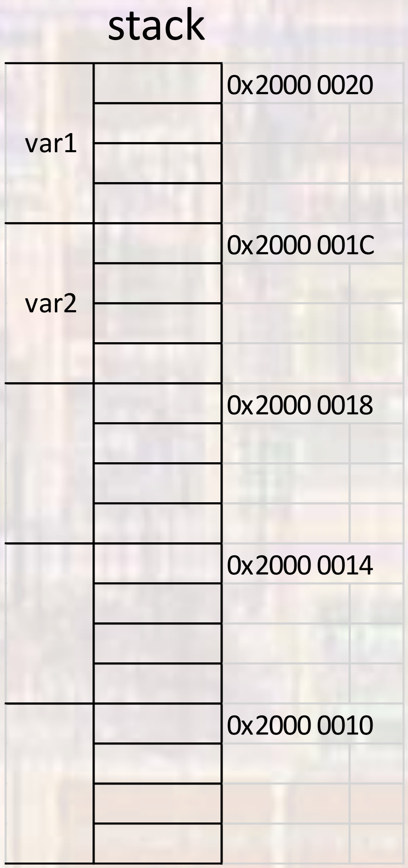
- Pointer
  - To determine the value of a variable pointed to by a pointer variable
    - precede the pointer variable with * (dereference operator)

```
*myVar1_ptr;
// provides the value held in the memory location
// pointed to by myVar1_ptr  (as an int)

*myVar2_ptr;
// provides the value held in the memory location
// pointed to by myVar2_ptr  (as a float)
```

Pointer Basics

- Pointer

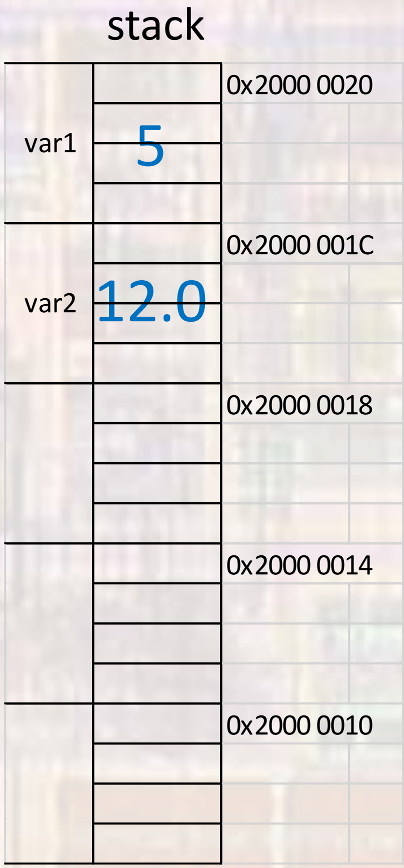
```
int foo1;
float foo2;


int var1;             // declare a variable of type int
float var2;           // declare a variable of type float
```



Pointer Basics

- Pointer

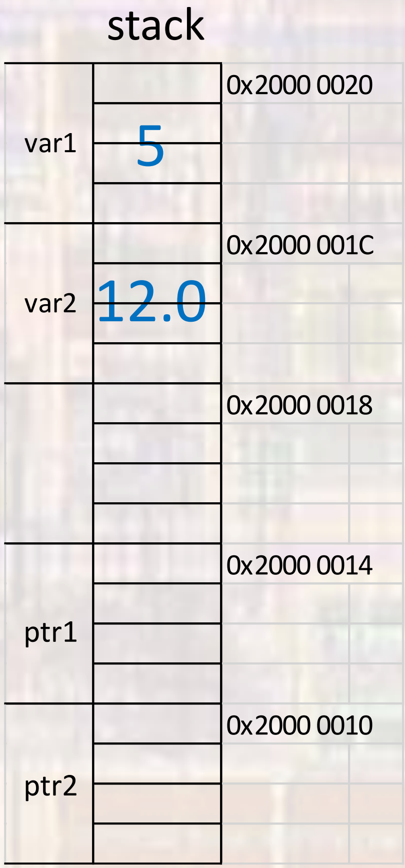
```
int foo1;
float foo2;


int var1;          // declare a variable of type int
float var2;        // declare a variable of type float

var1 = 5;          // stored in memory location 0x2000 0020
var2 = 12.0;       // stored in memory location 0x2000 001C
```



Pointer Basics

- Pointer

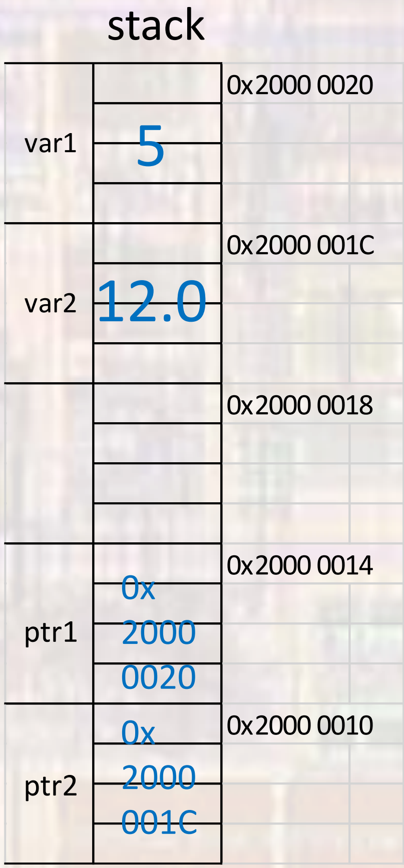
```
int foo1;
float foo2;


int var1;            // declare a variable of type int
float var2;          // declare a variable of type float

var1 = 5;            // stored in memory location 0x2000 0020
var2 = 12.0;         // stored in memory location 0x2000 001C

int* ptr1;           // declare a pointer to a variable of type int
float* ptr2;         // declare a pointer to a variable of type float
```



