

Nested Selection Structures

Both paths in a selection structure can include instructions that declare variables, perform calculations, and so on; both can also include other selection structures. When either a selection structure's true path or its false path contains another selection structure, the inner selection structure is referred to as a nested selection structure because it is contained (nested) entirely within the outer selection structure. Figure 2-31 shows the pseudocode and flowchart for the procedure in the Voter Eligibility application. The procedure contains an outer selection structure and a nested selection structure. The selection structures determine whether a person can vote and then display one of three messages. The appropriate message depends on the person's age and voter registration status. If the person is younger than 18 years old, the outer selection structure's false path displays the message "You are too young to vote." However, if the person is at least 18 years old, the nested selection structure displays one of two messages. The correct message to display is determined by the person's voter registration status. If the person is registered, then the appropriate message is "You can vote."; otherwise, it is "You must register before you can vote." After the appropriate message is displayed, the nested and outer selection structures end. Notice that the nested structure in Figure 2-31 is processed only when the outer structure's condition evaluates to True.

1. declare intAge variable for the age
2. convert txtAge.Text property to a number and store it in the intAge variable
3. if the value in the intAge variable is at least 18
 - if txtRegistered.Text contains "Y"
 - display "You can vote." message
 - else
 - display "You must register before you can vote." message
- end if
- else
 - display "You are too young to vote." message
- end if

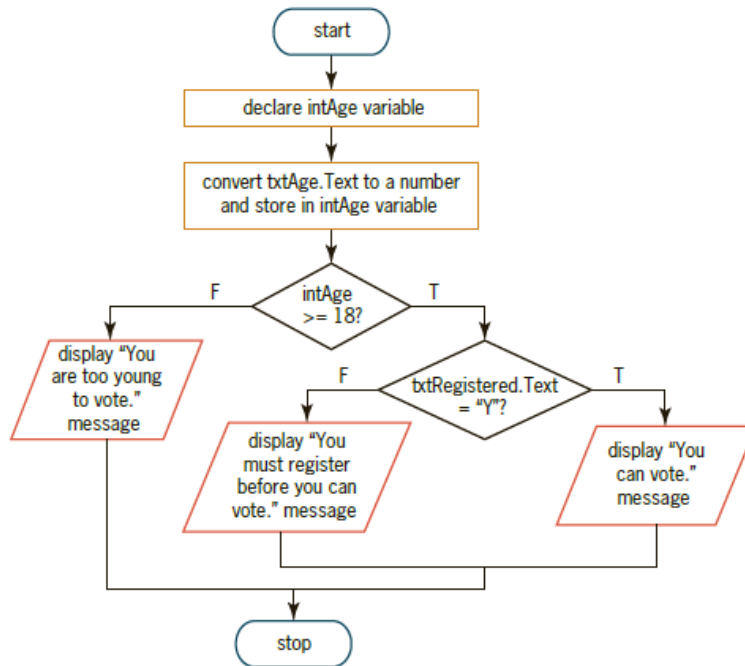


Figure 2-31 Pseudocode and flowchart for the Voter Eligibility procedure

```

1  Public Class Form3
2  Private Sub Button1_Click(sender As Object, e As EventArgs) Handles Button1.Click
3  Dim age As Double = TextBox1.Text
4  Dim register As String = TextBox2.Text
5  If age >= 18 Then
6  If register = "Y" Then
7  Label1.Text = "you can vote"
8  Else
9  Label1.Text = " You must register before you can vote"
10 End If
11 Else
12 Label1.Text = "You are too young to vote"
13 End If
14 End Sub
15
16 Private Sub Button2_Click(sender As Object, e As EventArgs) Handles Button2.Click
17 Close()
18 End Sub
19 End Class
  
```

Figure 2-32 shows the code for the Pseudocode procedure in the Figure 2-31.

And the application design will be as the interface shown in Figure 2-33 indicates, the application displays the appropriate message on the label tool.

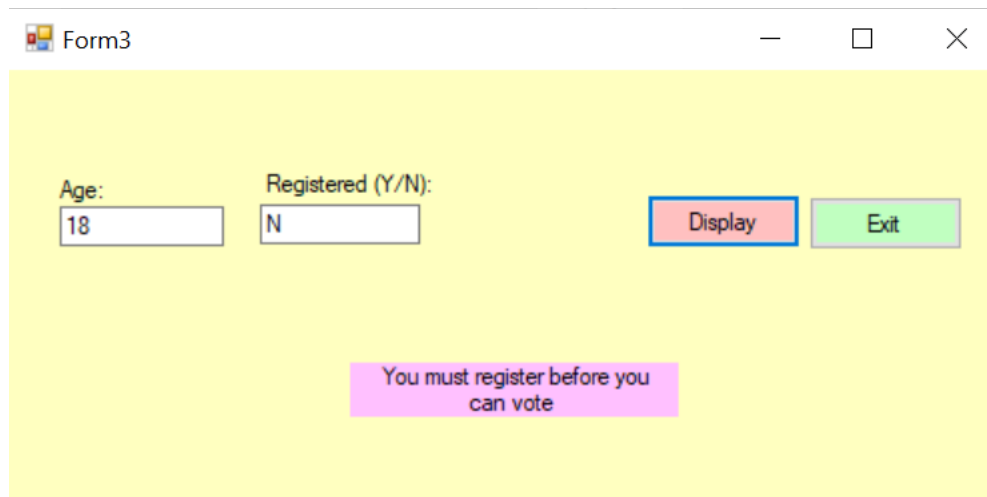


Figure 2-33 User interface for the Voter Eligibility procedure

Common Errors in Selection Structures

Figure B-11 lists four common errors made when writing selection structures.

