Pointers and Arrays

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October 3, 2017

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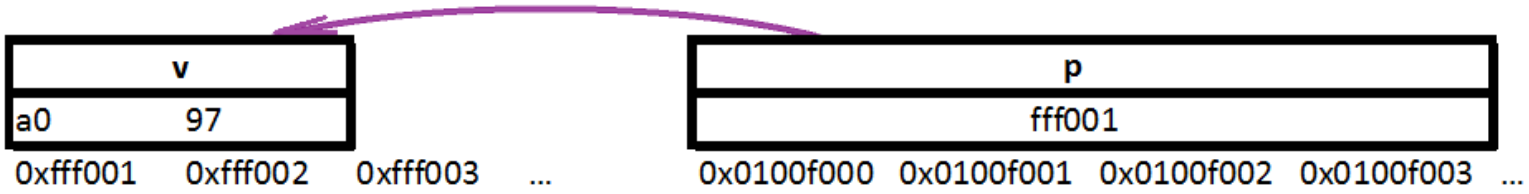

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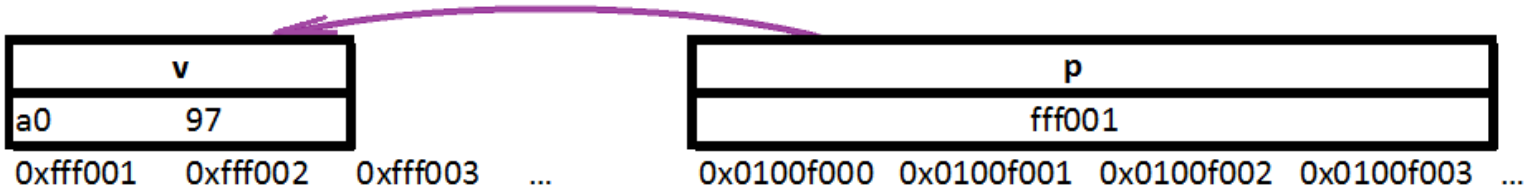

8 memory cells (8 bytes) can hold:

1. one instance of long long int //64 bits.
2. one - double
3. two - int //2 * 32 = 64 bits.
4. four - short
5. eight - char

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type * name;

Pointer declaration examples:

1. int* count;
2. char* name;
3. double* ratio;
4. void* data; //**Pointer to void is generic pointer.**

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int* address = &days; //Address now points to days
* address += 1; //The days value becomes 26.
int count = * address; //Value of count will be 26.
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The last line of the above example can be read as "**count** is equal to value pointed to by address".

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To increment the value p points to:

1. `*p = *p + 1;`
2. `*p = 1 + *p;`
3. `*p += 1;`
4. `++*p;`
5. `++(*p); //This is a safer way.`
6. `(*p)++;`

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Parentheses are mandatory in previous line because ***p++** will **increment p** by 1 instead of incrementing days. This is because dereference * associate **right-to-left** and **postfix increment** has highest **precedence**.

Quick review of C Operator Precedence

The following table lists the precedence and associativity of C operators. Operators are listed top to bottom, in descending precedence.

Precedence	Operator	Description	Associativity
1	++ --	Suffix/postfix increment and decrement	Left-to-right
	( )	Function call	
	[ ]	Array subscripting	
	.	Structure and union member access	
	->	Structure and union member access through pointer	
	(*type*){*list*}	Compound literal(C99)	
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)	
3	* / %	Multiplication, division, and remainder	Left-to-right
4	+ -	Addition and subtraction	
5	<< >>	Bitwise left shift and right shift	
6	< <=	For relational operators < and ≤ respectively	
	> >=	For relational operators > and ≥ respectively	
7	== !=	For relational = and ≠ respectively	
8	&	Bitwise AND	
9	^	Bitwise XOR (exclusive or)	

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++(*p); //days is 26.
*p = 27; //days is 27.
```

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Example:

```
int days = 25;
int* const p = &days;

++(*p); //days is 26.
*p = 27; //days is 27.