Pointer Basics

- Pointer

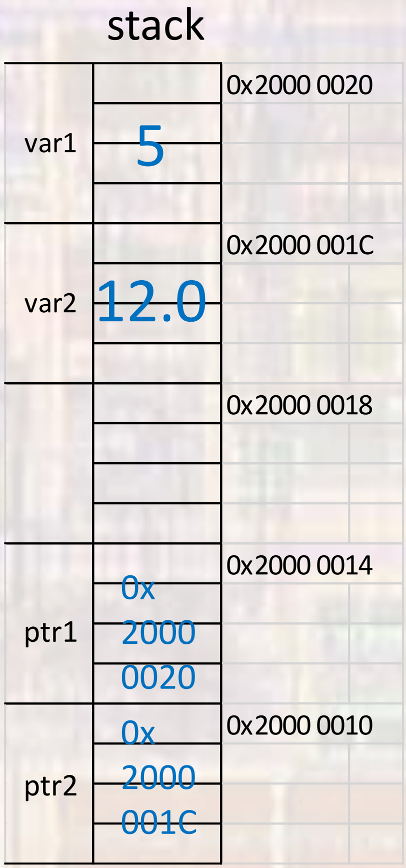
```
int foo1;
float foo2;



int var1;           // declare a variable of type int
float var2;         // declare a variable of type float

var1 = 5;           // stored in memory location 0x2000 0020
var2 = 12.0;        // stored in memory location 0x2000 001C

int* ptr1;          // declare a pointer to a variable of type int
float* ptr2;        // declare a pointer to a variable of type float

ptr1 = &var1;       // set ptr1 to 0x2000 0020
ptr2 = &var2;       // set ptr2 to 0x2000 001C
```



Pointer Basics

- Pointer

```
int foo1;
float foo2;


int var1;            // declare a variable of type int
float var2;          // declare a variable of type float

var1 = 5;            // stored in memory location 0x2000 0020
var2 = 12.0;         // stored in memory location 0x2000 001C

int* ptr1;           // declare a pointer to a variable of type int
float* ptr2;         // declare a pointer to a variable of type float

ptr1 = &var1;        // set ptr1 to 0x2000 0020
ptr2 = &var2;        // set ptr2 to 0x2000 001C

foo1 = *ptr1;        // set foo1 to 5
foo2 = *ptr2;        // set foo2 to 12.0
```



stack

0x2000 0020

var1 5

0x2000 001C

var2 12.0

0x2000 0018

0x2000 0014

ptr1 0x 2000 0020

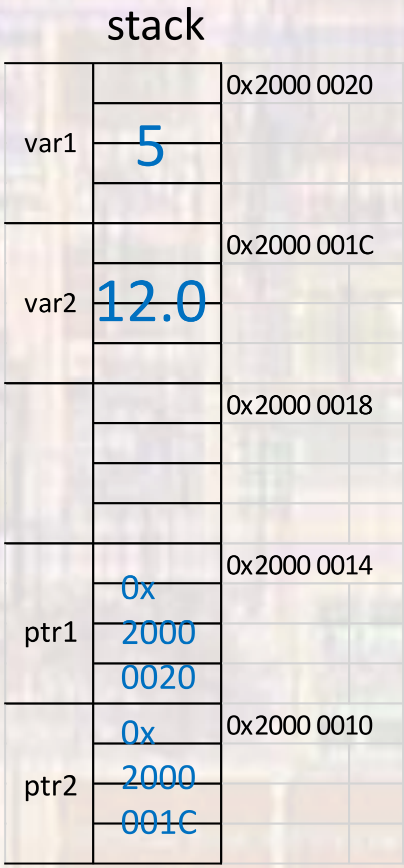
0x2000 0010

ptr2 0x 2000 001C

Pointer Basics

- Pointer

```
int foo1;
float foo2;


int var1;            // declare a variable of type int
float var2;          // declare a variable of type float

var1 = 5;            // stored in memory location 0x2000 0020
var2 = 12.0;         // stored in memory location 0x2000 001C

int* ptr1;           // declare a pointer to a variable of type int
float* ptr2;         // declare a pointer to a variable of type float

ptr1 = &var1;        // set ptr1 to 0x2000 0020
ptr2 = &var2;        // set ptr2 to 0x2000 001C

foo1 = *ptr1;        // set foo1 to 5
foo2 = *ptr2;        // set foo2 to 12.0

Note:     &ptr1      // 0x2000 0014
          &ptr2      // 0x2000 0010
```


stack
var1
5
0x2000 0020
var2
12.0
0x2000 001C
0x2000 0018
ptr1
0x
2000
0020
0x2000 0014
ptr2
0x
2000
001C
0x2000 0010