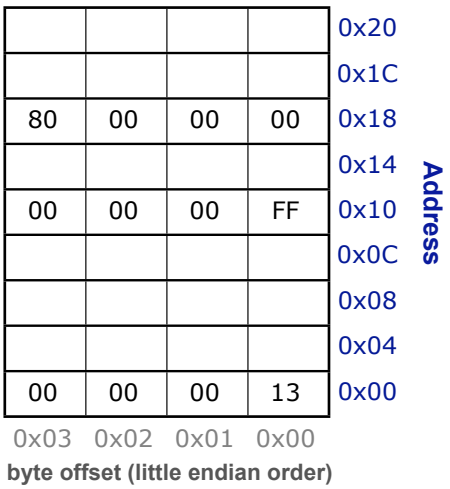
Pointers

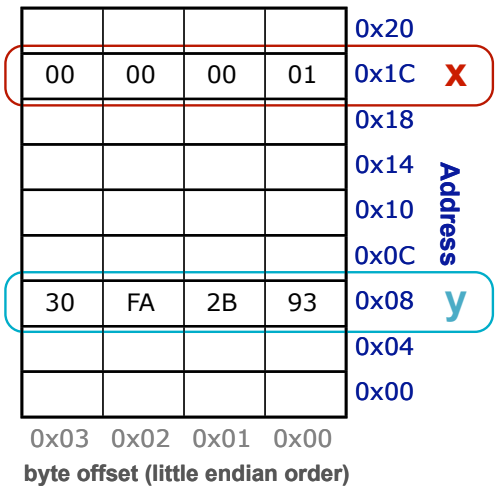
address = index of a byte in memory

pointer = a piece of data storing an address



Variables as Addresses in C

```
int x; // x at 0x1C
int y; // y at 0x08

x = 1;
y = 0x30FA2B93;
```



Pointer Operations

address = index of a byte in memory

pointer = a piece of data storing an address

T* x;	declare a pointer x that will point to something of type T
&x	**address of** x (get a pointer to x)
***x**	**contents at** address given by pointer x (aka "dereference x" – follow the pointer)

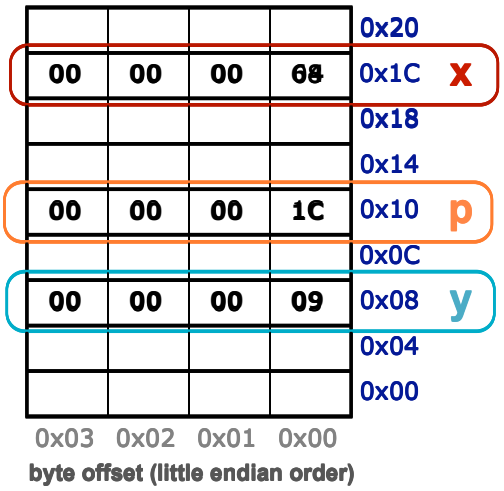
Pointer Example

```
int* p; // p: 0x10

int x = 8; // x: 0x1C
int y = 3; // y: 0x08
```

```
p = &x;
```

```
y = 1 + *p;
```

```
*p = 100;
```

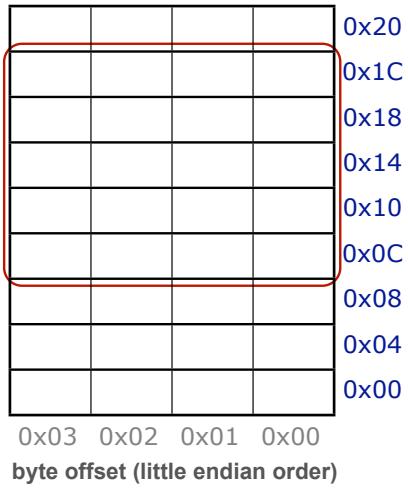


Pointer Example

```
void do_something(int* p1, int* p2) {
    int temp = *p1;
    *p1 = *p2;
    *p2 = temp;
}

void main() {
    int x = 5;
    int y = 3;

    printf("%d %d\n", x, y);

    do_something(&x, &y); // swap!

    printf("%d %d\n", x, y);
}
```