*(++p) = 28; //Compilation error.
*p++; //Cannot assign value to const variable p.
```

The two last lines of this example will not compile.

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Example:
```
int days = 25;
int month = 1;
const int* p = &days;
++p; //p would probably point to month - do not do this.
*p = 26; //Compilation error.
```

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Solution is to use **pointers**.

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{
int temp;
temp = *px;
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void swap(int *px, int *py);
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```

swap(&a, &b) sends the address of a and b as arguments.

So void swap(int *pa, int *pb) function interchanges the actual arguments a and b.

Swap via pointers

Example:

```
# include<stdio.h>
void swap( int *a, int *b);
void main() {
  int x = 10, y = 20;
  printf("Values before swap in main x = %d, y = %d \n",x,y);
  //x=10 y=20
  swap(&x,&y);
  printf("Values after swap in main x = %d, y = %d \n",x,y);
  //x=20 y=10
}
```

Swap via pointers

```
void swap( int *a, int *b )
{
  int temp;
  temp = *a;
  *a = *b;
  *b = temp;
  printf(" Values after swap inside swap function: x = %d, y = %d", *a, *b);
  //x=20 y=10
}
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int b = *pa; //Copy the contents of a[0] into b.
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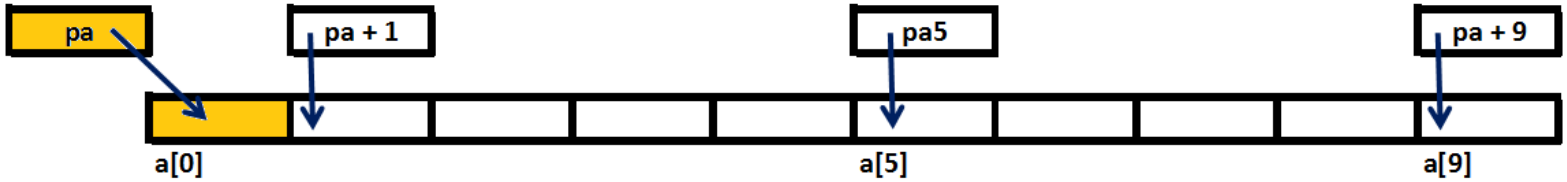
Pointer arithmetic




```
int a[10];

int *pa = &a[0];

int *pa5 = a + 5;
```

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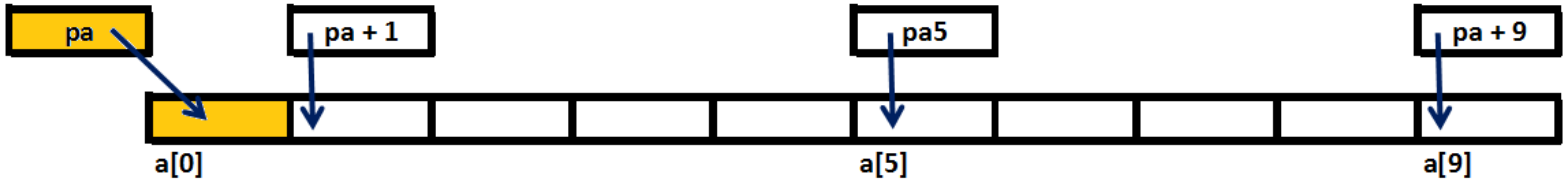


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1. pa points to 0-th element of array a.
2. pa5 points to 5-th element of a.
3. (pa5 + 1) points to next (6-th) element.
4. (pa5 - n) points n elements before pa5.
5. *(pa+1) refers to contents of a[1].

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   If p1 points to a particular element of an array , then p1+1 points to the next element.
3. **Subtraction or comparison** of two pointers to same array.
   Example: int a[10];
   int *p1 = a + 2;
   int *p2 = a + 5;
   printf("%d", p2-p1);// prints 3

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3. Pointer of one type cannot be assigned to pointer of another type.

   Example:

```
int*p1;
char*b = p1; //Error
char*valid_cast = (char*)p1;
```

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1. `char a1[] = "good news";`
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What is the difference between the two?

1. a1 is an **array** of 10 chars that always refers to same storage, although characters within array may be changed.
2. p2 is **pointer** to **string constant**. If this string constant is modified, result is undefined.

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strcpy using pointers:

```
void strcpy2(char *t, char const*s) {
   while ('\0' != (*t = *s)) {
     ++s;
     ++t; }
}
```

String is copied each character at a time, until '\0'.

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int strcmp1(char *s, char const*t) {
   int i;
   for(i=0; s[i] && t[i]; i++ )
     if(s[i] != t[i] )
        retun 0;
   if( s[i] == '\0' && t[i] ) return 0;
   else return 1;
}
```