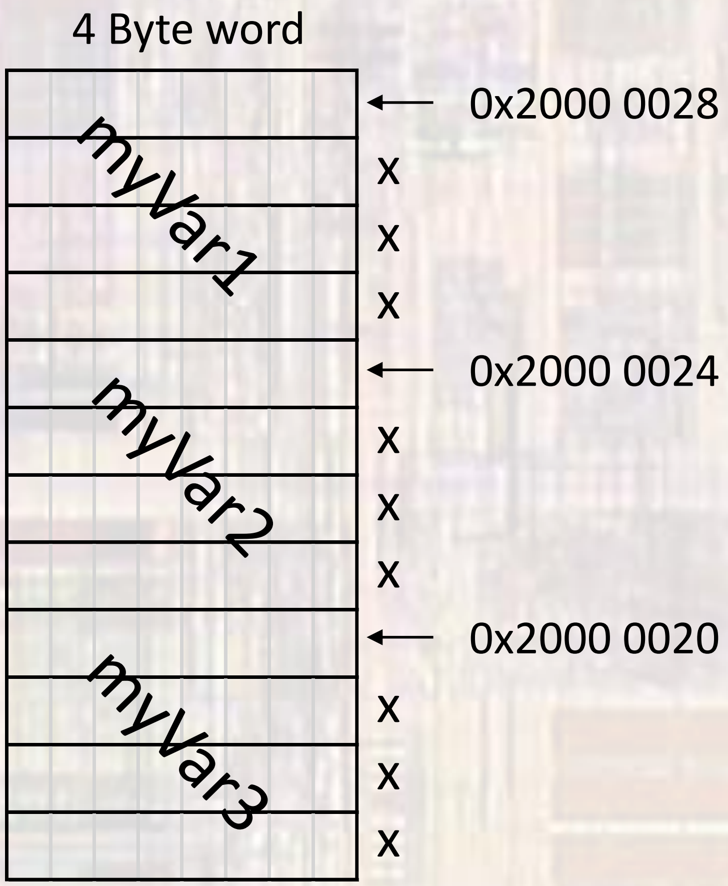
Pointer Basics

Last Updated 9/7/21

Pointer Basics

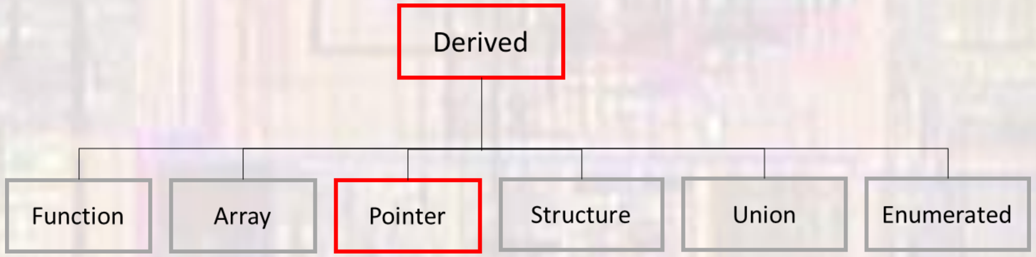
- Review variables in memory (stack)

  - address for myVar1
    0x2000 0028
  - address for myVar2
    0x2000 0024
  - address for myVar3
    0x2000 0020



