Chapter 2
Selection Control Structures

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Objectives

After completing this lesson, students will be able to:

- Elaborate on the uses of simple selection, multiple selection and nested selection in algorithms
- Explain the uses of the case structure
- Develop algorithms using variations of the selection control structure

The IF Structure

This structure represents the decision making abilities of the computer

- The condition in the IF statement is based on a comparison of two items
  - Usually expressed with one of the following relational operators
    - * <
    - * >
    - * <=
    - * >=
    - * =
    - * <>

Four Types of Selection Structures

1. Simple selection (simple IF statement)
2. Simple selection with null false branch (null ELSE statement)
3. Combined selection (combined IF statement)
4. Nested selection (nested IF statement)

Simple Selection

The IF Structure

Simple Selection
Simple IF Statement

- A choice is made between two alternate paths
  - Depending on the result of a condition being true or false

E.g.,

IF account_balance < 500 THEN
  service_charge = 5.00%
ELSE
  service_charge = 2.00%
ENDIF
Simple Selection with Null False Branch

The IF Structure

Simple Selection with Null False Branch

Null ELSE Statement

- A task is performed only when a particular condition is true
- If the condition is false
  - Then no processing will take place

e.g.,

IF student_attendance = sick_leave THEN
  add 1 to sick_count
ENDIF

Figure 1: Simple IF statement.

Figure 2: Null ELSE statement.
Combined Selection

The IF Structure

Combined Selection

Combined IF Statement

- The statement that contains multiple conditions
  - Each connected with the logical operators AND or OR

**e.g., The AND operator**

```
IF student_attendance = sick_leave
AND letter_absent = no THEN
    add 0 to score_attendance
ENDIF
```

**e.g., The OR operator**

```
IF student_attendance = sick_leave
OR student_attendance = absent
    add 0 to score_attendance
ENDIF
```

**e.g., The AND and OR operator**

```
IF (student_attendance = sick_leave
OR student_attendance = absent)
AND letter_absent = no THEN
    add 0 to score_attendance
ENDIF
```

**e.g., The NOT operator**

```
IF NOT(student_major = MIT)
    delete student record
ENDIF
```

**e.g., The NOT and AND operator**

```
IF NOT(student_major = MIT
AND student_year = 1)
    delete student record
ENDIF
```
Nested Selection

The IF Structure

Nested Selection

Nested IF Statement

- The word IF appears more than one within an IF statement
- Two types
  - Linear nested IF statements
  - Non-linear nested IF statements

Linear Nested IF Statement

- A field is being tested for various values
  - A different action is to be taken for each value
- Linear
  - Each ELSE immediately follows the IF condition to which it corresponds

![Figure 3: Linear nested IF statements.](image-url)
e.g.,
IF score $\geq 80$ THEN
  grade = 'A'
ELSE
  IF score $\geq 70$ THEN
    grade = 'B'
  ELSE
    IF score $\geq 60$ THEN
      grade = 'C'
    ELSE
      grade = 'D'
    ENDIF
  ENDIF
ENDIF

Non-Linear Nested IF Statement

- A number of different conditions needs to be satisfied before a particular action can occur
- Non-linear
  - The ELSE statement may be separated from the IF statement

Figure 4: Non-linear nested IF statements.
e.g.,
IF student\_attendance = sick\_leave\ THEN
  IF letter\_absent = no\ THEN
    IF inform = no\ THEN
      add 0 to score\_attendance
    ELSE
      add 0.3 to score\_assignment
    ENDIF
  ELSE
    add 1 to score\_attendance
  ENDIF
ELSE
  add 1 to score\_attendance
ENDIF

Non-Linear nested IF statements easily contain logic errors

- If possible, replace a series of non-linear nested IF statements with a combined IF statement

  e.g.,
  IF student\_attendance = sick\_leave\ THEN
    IF letter\_absent = no\ THEN
      IF inform = no\ THEN
        add 0 to score\_attendance
      ELSE
        add 0.3 to score\_assignment
      ENDIF
    ELSE
      add 1 to score\_attendance
    ENDIF
  ELSE
    add 1 to score\_attendance
  ENDIF

  Can be written as a combined IF statement:
  IF student\_attendance = sick\_leave\ AND letter\_absent = NO\ AND inform = NO\ THEN
    add 0 to score\_attendance
  ENDIF
The CASE Structure

The Case Control Structure

- Another way of expressing a linear nested IF statement
- The structure which makes the algorithm easier to write and understand

e.g., Linear nested IF structure

IF number = 1 THEN
  prize = 1000
ELSE
  IF number >= 2 THEN
    prize = 500
  ELSE
    IF number >= 3 THEN
      prize = 100
    ELSE
      prize = 10
    ENDIF
  ENDIF
ENDIF

Rewrite with a CASE statement

CASE OF number
  1: prize = 1000
  2: prize = 500
  3: prize = 100
  other: prize = 10
ENDCASE

Summary

- The IF structure
  1. Simple selection
  2. Null ELSE statements
  3. Combined IF statements
  4. Nested IF statements
- The CASE structure
  - A means of expressing a linear nested IF statement in a simpler and more concise form
References


Sources of Pictures:


