

### Boiler plate program

```
program name
    imp licit none
    ! module imports go here
    ! local variables go here
    ! code goes here, there
is not main entry point.
end program
```

### Module

```
module name
    imp licit none
    use other_module !
import another module
    ! local variables go here
    con tains
    ! functions and subrou -
tines goes here
end module
```

### Function

```
! return type goes before the
function
integer function f()
    f = 42 ! the function
name is result variable
end function
```

### Subroutine

```
! subroutines does not return a
value
! but they have out parameters
subroutine sub(a, b, c)
    int eger, intent(in) ::
a
    int eger, intent(in) ::
b
    int eger, intent (out)
:: c
    c = a + b
end subroutine
```

### Loops

```
do while (logical expr)
    ! Control:
    ! exit for break
    ! cycle for continue
end do
label: do i = start, stop ! ,
step ! (optional)
    ! statements
end do
```

### Conditions

```
if (cond) then
    ! ...
else if (cond) then
    ! ...
else
    ! ...
end if
```

### Operators

|                     |                          |
|---------------------|--------------------------|
| <b>+ -</b>          | addition, subtraction    |
| <b>* /</b>          | multiplication, division |
| <b>**</b>           | exponentiation           |
| <b>==</b>           | equality (numbers)       |
| <b>/=</b>           | inequality (numbers)     |
| <b>&gt;, &lt;</b>   | greater/less than        |
| <b>&gt;=, &lt;=</b> | greater/less or equal    |
| <b>.eqv.</b>        | equality (booleans)      |
| <b>.neqv.</b>       | inequality (booleans)    |

### Operators (cont)

**.and., .or., .not.** logical and, or and not.

### Native functions

|                                 |                                             |
|---------------------------------|---------------------------------------------|
| <b>abs(v)</b>                   | absolute value of v                         |
| <b>aimag(z)</b>                 | imaginary part of z (single prec)           |
| <b>int(v, kind)</b>             | truncates toward zero to convert to integer |
| <b>ceiling(v, kind)</b>         | ceiling and convert                         |
| <b>floor(v, kind)</b>           | floor and convert                           |
| <b>modulo(a, p)</b>             | polymorphic modulo (sign of p)              |
| <b>cmplx(x, y, kind)</b>        | make a complex from floats                  |
| <b>conjg(z)</b>                 | conjugate complex                           |
| <b>cos(x), dcos(x), ccos(x)</b> | cosine                                      |
| <b>sin(x), dsin(x), csin(x)</b> | sine                                        |
| <b>acos(x), dacos(x)</b>        | inverse cosine                              |
| <b>asin(x), dasin(x)</b>        | inverse sine                                |
| <b>dprod(x, y)</b>              | x * y as a double                           |
| <b>exp(x), dexp(x), cexp(x)</b> | exponential                                 |
| <b>erf(x), derf(x)</b>          | error function                              |
| <b>erfc(x), derfc(x)</b>        | complementary error function                |

### Native functions (cont)

|                                                                                                    |                                               |
|----------------------------------------------------------------------------------------------------|-----------------------------------------------|
| hypot(a, b)                                                                                        | hypotenuse of x and y (single prec)           |
| log(x), log10(x)                                                                                   | natural and base 10 logarithm                 |
| max(a, b, ...), min(a, b, ...)                                                                     | polymorphic extrema                           |
| sum(arr), product(arr), minval(arr), maxval(arr), all(arr), any(arr)                               | polymorphic reduction of array                |
| sum(arr, dim), product(arr, dim), minval(arr, dim), maxval(arr, dim), all(arr, dim), any(arr, dim) | polymorphic reduction of array along axis dim |
| minloc(arr), maxloc(arr)                                                                           | the coordinates of an extrema as a 1D array   |
| minloc(arr, dim), maxloc(arr, dim)                                                                 | the indices of extrema in along axis dim      |

### Data types

|                  |                                 |
|------------------|---------------------------------|
| logical          | boolean                         |
| integer(k ind=1) | 8 bits signed integer           |
| integer(k ind=4) | 32 bits signed integer          |
| integer(k ind=8) | 64 bits signed integer          |
| real(k ind=4)    | simple precision float          |
| real(k ind=8)    | double precision float          |
| complex(k ind=4) | simple precision complex number |

### Data types (cont)

|                          |                                 |
|--------------------------|---------------------------------|
| complex(k ind=8)         | double precision complex number |
| character(len=n)         | string of size n                |
| integer, dimension(m, n) | 2D array of shape (m, n)        |

### Derived types

```

type :: name
    integer :: i
    real :: x
    ! more fields
end type
type(some_type) :: obj
! Initialize
obj%field_a = 1
obj%field_b = 0.5

```



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