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12.010 Computational Methods of Scientific Programming
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12.010 Basic C: C and Fortran 77 Syntax

Declarations

C (statements end in ; all variables must be declared explicitly)	F77 (start in column 7)
<code>int a;</code>	INTEGER A
<code>float a;</code>	REAL A
<code>double a;</code>	DOUBLE PRECISION A
<code>char a;</code>	CHARACTER A
<code>short a;</code>	
<code>uint a;</code>	
<code>long int a;</code>	
<code>int a[10];</code>	INTEGER A(10)
<code>float a[10][10];</code>	REAL A(10,10)
<code>char a[10];</code>	CHARACTER A(10)
<code>char a[10];</code>	CHARACTER A(10)

Simple Loop

C (array indices range 0 to N-1)

```
int i,j;
float arr[10][10];

for (j=0;j<10;++j){
  for (i=0;i<10;++i){
    arr[j][i]=1
  }
}
```

F77 (array indices range 1 to N)

```
INTEGER I
INTEGER J
REAL ARR(10,10)

DO J=1,10
  DO I=1,10
    ARR(I,J)=1
  ENDDO
ENDDO
```

C Hello World

```
#include <stdio.h>
```

```
main() {
  printf("Hello\n");          /* printf always goes to "standard output". */
  fprintf(stdout,"Hello\n"); /* fprintf goes to specified output stream */
}
```

F77 Hello World

```
PROGRAM MAIN
WRITE(6,*) 'Hello'
END
```

Formatting output

(see "man fprintf")

Integers

C	F77
<pre>main() {</pre>	<pre>PROGRAM MAIN</pre>
<pre> int i;</pre>	<pre>INTEGER I</pre>
<pre> i = 7;</pre>	<pre>I=7</pre>
<pre> printf("\n"); /* New line */</pre>	<pre>WRITE(6,'(1X)')</pre>
<pre> printf("Leading blanks\n");</pre>	<pre>WRITE(6,'(A)') 'Leading blanks'</pre>
<pre> printf("%1d\n",i);</pre>	<pre>WRITE(6,'(I1)') I</pre>
<pre> printf("%2d\n",i);</pre>	<pre>WRITE(6,'(I2)') I</pre>
<pre> printf("%3d\n",i);</pre>	<pre>WRITE(6,'(I3)') I</pre>
<pre> printf("%4d\n",i);</pre>	<pre>WRITE(6,'(I4)') I</pre>
<pre> printf("%5d\n",i);</pre>	

```

printf("%6d\n",i);
printf("\n"); /* New line */
printf("Leading zeros\n");
printf("%1.1d\n",i);
printf("%2.2d\n",i);
printf("%3.3d\n",i);
printf("%4.4d\n",i);
printf("%5.5d\n",i);
printf("%6.6d\n",i);
}
WRITE(6,'(I5)') I
WRITE(6,'(I6)') I
WRITE(6,'(IX)')
WRITE(6,'(A)') 'Leading zeros'
WRITE(6,'(I1.1)') I
WRITE(6,'(I2.2)') I
WRITE(6,'(I3.3)') I
WRITE(6,'(I4.4)') I
WRITE(6,'(I5.5)') I
WRITE(6,'(I6.6)') I
END

```

Text

```

C
main() {
    printf("A");
    printf(" new");
    printf(" line");
    printf(" must");
    printf(" be");
    printf(" specified");
    printf(" explicitly.");
    printf("\n");
}
F77
PROGRAM MAIN
    WRITE(6,'(A)') ' A new line is implicit in Fortran'
END

```

Floating Point

```

C
main() {
    printf("%f",3.1459); printf("\n");
    printf("%f\n",3.1459);
    printf("%10.10f\n",3.1459);
    printf("%.10f\n",3.1459);
    printf("%10f\n",3.1459);
    printf("%10f\n",3.1459e12);
    printf("\n");
    printf("%e\n",3.1459);
    printf("%10.3e\n",3.1459);
    printf("%-10.3e\n",3.1459);
    printf("%+12.3e\n",3.1459);
    printf("%+ -12.3e\n",3.1459);
    printf("%.10e\n",3.1459);
    printf("%10e\n",3.1459);
    printf("\n");
    printf("%E\n",3.1459);
}
F77
PROGRAM MAIN
    WRITE(6,'(F10.3)') 3.1459
    WRITE(6,'(E10.3)') 3.1459
    WRITE(6,'(E20.12)') 3.1459
    WRITE(6,'(1PE20.12)') 3.1459
END

```

```

printf("%10.3E\n",3.1459);
printf("%.10E\n",3.1459);
printf("%10E\n",3.1459);
printf("\n");

printf("%g\n",3.1459);
printf("%10.3g\n",3.1459);
printf("%.10g\n",3.1459);
printf("%10g\n",3.1459);
printf("\n");
}

```

C Conditional

```

#include <stdio.h>
#include <errno.h>

main(){

    int i = 0;

    /* == returns logical result, proper conditional */
    if ( i == 0 ) {
        printf("test 1: i is set to %d\n",i);
    }

    /* Using = not == for equality tests is a common typing mistake in C */
    /* Using = is valid syntax but it doesn't mean what you think it means! */
    /* i = 0 is false ( it returns 0 ) by definition, irrespective of the */
    /* value of i. */
    if ( i = 0 ) {
        printf("test 2: i is set to %d\n",i);
    }

    /* i = 1 is true ( it returns non-zero ) by definition, irrespective of */
    /* the value of i. */
    if ( i = 1 ) {
        printf("test 3: i is set to %d\n",i);
    }

}

```

F77 Conditional

```

PROGRAM MAIN

INTEGER I

```

```
I = 0
```

```
IF ( I .EQ. 0 ) THEN
```

```
  WRITE(6,'(A,I4)') 'I is set to', I
```

```
ENDIF
```

```
END
```