FORTRAN 90: Selective Execution

Meteorology 227
Fall 2019
Logical Expressions

• Can be simple or compound.

• (expression) (relational-operator) (expression)

• Relational Operators
  – < or .LT. Is less than
  – > or .GT. Is greater than
  – == or .EQ. Is equal to
  – <= or .LE. Is less than or equal to
  – >= or .GE. Is greater than or equal to
  – /= or .NE. Is not equal to

• Note:
  – == is a relational operator
  – = is an assignment statement

• Logical Expressions evaluate to .TRUE. Or .FALSE.
Examples

• $B^{**2} \geq 4.0 \times A \times C$
• $1.0 \leq 24.0$
• “A” < “F”
• “cat” < “dog”
• “cat” < “cow”
• “June” < “July”
• “cat” < “cattle”
Compound Logical Expressions

• Compound operators
  – .NOT. (negation)
  – .AND. (conjunction)
  – .OR. (disjunction)
  – .EQV. (equivalence)
  – .NEQV. (Non-equivalence)

• Order of operations
  1. Arithmetic operations
  2. Relational operators
  3. Logical operation in the order: .NOT., .AND., .OR., .EQV. (.NEQV.)

• Use Parentheses to remove any ambiguity.
Examples

- Let $N=4$

- $N^2 + 1 > 10 \ \text{AND} \ \text{NOT} \ N < 3$

- $(N^2 + 1 > 10) \ \text{AND} \ \text{NOT} \ (N < 3)$

- Data_Name $==$ "RAIN_NON" $\ \text{OR} \ \text{"RAIN_CON"}"
IF constructs

• Block IF construct
  – IF (logical-expression) THEN
    statement-sequence
  ENDIF
  – IF (Precip_Rate >= 0.50) THEN
    Accumulation = Precip_Rate * Time_Interval
    Print *, ‘It is raining cats and dogs!’
  ENDIF

• Logical IF statement
  – IF (logical-expression) statement
  – IF (Precip_Rate >= 0.50) Print *, ‘It is raining cats and dogs!’
General form

- Flowchart
- IF (logical-expression) THEN
  statement-sequence 1
ELSE
  statement-sequence 2
ENDIF
- IF ((Precip_Rate > 0.0).AND.(Temp < 32.0)) THEN
  Print *, ‘It is Snowing’
ELSE
  Print *, ‘It is Raining’
ENDIF
IF-ELSE IF constructs

• How would you do it now?
  – IF (logical-expression) THEN
    statement-sequence
    ELSE
    IF (logical-expression) THEN
      statement-sequence
    ELSE
    ENDIF
    ENDIF
  ELSE
  ENDIF

• This method is somewhat tedious. FORTRAN helps you out a bit.
IF-ELSE IF cont.

- IF (logical-expression) THEN
  statement-sequence
ELSE IF (logical-expression) THEN
  statement-sequence
ELSE IF (logical-expression) THEN
  statement-sequence
ELSE
  statement-sequence
ENDIF
CASE construct

• Less general form of IF-ELSE IF construct, but still very useful.

• General Form
  – SELECT CASE (Selector)
    CASE (label-list-1)
      Statement-sequence 1
    CASE (label-list-2)
      Statement-sequence 2
      ….  
    CASE (label-list-n)
      Statement-sequence n
  END SELECT
CASE cont.

- Selector: Integer, character, or logical expression

- Label-list: List of one or more possible values of the selector, enclosed in parentheses, or the word default.
  - Value
  - Value-1 : Value-2
  - Value-1 :
  - : Value-2

- If the value is not any of the lists of values, the sequence of statements associated with DEFAULT is executed.
Example 1 – Class Code

- SELECT CASE (ClassCode)
  CASE (1)
    Print *, ‘Freshman’
  CASE (2)
    Print *, ‘Sophomore’
  CASE (3)
    Print *, ‘Junior’
  CASE (4)
    Print *, ‘Senior’
  CASE (5)
    Print *, ‘Graduate’
  CASE DEFAULT
    Print *, ‘Illegal class code:’, ClassCode
END SELECT
Example 2 – Enhanced Fujita Scale

- SELECT CASE (Wind_Speed)
  CASE (:85)
    Print *, ‘EF-0’
  CASE (86:110)
    Print *, ‘EF-1’
  CASE (111:135)
    Print *, ‘EF-2’
  CASE (136:165)
    Print *, ‘EF-3’
  CASE (166:200)
    Print *, ‘EF-4’
  CASE (200:318)
    Print *, ‘EF-5’
  CASE DEFAULT
    Print *, ‘Finger of God’
END SELECT
LOGICAL Data Type

• Two logical constants in FORTRAN
  – .TRUE. And .FALSE.

• Logical variable
  – LOGICAL :: list
  – LOGICAL :: End_of_Data, RootExists

• Assignment Statement
  – RootExists = Discriminant >=0

• List output of a logical variable
  – Let A=True, B and C = False
  – Print *, A,B,C,.True,.False.
  – T_F_F_T_F

• Program example