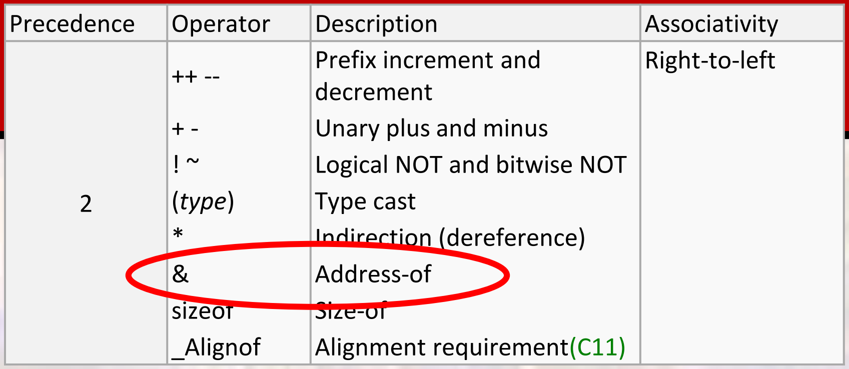
Pointer Basics

- 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



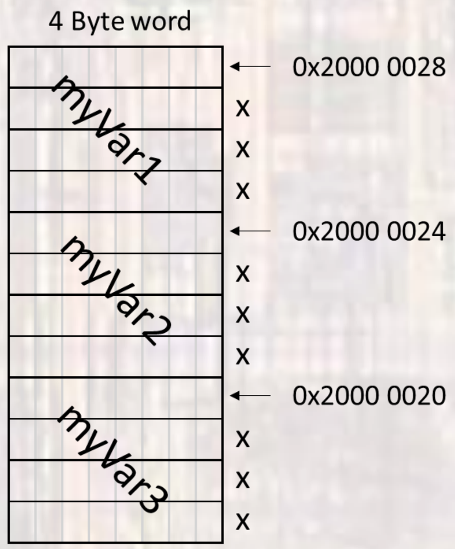
Precedence	Operator	Description	Associativity
2	++ --	Prefix increment and decrement	Right-to-left
	+ -	Unary plus and minus	
	! ~	Logical NOT and bitwise NOT	
	(*type*)	Type cast	
	*	Indirection (dereference)	
	&	Address-of	
	sizeof	Size-of	
	_Alignof	Alignment requirement(C11)	

- Variable location
  - To find the memory location of a variable use the "address of" operator: &

&myVar1 → 0x2000 0028

&myVar2 → 0x2000 0024

&myVar3 → 0x2000 0020

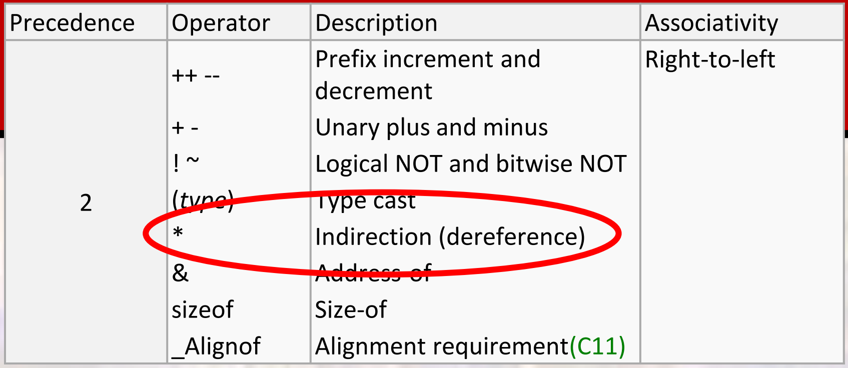


Pointer Basics

- Pointer variable declaration
  - 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)	

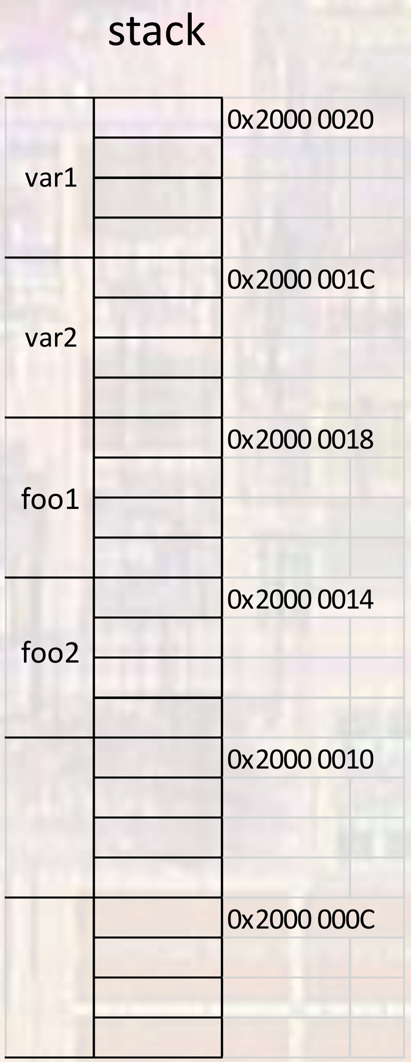
- Dereferencing
  - To determine the value of a variable pointed to by a pointer variable
    - precede the pointer variable with * (dereference operator)

```
*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

- Example

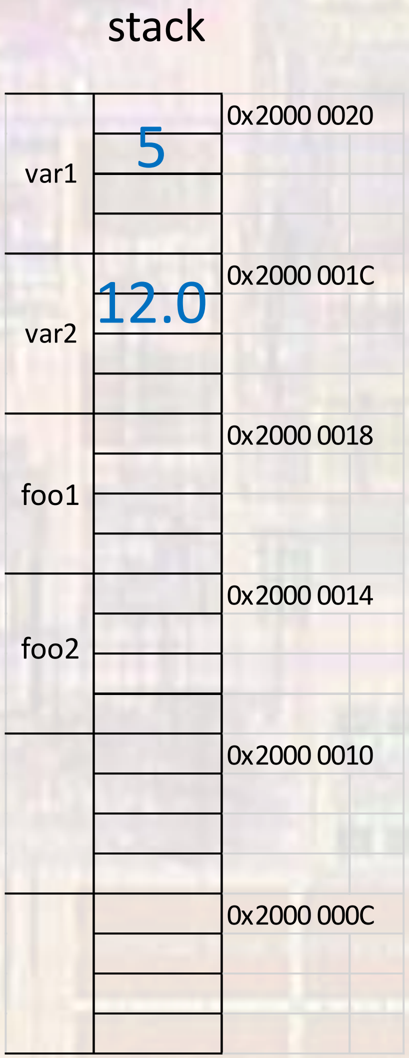
```
int var1;               // declare a variable of type int
float var2;             // declare a variable of type float