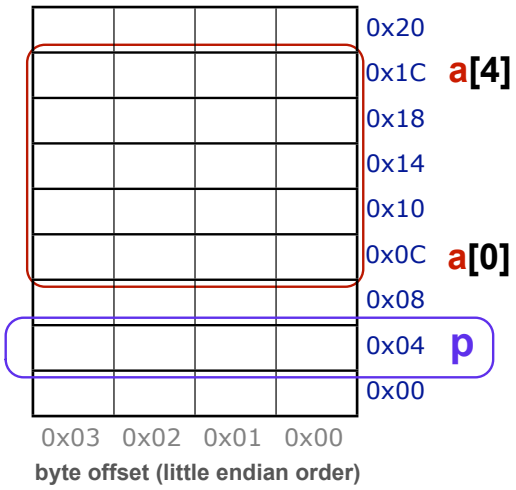

Arrays in C

```
int a[5]; // declaration
```



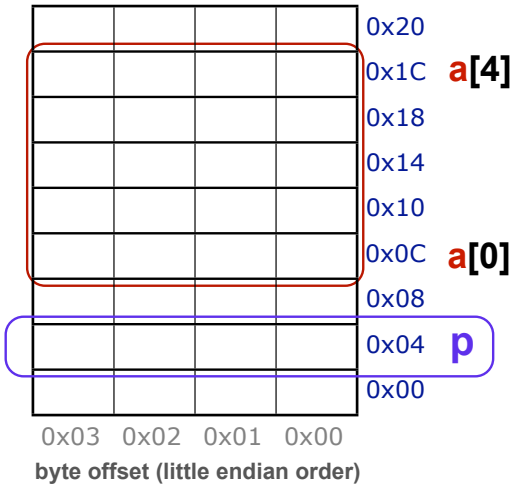
Arrays as Pointers

```
int a[5];

int* p;
```



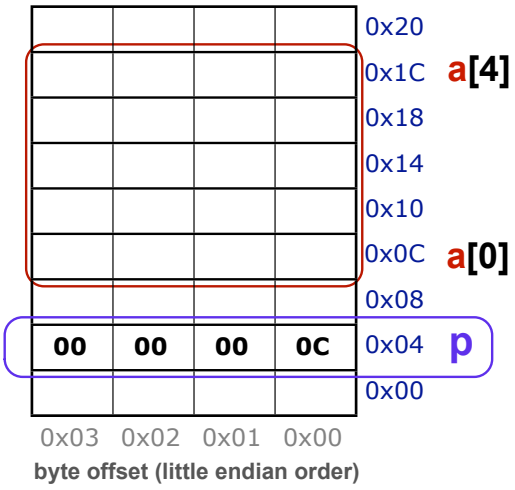
Arrays as Pointers

```
int a[5];

int* p;

p = &a[0];
```



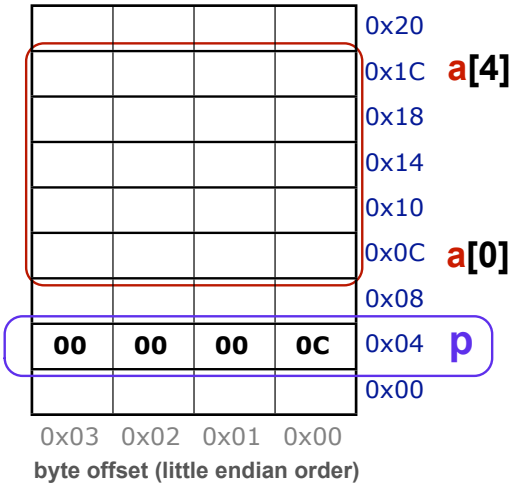
Arrays as Pointers

```
int a[5];

int* p;

p = &a[0];
```



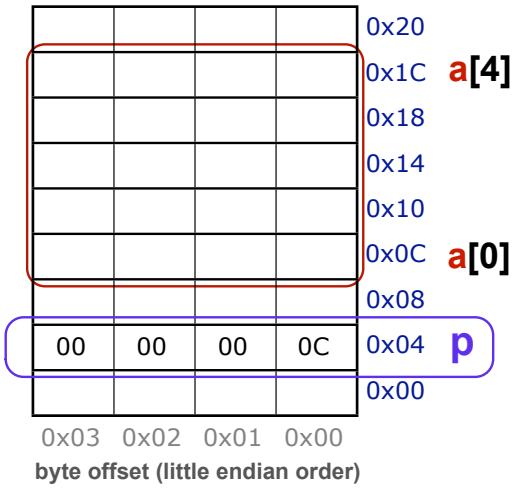
Arrays as Pointers

```
int a[5];

int* p;

p = &a[0]; // or p = a;
```



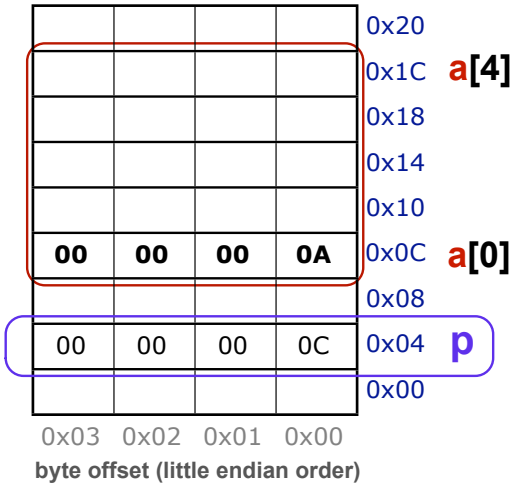
Arrays as Pointers

```
int a[5];

int* p;

p = a; // &a[0]

*p = 0xA;
```