Common Errors in Selection Structures

1. Using a compound condition rather than a nested selection structure.
2. Reversing the decisions in the outer and nested selection structures.
3. Using an unnecessary nested selection structure.
4. Including an unnecessary comparison in a condition.

It is easier to understand the errors listed above by viewing them in a procedure. The first three errors will be illustrated using a procedure that displays the daily fee for renting a car. The daily fee is \$55; however, there is an additional charge for renting a luxury car. The additional charge, either \$20 or \$30, depends on whether the customer belongs to the Car Rental Club. Notice that the car's classification determines whether the renter is charged an additional amount. If the car is classified as a luxury vehicle, then whether the customer is a club member determines the appropriate additional amount. In this case, the decision regarding the car's classification is the primary decision, while the decision regarding the customer's membership status is the secondary decision. The pseudocode shown in Example 1 in Figure 2-34 contains the correct selection structures for this procedure. The selection structures in Examples 2 through 4 illustrate the first three errors.

Example 1—pseudocode (correct)

1. daily fee = 55
2. if luxury car
 - if club member
 - add 20 to the daily fee
 - else
 - add 30 to the daily fee
- end if
- end if
3. display the daily fee

The selection structures indicate that a hierarchy exists between the car classification and the membership decisions. The decision regarding the car classification must be made first. The membership decision is necessary only when the car classification decision evaluates to True.

Example 2—pseudocode (first error)

1. daily fee = 55
 2. if luxury car and club member
 - add 20 to the daily fee
 - else
 - add 30 to the daily fee
 - end if
 3. display the daily fee
- uses a compound condition instead of a nested selection structure

The compound condition indicates that only club members who are renting a luxury car are charged \$20 extra; everyone else is charged \$30 extra. If a customer is renting a standard vehicle, this selection structure will incorrectly charge him or her an additional \$30.

Example 3—pseudocode (second error)

1. daily fee = 55
 2. if club member
 - if luxury car
 - add 20 to the daily fee
 - else
 - add 30 to the daily fee
 - end if
 - end if
 3. display the daily fee
- reverses the outer and nested decisions

The selection structures indicate that a hierarchy exists between the car classification and the membership decisions. The decision regarding the membership must be made first. The car classification decision is necessary only when the membership decision evaluates to True. These selection structures will incorrectly charge a club member renting a standard vehicle an extra \$30, and it will not charge anything extra to a nonmember renting a luxury vehicle.

Example 4—pseudocode (third error)

1. daily fee = 55
 2. if luxury car
 - if club member
 - add 20 to the daily fee
 - else
 - if nonmember
 - add 30 to the daily fee
 - end if
 - end if
 3. display the daily fee
- unnecessary nested selection structure

The third selection structure is unnecessary because the second selection structure's condition already determines the membership status. Although these selection structures produce the correct results, they do so less efficiently.

Figure 2-34 Correct and incorrect pseudocode for the car rental procedure

The fourth error will be illustrated using a procedure that displays the price of an item. The item price is based on the quantity purchased, as shown in Figure 2-35. Example 1 in the figure shows the correct selection structures for this procedure; the selection structures in Example 2 illustrate the fourth error. Although Example 2's selection structures produce the correct results, they do so in a less efficient manner than the ones shown in Example 1

<u>Information</u>	
Quantity purchased	Price per item
Less than or equal to 0	\$0.00
1-99	\$9.50
100 or more	\$7.75

<p><u>Example 1—pseudocode (correct)</u></p> <ol style="list-style-type: none"> 1. if quantity <= 0 <ul style="list-style-type: none"> price = 0 else <ul style="list-style-type: none"> if quantity < 100 <ul style="list-style-type: none"> price = 9.50 else <ul style="list-style-type: none"> price = 7.75 end if end if 2. display the price 	<p><u>Example 2—pseudocode (fourth error)</u></p> <ol style="list-style-type: none"> 1. if quantity <= 0 <ul style="list-style-type: none"> price = 0 else <ul style="list-style-type: none"> if quantity > 0 and quantity < 100 <ul style="list-style-type: none"> price = 9.50 else <ul style="list-style-type: none"> price = 7.75 end if end if 2. display the price
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Figure 2-35 Correct and incorrect pseudocode for the item price procedure