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The current version of the standard is ANSI C11 (actually an ISO standard adopted by ANSI), was approved in December 2011

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But also in many other situations: it is very flexible and lends itself to many kinds of problem

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This is an explicit trade-off of speed of C programs against the (relative) safety of managed languages (like Java)

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If you don't know Java, you are so much better off (in many ways)

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Unlike Java, which tries to hide the hardware from the programmer

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Note: this is not a judgement of which language is “better”

C

The only question is “which language is better suited **to the problem in hand**”

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Exercise. Which is the better tool: a screwdriver or a hammer?

C

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Write C programs

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I've lost count of the number of students who have handed in pitiful coursework while saying "I wish I'd had more practice before starting this"

Practice!

C

We start with a couple of example C programs

```
main(t,_,a )
char
*
a;
{
return!

0<t?
t<3?

main(-79,-13,a+
main(-87,1-_,
main(-86, 0, a+1 )


+a)):

1,
t<_?
main( t+1, _, a )
:3,

main ( -94, -27+t, a )
&&t == 2 ?_
<13 ?

main ( 2, _+1, "%s %d %d\n" )
```

```
"@n'+,#'/*{}w+/w#cdnr/+,{}r/*de}+,/*{*+,/w{%+,/w#q#n+,/#{l,+,/n{n+,/+#n+,/#;#q#
:'d*'3,}{w+K w'K:'+}e#';dq#'l
q#'+d'K#!/+k#;q#'r}eKK#}w'r}eKK{nl]'/#;#q#n'){)#}w'){){nl]'/+#n';d}rw'
i;# ){nl]!/n{n#'; r{#w'r nc{nl]'/#{l,+'K {rw' iK{;[{nl]'/w#q#n'wk nw'
iwk{KK{nl]!/w{%'l##w#' i; :{nl]'/*{q#'ld;r'}{nlwb!/*de}'c
;;{nl'-{}rw]'/+,}##'*}#nc,',#nw]'/+kd'+e}+;#'rdq#w! nr'/ ') }+}{rl#'{n'
')# }'+}##(!!/")
:
t<-50?
_==*a ?
putchar(31[a]):

main(-65,_,a+1)
:
main((*a == '/') + t, _, a + 1 )
:

0<t?

main ( 2, 2 , "%s")
:*a=='/'||

main(0,

main(-61,*a, "!ek;dc i@bK'(q)-[w]*%n+r3#l,{}:\nuwloca-O;m
.vpbks,fxntdCeghiry")
```

C

Written by Ian Phillipps

C

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When run this produces...

C

```
On the first day of Christmas my true love gave to me
a partridge in a pear tree.

On the second day of Christmas my true love gave to me
two turtle doves
and a partridge in a pear tree.

On the third day of Christmas my true love gave to me
three french hens, two turtle doves
and a partridge in a pear tree.

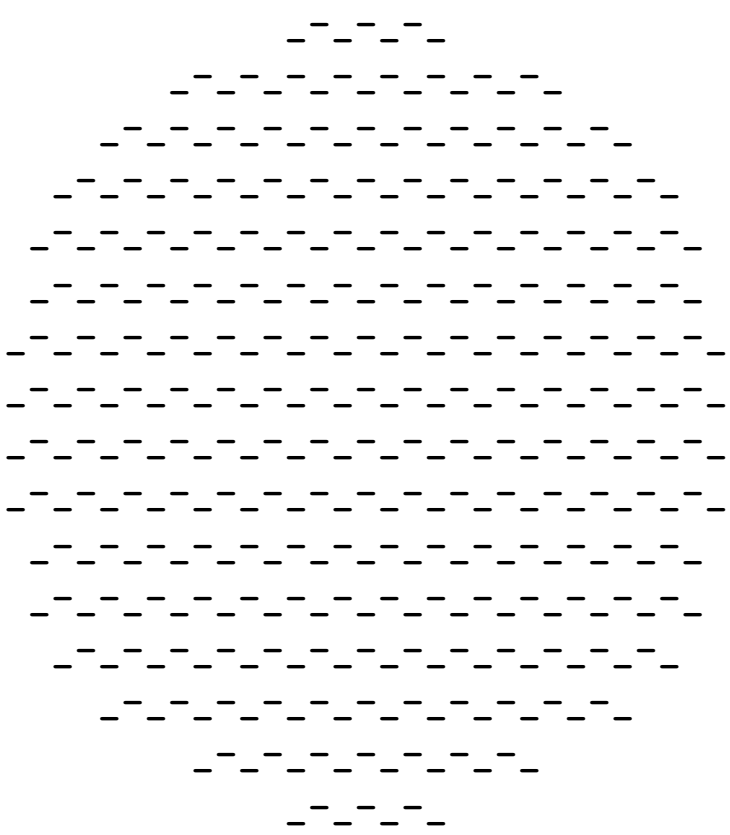
On the fourth day of Christmas my true love gave to me
four calling birds, three french hens, two turtle doves
and a partridge in a pear tree.

On the fifth day of Christmas my true love gave to me
five gold rings;
four calling birds, three french hens, two turtle doves
and a partridge in a pear tree.

On the sixth day of Christmas my true love gave to me
six geese a-laying, five gold rings;
four calling birds, three french hens, two turtle doves
...
```

C

```
#define _ F-->00||-F-OO--;
int F=00,OO=00;main(){F_OO();printf("%1.3f\n",4.*-F/OO/OO);}F_OO()
{
```



```
}
```

C

Written by Brian Westley

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When run this produces...

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When run this produces...

```
3.141
```

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These are taken from the Obfuscated C Competition: a competition to see how unreadable you can make a C program: `http://www.no.ioccc.org/years.html`

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So you need to be extra-careful on layout and presentation when writing C!

C

So here is a simpler example. In file `hello.c`

```
#include <stdio.h>

/* This is a
   block comment */
int main(void)
{
  // do something interesting
  printf("hello world\n");

  return 0;
}
```

C

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- The `#include` we shall describe later: for now just think of it as something to put at the start of every C file
- The function `main` is the entry point of the program. i.e., when the program is run, it starts executing from here
- It doesn't have any fancy type: it just returns an integer

C

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- The function `printf` prints stuff, here a string with a newline at the end (the `\n`)
- The program exits when you return from `main`
- `main` returns a value back to the operating system when the program finishes. The OS can use this in various ways, if it wishes. The convention is `0` means “finished successfully”, while non-zero values can signify various kinds of error

C

We can compile this file

```
% cc -Wall -o hello hello.c
```

C

- The % is a command line prompt

C

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- `-Wall` is a option to the compiler that tells it to report all warnings. A warning is something in your code that might not be technically wrong, but is sufficiently dodgy to be worth looking at. Always use this option. You should aim to write code with no warnings (and no errors!)

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- `-Wextra` gives even more warnings
- `-Werror` makes warnings into errors: the compiler will refuse to produce any output until you fix the warnings
- `-o hello` says put the compiled program in the file named `hello`. This filename can be anything you like, not necessarily related to the source code file

Aside

Note: this is an example of compiling a C program using a command-line compiler (gcc in this case)

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Exercise. Investigate these to find something that suits your personal taste

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Keep them separate in your mind

More Aside

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Not many C programs are fully standards-compliant

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A program that follows the standards will be much more portable

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Many other C compilers exist: Intel; Clang; Microsoft; Norcroft; etc.

More Aside

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You are not that stupid are you?

More Aside

Also, use a **text editor** (or an IDE) to write programs, not a word processor

You are not that stupid are you?

And always use a **fixed width** font when printing out code. Layout is important in all languages, particularly in C

Running the program

```
% ./hello
hello world
```

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hello world
```

I usually include the `./` to ensure I run the program named `hello` that lives in the current directory, not some program of the same name from somewhere else in the system

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There is no analogue to the `java` runtime program you need to run a Java program

C

Java: “write once, compile once, run everywhere”

C: “write once, compile everywhere, run everywhere”

C

Java: “write once, compile once, run everywhere”

C: “write once, compile everywhere, run everywhere”

Another trade-off

C

A bad program. `hello2.c`

```
#include <stdio.h>

int main(void)
{
  int n;

  n = n + 1;

  printf("hello world\n");

  return 0;
}
```

More Aside

```
% cc -Wall -o hello2 hello2.c
hello2.c: In function 'main':
hello2.c:7:5: warning: 'n' is used uninitialized
in this function
```

C

A simple example of a warning message

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It is **very** important you get used to reading warning and error messages

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Get used to them, and get used to fixing the problems they refer to: don’t ignore warnings

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(In this case, the compiler happens to generate an executable; for more serious errors it wouldn't)