
Pointers and Strings
Chapters 10, 12

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Pointers and Arrays (10.3)

- An array of `ints` can be declared as
 - `int numbers[] = {1, 2, 3, 4, 5};`
- `numbers` is also a pointer to the first element in the array
- Therefore, it can be dereferenced to access the elements of the array
 - `*numbers = 2;`
 - What are the contents of the above array now?

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Pointers and Arrays (10.3)

- The name of the array is a pointer to the **first** element in the array
- What about the other elements in the array?
 - You can add 1 to the array name to access the second element
 - You can add 2 to the array name to access the second element...and so on
- When adding a number to the array name, you are actually adding that number times the size of the element in the array

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Pointers and Arrays (10.3)

```
int numbers[] = {1, 2, 3, 4, 5};
*(numbers + 1) = 1;
*(numbers + 2) = 1;
*(numbers + 3) = 1;
*(numbers + 4) = 1;
```

- What are the contents of the array now?
- What would happen if we did the following:
 - `*(numbers + 5) = 1;`

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Pointers and Arrays (10.3)

- Rewrite the following so that it uses pointer notation instead of subscript notation

```
for(int x = 0; x < 100; x++)
{
    cout << array[x] << endl;
}
```

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Strings

- What is a string in C++?
- How have we declared string variables? We have used two ways.

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C-Strings (12.1)

- In C++, strings are arrays of characters that end in the null character `\0`
- A C-string can be declared as:
 - `char pet[] = "cat";`
 - `char *pPet = "cat";`

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Strings and Pointers

- When declaring an array, the name of the array is also a constant pointer to the first element in the array

```
int array[] = {2, 4, 6, 8};
int *pArray;
```

```
pArray = array;
pArray = &array[0];
cout << array[2]
      << *(pArray + 2);
pArray++;
array++; // ERROR
```

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Strings

- Assuming that the string `pet` has been declared as:
 - `char pet[] = "cat";`
- Write a function that will output the contents of the string. The function should accept the array and its size
- Write a function that will output the contents of the string. The function should accept a pointer to char

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Strings and Pointers

- Write a function `strLength` that accepts a string (as a pointer) and returns the length of the string

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Strings and Pointers

```
int strLength (const char *pStr)
{
    int index;
    for (index = 0; *(pStr + index) != '\0'; index ++);
    return index;
}
```

- What is the purpose of `const` in the function header?
- Is the `;` at the end of the for loop a mistake?
- What would happen if the `;` was eliminated?

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Pointer Arithmetic (10.4)

```
int strLength2 (char *pStr)
{
    char *pTemp = pStr;
    while (*pTemp)
    {
        pTemp ++;
    }
    return pTemp - pStr;
}
```

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What is happening?

```
int sumInts (int *pArray, int size)
{
    int sum = 0;
    int index;

    for (index = 0; index < size; index ++)
    {
        sum += *pArray ++;
    }

    return sum;
}

int array[] = {10, 20, 30, 40, 50}; creates an array
as follows:
Address  Value  Element
2000    10    0
2004    20    1
2008    30    2
2012    40    3
2016    50    4
```

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Constant Pointers

- So far we have seen:
 - Nonconstant pointers to nonconstant data
 - Nonconstant pointers to constant data
- What about constant pointers?
- We said that array names are constant pointers to the first element in the array. What does that mean?

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Constant Pointers

```
int * const pNum, num, num2;
num = 9;
num2 = num + 8;
pNum = &num;
*pNum *= 2;
pNum = &num2; // ERROR
```

- pNum has been declared as a constant pointer
- It cannot point to any other memory location

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Arrays of Pointers

- What do you make of the following declaration?

```
char *cardSuits[4] = {"Clubs", "Diamonds",  
                    "Hearts", "Spades"};
```

- What gets output in each of the following cases?

```
cout << cardSuits[1] << endl;
```

```
cout << *cardSuits[1] << endl;
```