int foo1;               // declare a variable of type int
float foo2;             // declare a variable of type float
```



Pointer Basics

- Example

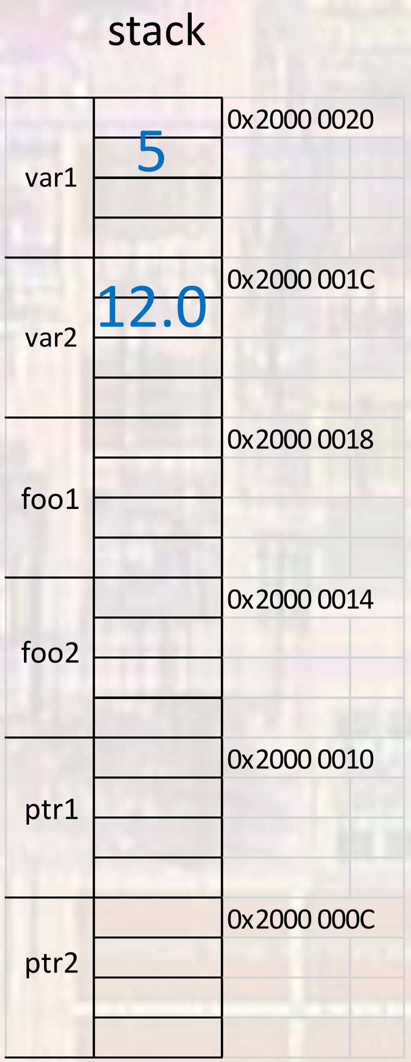
```
int var1;            // declare a variable of type int
float var2;          // declare a variable of type float

int foo1;            // declare a variable of type int
float foo2;          // 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

