

Read King Chapters 4, 5 and 6 (expressions, simple statements and loops) Basic C Data Types (King Chapter 7)

C has a few basic data types, they are:

- A character: `char`
- An integer: `int`
- A floating point number: `float` and `double`

There are three modifiers that are commonly applied to some basic data types

- `long`, which basically doubles the space allocated to `int` and `float/double` types.
- `short`, which handles ints up to 32768 (it is less important now that computers have more memory).
- `unsigned`, which is applied to integers and changes their range from $[-2^{31}, 2^{31})$ to $[0, 2^{32})$.
A unsigned value does not view its left-most bit as a sign, it is part of the value.

The type qualifier `const` is important.

- `const` qualifies data items that must not alter during execution of the program.

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Variables can be initialized at declaration:

```
char c = 'd';
```

```
int q = 4;
```

```
float u = 13.5;
```

```
double v = 7.9e-2;
```

Thus a declaration has the following general format:

```
Type VariableName = InitialValue ;
```

The '= InitialValue' part is optional

A pointer to a data item is declared in the following way

```
Type* VariableName ;
```

```
int* ptr;
```

The type specifies the kind of item referred to. Here `ptr` points to an integer object. As things stand this is not particularly useful. Later pointers come into their own when we access arrays and other objects indirectly with pointers.

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I also consider a `pointer` to be a basic data type - a pointer is always the size of a machine address and is treated like an unsigned integer

See King Page 111, for the range of integer values for 32-bit computers.

Use the `sizeof` operator to determine space needs of datatypes. King P. 489 and 494 give i/o conversion specifics.

Declaration	Space	scanf	printf
<code>char c;</code>	1 byte (8 bits)	<code>%c</code>	<code>%c</code>
<code>short int p;</code>	2 bytes	<code>%hd</code>	<code>%hd</code>
<code>int q;</code>	4 bytes	<code>%d</code>	<code>%d</code>
<code>unsigned int r;</code>	4 bytes	<code>%u</code>	<code>%u</code>
<code>long int s;</code>	4 bytes, (8 ?)	<code>%ld</code>	<code>%d</code>
<code>float u;</code>	4 bytes	<code>%f</code>	<code>%f</code>
<code>double v;</code>	8 bytes	<code>%lf</code>	<code>%f</code>
<code>long double x;</code>	8 bytes, (16 ?)	<code>%le</code>	<code>%f</code>

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Character Constants

Character constants are enclosed in single quotes, for example,

```
'a', 'b', 'c'.
```

There are a number of special characters that must be "escaped" so they can be recognized. See King P. 119.

The common ones are:

```
New Line   '\n'  
Tab        '\t'  
Backslash  '\\'
```

the `\` is also used to provide values for octal and hexadecimal numbers. See King page 111.

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String Constants (literals)

Literal strings are seen first in print statements, and are enclosed in double quotes. They may form an output message like

```
printf ("Hello World");
```

or may appear as the format string for presenting the value of an expression or a variable

```
printf ("Here we have a fifteen %d", 3*5);
```

We will deal with string variables later after we cover arrays and pointers. See also King, Chapter 13.

Arrays

- * Arrays and pointers are closely related in C
- * C basically supports one dimensional arrays, the first subscript value is 0
- * An array is declared in the following way:
Type ArrayVariable [size];
Thus valid indices are in the range 0 to size-1.
- * The type, name and size (length) of the array are all specified here.

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- * In C and Unix a text string is terminated by a zero byte (or NULL byte), this is written as '\0'. An empty string requires one byte of storage. In general a string with n characters requires n+1 bytes of storage. Later in the course you must be careful to allocate space for that extra byte.

```
char data[5] = "WORD";
```

is the same as:

```
char data[5];
```

```
data[0] = 'W';  
data[1] = 'O';    /* this is the letter Oh */  
data[2] = 'R';  
data[3] = 'D';  
data[4] = '\0';  /* this is the digit Zero */
```

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For example

```
int a[100];
```

produces an array with room for 100 integers. The first element is a[0] and the last element is a[99]

- * Arrays can be initialized at declaration time with a list of values

For example

```
int a[10] = { 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 };  
int b[10] = {-3, -1, 0, 1, 3, 5, 7, 9, 11, 13};  
int c[ ] = {-3, -1, 0, 1, 3, 5, 7, 9};
```

- * A text string is a one-dimensional array of char elements

For example, a text string can be declared and initialized in the following way:

```
char string[25] = "This uses 19 bytes";
```

- * A character string constant is enclosed in double quotes ("), for example:
"this is a text string"
Note the different usage of single and double quotes

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