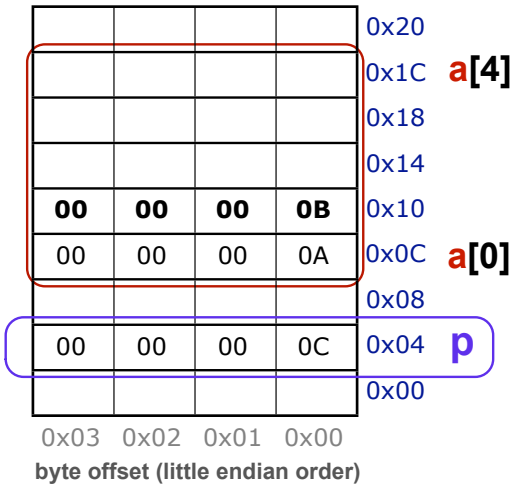
Arrays as Pointers

```
int a[5];

int* p;

p = a; // &a[0]

*p = 0xA;
```



Arrays as Pointers

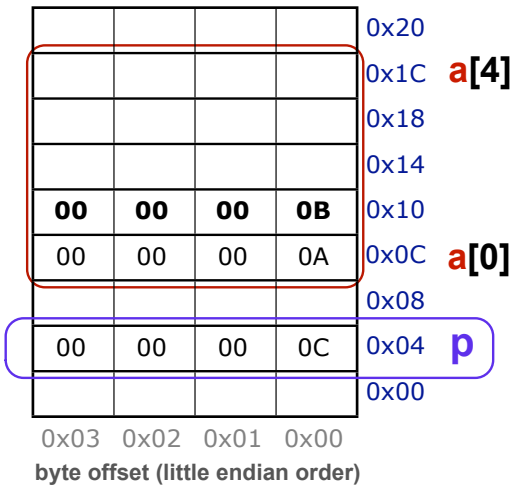
```
int a[5];

int* p;

p = a; // &a[0]

*p = 0xA;
p[1] = 0xB;
```



Pointer Arithmetic

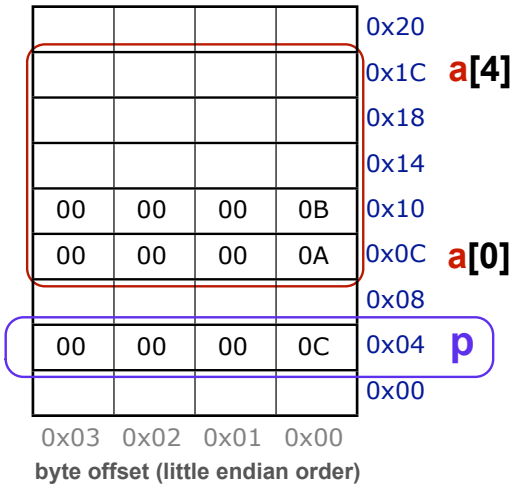
```
int a[5];

int* p;

p = a; // &a[0]

*p = 0xA;
p[1] = 0xB;
*(p + 1) = 0xB;
```

Equivalent!



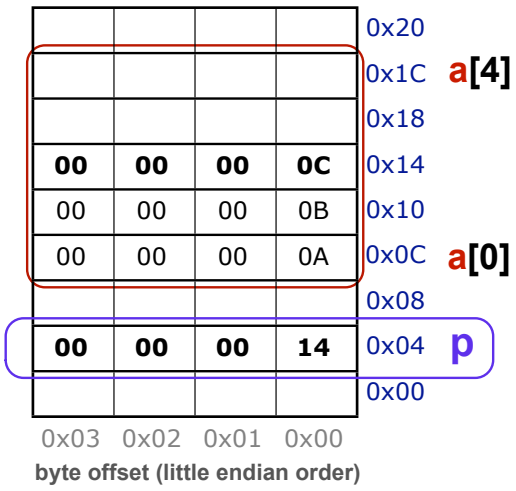
Pointer Arithmetic

```
int a[5];

int* p;

p = a; // &a[0]

*p = 0xA;
*(p + 1) = 0xB;

p = p + 2;
*p = a[1] + 1;
```



Pointer Arithmetic

```
int a[5];

int* p;

p = a; // &a[0]

*p = 0xA;
*(p + 1) = 0xB;

p = p + 2;
*p = a[1] + 1;
```



Null-Terminated Strings