

# Level II Computing - Fortran Summary

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## Subtitle: Enough Fortran to get by

### Program structure

```

Columns
1234567-----72
C The main program block is first
  PROGRAM MAIN
C Dimension and type declarations come next
  DIMENSION Z(100)
  REAL K2O,NA2O,OXIDES(10,100),MEAN
C Then executable statements follow
  READ (*,*) A,B,C
  WRITE (*,*) A,B,C
C The next statement has a label. Labels may only appear in 1-5.
777  SUM=A+B+C
C The next statement continues over two lines. Note column 6.
  WRITE (*,*)
    & 'The sum is ',SUM
C Spaces are only significant inside 'character constants'
  .
  .
C Function MEAN is called and variables Z and N are
C passed. Result assigned to A
  A=MEAN(Z,N)
  .
  .
C Subroutine STATS is called and variables Z, N, XBAR and XSIG
C are passed AND returned
  CALL STATS(Z,N,XBAR,XSIG)
  .
  .
  STOP
  END

C The main block is followed by functions and subroutines
C Each sub-program has its own dimension or type statements

  REAL FUNCTION MEAN(ARRAY,N)
  DIMENSION ARRAY(N)
  .
  .
  MEAN=.....
  .
  .
  END

  SUBROUTINE STATS(ARRAY,N,MEAN,SDEV)
  DIMENSION ARRAY(N)
  REAL MEAN
  .
  .
  .

```

END

## Constants

**real** 152.2 1.522E2 **integer** -4 3754 4E-4  
**logical** .true. .false. **character** 'cucumber'

## Variables

**real** A-H, O-Z **integer** I-N

## Data types

REAL, INTEGER, LOGICAL, CHARACTER\*N

## Arrays

DIMENSION K(10), REAL M(9,10), CHARACTER NAME(6)\*6

## Initialisation

DATA K/7,4,5,9,2,13,4,5,6,5/  
 DATA M/90\*0.0/  
 DATA NAME/'Trevor','Harold','Lucy','Muppet','Pooh','Bear'/

## Arithmetic operators

**\*\***, **\***, **/**, **+**, **-**. Use brackets () to be sure of order of evaluation.

## Expressions

Beware of mixing types and especially integer division e.g.  $7.0/2.0=3.5$  but  $7/2=3$  and  $1/2=0$ .

## Logical operators

**.EQ.**, **.NE.**, **.LT.**, **.GT.**, **.LE.**, **.GE.**, **.AND.**, **.OR.**

## Intrinsic functions

There are many including  $\log(x)$ ,  $\log_{10}(x)$ ,  $\exp(x)$ ,  $\sin(x)$ ,  $\cos(x)$ ,  $\tan(x)$  and  $\text{sqrt}(x)$ .  $x$  in radians for trig. functions.

## DO LOOPS

```

      DO 222, I=1,5
      .
      statements
      .
222   CONTINUE

```

## BLOCK IF statement

```

      IF (A .GT. B) THEN
      .
      statements
      .
      ELSE
      .
      statements
      .
      ENDIF

```

## GOTO statement

```
GOTO 1234
```

## INPUT

READ (*, *) A, K	list directed from default device
READ (3, *) A, K	list directed from device associated with unit 3
READ (3, *, END=999) A, K	list directed from device associated with unit 3 and GOTO 999 if end of file reached
READ (3, *) (M (1, J), J=1, 10)	implied DO-loop - read elements M(1,1) through to M(1,10)

## OUTPUT

WRITE (*, *) 'String'	list directed to default device
WRITE (4, *) A, K	list directed to device associated with unit 4
WRITE (4, 101) A, K	formatted using label 101 to device associated with unit 4
WRITE (4, *) (M(J, 3), J=5, 8)	implied DO-loop - write elements M(5,3),M(6,3),M(7,3),M(8,3)

## FORMAT statement

```
101 FORMAT (X, 'A is ', F6.2, ' and K is ', I4)
```

X is space, 'String of characters', F6.2 is nnn.nn, I4 is nnnn  
Also for character variables use An

## OPEN and CLOSE

OPEN (UNIT=5, FILE='Numbers', STATUS='OLD') means associate unit 5 with the file Numbers which already exists

OPEN (UNIT=6, FILE='Results', STATUS='NEW') means associate unit 6 with the file Results and create or overwrite

CLOSE (UNIT=6) means close the file associated with unit 6

## FUNCTIONS

User-defined functions, like intrinsic functions, return a result. Arguments passed must match in both number and in type.

```
REAL FUNCTION MEAN (ARRAY,N)
DIMENSION ARRAY (N)
SUM=0.0
DO 20, I=1,N
    SUM=SUM+ARRAY (I)
20 CONTINUE
MEAN=SUM/N
END
```

## SUBROUTINES

In contrast to functions, all arguments passed to a subroutine are returned to the calling program. Arguments passed must match in both number and in type.

```
SUBROUTINE STATS (ARRAY,N,MEAN,SDEV)
DIMENSION ARRAY (N)
REAL MEAN
SUM=0.0
SQSUM=0.0
DO 30, I=1,N
    SUM=SUM+ARRAY (I)
    SQSUM=SQSUM+ARRAY (I) **2
30 CONTINUE
MEAN=SUM/N
SDEV=SQRT ( (N*SQSUM-SUM**2) / (N* (N-1) ) )
END
```

## INCLUDE

Collections of functions and subroutines may be inserted into your program file by means of the INCLUDE statement.

```
PROGRAM MAIN
.
.
.
.
.
STOP
END

INCLUDE misc.sub
```