CME111 Programming Languages I

Week 3
Decision Structures

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Algorithm

[ THE ALGORITHM OF LOVE ]
Decision Structures

► The **diamond symbol** also called the **decision symbol** which indicates that a decision is to be made is one of the most important flowcharting symbol.

► The decision symbol contains an **expression** such as a **condition** that can be either **true** or **false**.

► The decision symbol has two flowlines emerging from it. One indicates the direction to be taken when the expression in the symbol is true; the other indicates the direction to be taken when the expression is false.
Decision Structures (if)

- The if selection statement performs an indicated action only when the condition is true; otherwise the action is skipped.
- Also called single selection.

```plaintext
if <conditional expression>
  action1;
```
Assume that passing grade of a course is 60.

If we want to print "Passed" if the student's grade is greater than or equal to 60:

Pseudo code:

```plaintext
if grade >= 60
  print "Passed"
```

Decision Structures (if)
Decision Structures (if-else)

- The if..else selection statement allows you to specify that different actions are to be performed when the condition is true than when the condition is false.
- Also called double selection.

```java
if <conditional expression>
  action1;
else
  action2;
```

![Decision Structures Diagram](image)
If we want to print "**Passed**" if the student's grade is greater than or equal to 60 and print "**Failed**" if the student's grade is less than 60.

Pseudo code:

```python
if grade >= 60
    print "PASSED"
else
    print "FAILED"
```
Sometimes we test for multiple cases by placing if..else statements inside if..else statements

```c
if <conditional expression>
    action1;
else if <conditional expression>
    action2;
else if <conditional expression>
    action3;
    .......
else
    actionN;
```
Nested if-else Structure

For example, we want to test if number n is equal to zero or greater than zero or less than zero.

```python
if n < 0
    print "less than zero"
else if n == 0
    print "zero"
else
    print "greater than zero"
```
Nested if-else Structure

- If $n < 0$, print "Less than zero".
- If $n == 0$, print "Zero".
- If $n > 0$, print "Greater than zero".

The diagram illustrates the decision process for determining the value of $n$ and printing the appropriate message.
Example 1

- Read two numbers from keyboard and subtract the small number from big one and print result.

  - Pseudo code:
    
    Start
    Read A,B
    if A>=B
      result = A-B
    else result = B-A
    print result
    End
Example 1
Example 2

Enter grade from keyboard and convert it into letter form.

- **Pseudo code:***
  
  Start
  Read, grade
  if grade >= 90
    print "A"
  else if grade >= 80
    print "B"
  else if grade >= 70
    print "C"
  else if grade >= 60
    print "D"
  else
    print "F"
  End
Example 2

1. Başla
2. Not gir, Not +
3. Not ≥ 90 → yaz, "A"
4. Not ≥ 80 → yaz, "B"
5. Not ≥ 70 → yaz, "C"
6. Not ≥ 60 → yaz, "D"
7. yaz, "F"
8. Bitir
Example 3

► Draw a flowchart of an algorithm that calculates the area of a square when the input value is 1 from keyboard and calculates round measure when the input value is 2. If user puts out of 1 or 2 it will give "Wrong input message".

► The edge length of square is also put from keyboard.
Example 3

1. **BASLA**
2. **Secimi gir [1,2], secim**
3. **Kenar uzunlugu gir, a**
4. **secim==1** → **T** → **alan = a * a** → **yaz, alan** → **F** → **secim==2**
5. **secim==2** → **T** → **cevre = 4 * a** → **yaz, cevre** → **F**
6. **yaz, "Yanlis secim yaptiniz"**
7. **BITIR**
Example 4

► Draw flowchart of an algorithm that calculates the roots of a second degree equation so that it's coefficients are put from keyboard.
Example 4

1. Başla
2. Katı sayıları gir, a, b, c
3. \[ d = (b^2 - 4ac) \]
4. \[ x_1 = \frac{-b - \sqrt{d}}{2a} \]
   \[ x_2 = \frac{-b + \sqrt{d}}{2a} \]
5. \[ d < 0 \]
   - Eğer d < 0 ise yaz "İkinci dereceden denklem yok"
6. \[ d = 0 \]
   - Eğer d = 0 ise yaz \[ y_0, x_1 \]
   - Eğer d ≤ 0 ve d ≠ 0 ise yaz \[ y_0, x_1, x_2 \]
7. Biter
Example 5

Pricing conditions are given for a flight ticket. Draw a flowchart of an algorithm to calculate total price to be paid. Number of passengers will be given from keyboard.

<table>
<thead>
<tr>
<th>Zaman</th>
<th>Sınıf</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-Morning</td>
<td>1- First Class</td>
<td>150 TL</td>
</tr>
<tr>
<td></td>
<td>2- Economy</td>
<td>100 TL</td>
</tr>
<tr>
<td>2-After Noon</td>
<td>1- First Class</td>
<td>140 TL</td>
</tr>
<tr>
<td></td>
<td>2- Economy</td>
<td>90 TL</td>
</tr>
<tr>
<td>3-At Night</td>
<td>1- First Class</td>
<td>120 TL</td>
</tr>
<tr>
<td></td>
<td>2- Economy</td>
<td>70 TL</td>
</tr>
<tr>
<td></td>
<td></td>
<td>%15 discount for more than 2 passengers</td>
</tr>
</tbody>
</table>
Example 5

Basla

Oku, Z, S, Y

Z == 1 T

S == 1 T

P = 150*Y

F

P = 100*Y

Z == 2 T

S == 1 T

P = 140*Y

F

P = 90*Y

Z == 3 T

S == 1 T

P = 120*Y

F

P = 70*Y

print("Yeni is secimi")

F

Y >= 2

ya2, P

T

P = P*0.15

Bitir
References


► Paul J. Deitel, “C How to Program”, Harvey Deitel.

► Bayram AKGÜL, C Programlama Ders notları