- Example

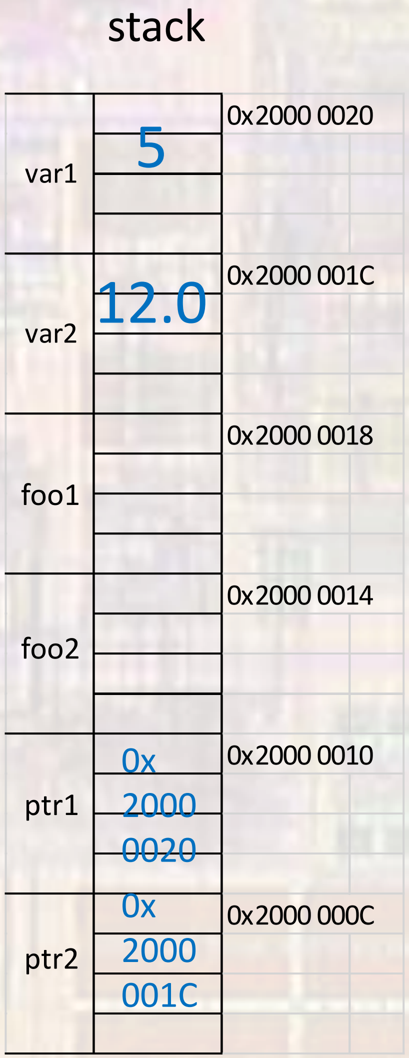
```
int var1;          // declare a variable of type int
float var2;        // declare a variable of type float

int foo1;          // declare a variable of type int
float foo2;        // 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

- Example

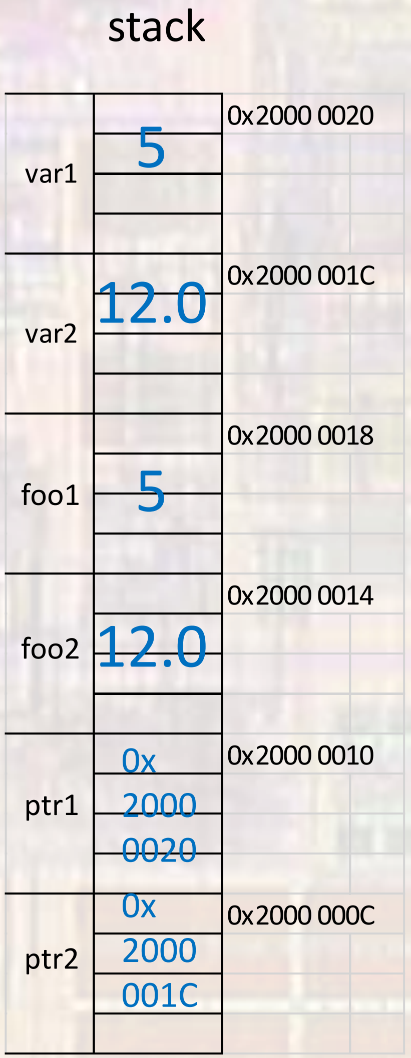
```
int var1;          // declare a variable of type int
float var2;        // declare a variable of type float

int foo1;          // declare a variable of type int
float foo2;        // 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 addr of var1: 0x2000 0020
ptr2 = &var2;      // set ptr2 to addr of var2: 0x2000 001C
```



Pointer Basics

- Example

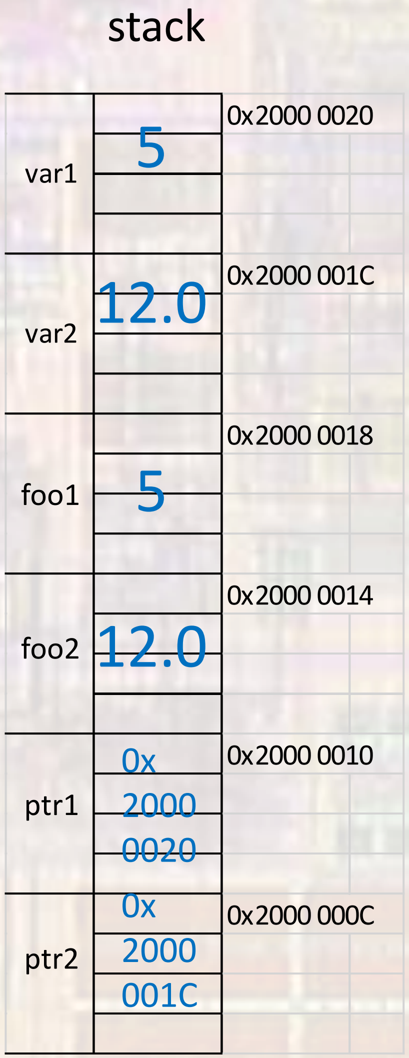
```
int var1;         // declare a variable of type int
float var2;       // declare a variable of type float

int foo1;         // declare a variable of type int
float foo2;       // 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 addr of var1: 0x2000 0020
ptr2 = &var2;     // set ptr2 to addr of var2: 0x2000 001C

foo1 = *ptr1;     // set foo1 to value pointed to by ptr1: 5
foo2 = *ptr2;     // set foo2 to value pointed to by ptr2: 12.0
```



Pointer Basics

- Example

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

int foo1;              // declare a variable of type int
float foo2;            // 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 addr of var1: 0x2000 0020
ptr2 = &var2;          // set ptr2 to addr of var2: 0x2000 001C

foo1 = *ptr1;          // set foo1 to value pointed to by ptr1: 5
foo2 = *ptr2;          // set foo2 to value pointed to by ptr2: 12.0

Note:     &ptr1        // 0x2000 0010
          &ptr2        // 0x2000 000C
```



stack
var1
5
0x2000 0020
var2
12.0
0x2000 001C
foo1
5
0x2000 0018
foo2
12.0
0x2000 0014
ptr1
0x 2000 0020
0x2000 0010
ptr2
0x 2000 001C
0x2000 000C