Fortran Quick Reference/Cheat Sheet

Remember: FORTRAN 77 and below is case sensitive.
Fortran 90 and above is NOT case sensitive.

Introduction:

Important things to note are:

- Fortran can perform array arithmetic operations.
- Spaces are ignored?
- Fortran is a compiled language which is compiled into an executable.
- Blue text indicates a feature which is available from Fortran 90 onwards.
- Purple text indicates a feature which is available from Fortran 95 onwards.
- Red text indicates a feature which is available from Fortran 2003 onwards.

Terminology

Statement – An instruction which is either executable or nonexecutable.
Construct – A sequence of statements ending with a construct terminal statement.
Function – A procedure that returns the value of a single variable.
Procedure – Either a function or subroutine. Intrinsic procedure, external procedure, module procedure, internal procedure, dummy procedure or statement function.
Subroutine – A procedure that is invoked by a CALL statement or defined assignment statement. It can return more than one argument.

Special Characters

' (Apostrophe)	Editing, declaring a string
" (Quotation Mark)	Declaring a string
* (Asterisk)	Comment lines
: (Colon)	Editing
:: (Double Colon)	Separator.
! (Exclamation)	Inline comment
/ (Slash)	Skip a line in a first statement?
; (Semicolon)	Separator. Statement on single source line. Except when it is in a character context, a comment or in line 6.
+ (Plus)	Arithmetic operator.
& (Ampersand)	Line continuation character. (Must be in line 7 of fixed format F77. For F90 can be anywhere after the line.

Data types

Type Declaration	Comments
INTEGER	INT(arg, kind)
	IDINT(arg, kind)
	IFIX(arg, kind)
REAL	REAL(arg, kind)
	FLOAT(arg, kind)
	SNGL(arg, kind)
CHARACTER	INTEGER :: i
	CHARACTER(len=20) :: ch
	WRITE(ch,"*)
COMPLEX	CMPLX(A,B, kind)

Type Declaration Statements

NON_OVERRIDABLE
Declares a bound procedure cannot be overridden in a subclass of this class.
PROCEDURE, NON_OVERRIDABLE :: pr
ALLOCATABLE
Declares an array is allocatable.
REAL, ALLOCATABLE, DIMENSION(:) :: a
DIMENSION
Declares the rank and and shape of an array.
REAL, DIMENSION(-7:10,-5:10) :: matrix
EXTERNAL
Declares that a name is a function external to a program unit.
REAL, EXTERNAL :: fun1
INTENT
Specifies the intended use of a dummy argument.
REAL, INTENT(IN) :: mks
INTRINSIC
Declares that a name is a specific intrinsic function.

Concepts and Elements

Concept	Statements
Module	Module
	Contains
	Private
	Public
	End Module
	Use
Interface Block	Interface
	Module Procedure
	End Interface
Derived data type	Derived type
	Private
	Sequence
	End Type
Subprogram	Function
	Subroutine
	Entry
	Contains
	Return
Input/Output	Backspace
	Close
	Endfile
	Format
	Inquire
	Open
	Print
	Read
	Rewind
	Write

Flow Control

Group	Statements
IF	IF
	ELSE IF
	ELSE
	ENDIF
CASE	SELECT CASE
	CASE
	END SELECT
DO/DO WHILE	DO
	DO WHILE
	END DO
	EXIT
	CYCLE
WHERE Construct	WHERE
	ELSEWHERE
	END WHERE

PASS
Declares that the derived data type variable used to invoke a bound procedure will be passed to it as its first calling argument.
PROCEDURE, PASS :: add
POINTER
Declares that a variable is a pointer.
INTEGER, POINTER :: ptr
PRIVATE
Declares that an object is private to a module.
REAL, PRIVATE :: internal_data
PROTECTED
Declares that an object is protected, meaning that it can be used but not modified outside the module in which it is defined.
REAL, PROTECTED :: i
PUBLIC
Declares that an object is private to a module.
REAL, PUBLIC :: pi=3.14
SAVE
Declares that an object is private to a module.
REAL, SAVE :: var SAVE
TARGET
Declares that an object is private to a module.
REAL, TARGET :: val1
VOLATILE
Declares that a value of a variable might be changed at any time by some source external to the program.
REAL, VOLATILE :: val1

Derived Data Types

Arrays

- Arrays can be up to seven dimensions.
- Fortran 90 allows the use of arithmetic array operations without the use of loops.
- Unsubscripted arrays are passed by reference. Subscripted arrays are passed by value?
- Arrays are stored in column major format. This is not the same as C which is stored in row major format.

Terminology

Order of Statements and Execution Sequence

	PROGRAM, FUNCTION, SUBROUTINE, MODULE or BLOCK DATA statement	
	USE statement(s)	
	IMPLICIT NONE	
FORMAT and ENTRY Statements	PARAMETER (also IMPLICIT) statements	IMPLICIT Statements
	PARAMETER and DATA Statements	DERIVED-TYPE DEFINITION, Interface Blocks, Type Declaration Statements, Statement Function Statements and Specification Statements.
	DATA Statements	Executable Constructs
	CONTAINS Statement	
	Internal subprograms or module subprograms	
	END statement	

Statements Allowed in Scoping Units

Scoping unit →	Main Prog	Module[1]	Block Data	External subprog	Module subprog	Internal subprog	Interface Body
USE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
DATA	Yes	Yes	Yes	Yes	Yes	Yes	No
FORMAT	Yes	No	No	Yes	Yes	Yes	No
DATA	Yes	Yes	Yes	Yes	Yes	Yes	No
CONTAINS	Yes	Yes	No	Yes	Yes	No	No
Derived data type definition	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Interface block	Yes	Yes	No	Yes	Yes	Yes	Yes
Executable statement	Yes	No	No	Yes	Yes	Yes	No
Statement function statement	Yes	No	No	Yes	Yes	Yes	No
Misc	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes:

1. Miscellaneous declarations are PARAMETER statements, IMPLICIT statements, type declaration statements, and specification statements such as PUBLIC, SAVE, etc.

2. Derived type definitions are also scoping units, but they do not contain any of the above statements, and so have not been listed in the table.

3. The scoping unit of a module does not include any module subprograms that the module contains.

REAL, DIMENSION(-2:9,2:5) :: arr_b *=-1 – A rank two array with 12 elements in the first dimension, starting at subscript -2. This is different form C where array subscripting always starts from zero.

Array Constructors

vector= (/1,2,3,4/)
vector= (/ (3d,3d=1,100 ,/) – using an implied do loop.
array=(/ (3d,3d=1,100,5) ,1,2) ,/)

Array Selection

arr(i,j)	Subscript for a single value.
arr(i,*)	Column i of a two dimensional array.
arr(i,j,l:k)	A 2D subarray of columns l to k, rows j to l.
arr(i:j:m)	A 1D array starting at subscript i and finishing at subscript k with a stride of m.
arr(:)(ncr2)	The elements of Array2 subscript the elements in Array1.

Functions for Determining Array Properties

ALL(Mask, dim)	Determines if all values are true in Mask along dimension dim.
ANY(Mask, dim)	Determines if any value is true in Mask along dimension dim.
ALLOCATED(array)	Returns true if array is allocated.
COUNT(Mask, dim)	Returns the number of true elements in Mask along dimension dim.
MAXLOC(arr)	Returns smallest values of entire array.
MINVAL(arr, dim)	Returns smallest element in dimension of array.
MAXLOC(arr)	Returns largest element of entire array.
MAXVAL(arr, dim)	Returns largest element in dimension of array.

A Fortran Primer And Cheat Sheet

R.R. Bowker Company. Department of Bibliography

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