A **cascading if-else** is a composite of **if-else** statements where the false path of the outer statement is a nested **if-else** statement. The nesting can continue to several levels.

### Cascading if-else Syntax

```plaintext
if ( truth value 1 )
    path 1
else
    if ( truth value 2 )
        path 2
    else
        if ( truth value 3 )
            path 3
        else
            . . .

statement below
```

### Cascading if-else Semantics

What the computer executes:

1. What is the *truth value 1*?
   - *true*
     - Execute *path 1*
   - *false*
     - What is the *truth value 2*?
       - *true*
         - Execute *path 2*
       - *false*
         - What is the *truth value 3*?
           - *true*
             - Execute *path 3*
           - *false*
             - . . .

Proceed to execute *statement below*

As illustrated in the picture, execution begins with the first (i.e. top-most) **if-else** statement.
by (1) evaluating truth value 1. If true, the computer (2) executes the statement or statements in path 1 after which it branches to the statement below the cascading if-else structure. If truth value 1 is false, the computer (3) proceeds to the second if-else statement and repeats the process.

If you write the cascading if-else correctly, then at most one of the execution paths (i.e. path1, path2, etc.) will be executed.

**Example**

This code illustrates the semantics of the cascading if-else. It takes an integer representing a student’s score and determines the corresponding letter grade using a 90/80/70/60 scale. For instance, if score is 75 then the relational expression at line 1 is false, that at line 4 is false and that at line 7 is true. At line 8, grade is set to C and the remaining lines are skipped.

```
1 if ( score >= 90 )
2    grade = 'A';
3 else
4    if ( score >= 80 )
5        grade = 'B';
6    else
7        if ( score >= 70 )
8            grade = 'C';
9        else
10            if ( score >= 60 )
11                grade = 'D';
12        else
13            grade = 'F';
```
Seasoned programmers prefer to avoid the text wandering across the page by indenting all the `else` keywords at the same level.

**Example**
Cascaded `if-else` statements indented as preferred by seasoned programmers.

```java
1 if ( score >= 90 )
2   grade = 'A';
3 else if ( score >= 80 )
4   grade = 'B';
5 else if ( score >= 70 )
6   grade = 'C';
7 else if ( score >= 60 )
8   grade = 'D';
9 else
10   grade = 'F';
```

**Beginner Error on Cascading if-else**
The most common error a novice programmer will make coding a cascading `if-else` is to omit an `else`.

**Example**
The code segment below incorrectly omits an `else` at line 5. This incorrect code gives any score over 70, including 80s and 90s, a grade of C.

```java
1 if ( score >= 90 )
2   grade = 'A';
3 else if ( score >= 80 )
4   grade = 'B';
5 if ( score >= 70 )
6   grade = 'C';
7 else if ( score >= 60 )
8   grade = 'D';
9 else
10   grade = 'F';
```
**Exercises**

1. What is the output of this code segment if the user enters 5? If the user enters 10? If the user enters 15? If the user enters 20? If the user enters 30? If the user enters 31?

```java
Scanner input = new Scanner( System.in );
int x = input.nextInt( );
if ( x <= 10 )
    x = x + 11;
else if ( x <= 20 )
    x = x + 11;
else if ( x <= 30 )
    x = x + 11;
else
    x = x + 11;
System.out.println( x );
```

2. What is the output of this code segment if the user enters 5? If the user enters 10? If the user enters 15? If the user enters 20? If the user enters 30? If the user enters 31?

```java
Scanner input = new Scanner( System.in );
int x = input.nextInt( );
if ( x <= 10 )
    x = x + 11;
if ( x <= 20 )
    x = x + 11;
if ( x <= 30 )
    x = x + 11;
else
    x = x + 11;
System.out.println( x );
```
3. What is the output of this code segment if the user enters 5? If the user enters 8? If the user enters 10?

```java
int x = scanner.nextInt();
if ( x < 10 )
    System.out.println( "UNDER TEN" );
else if ( x % 2 == 0 )
    System.out.println( "EVEN" );
else if ( x > 5 )
    System.out.println( "OVER FIVE" );
else
    System.out.println( "UNDER FIVE" );
```

4. What is the output of this code segment if the user enters 5? If the user enters 8? If the user enters 10?

```java
int x = scanner.nextInt();
if ( x < 10 )
    System.out.println( "UNDER TEN" );
if ( x % 2 == 0 )
    System.out.println( "EVEN" );
if ( x > 5 )
    System.out.println( "OVER FIVE" );
else
    System.out.println( "UNDER FIVE" );
```

For each of the following use a cascading if-else to complete the code fragment.

5. A PBS station gives donor gifts as shown below. Each donor receives only one gift. Write a Java code fragment that inputs a donor’s name and contribution and prints his or her name and gift.

<table>
<thead>
<tr>
<th>Donor's Contribution</th>
<th>Gift</th>
</tr>
</thead>
<tbody>
<tr>
<td>under $25</td>
<td>Tote bag</td>
</tr>
<tr>
<td>$25 to $50</td>
<td>Coffee mug</td>
</tr>
<tr>
<td>over $50</td>
<td>DVD set</td>
</tr>
</tbody>
</table>
Pistol Pete’s all-you-can-eat buffet restaurant charges as shown below. Write the Java code fragment that (1) inputs the customer’s age, (2) if the customer is a child, inputs his or her weight and (3) determines what price to charge.

<table>
<thead>
<tr>
<th>Age</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>under 6</td>
<td>Free</td>
</tr>
<tr>
<td>6 to 15</td>
<td>9¢ times child’s weight (in lbs.)</td>
</tr>
<tr>
<td>16-59</td>
<td>$10.95</td>
</tr>
<tr>
<td>60 and over</td>
<td>$8.95</td>
</tr>
</tbody>
</table>

Using the pay schedule shown below, write the Java code fragment that inputs an employee’s wage and hours and calculates his or her pay.

<table>
<thead>
<tr>
<th>Hours Worked</th>
<th>Pay</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 40</td>
<td>Base hourly wage</td>
</tr>
<tr>
<td>41 to 60</td>
<td>1½ times the base wage</td>
</tr>
<tr>
<td>61 to 80</td>
<td>2 times the base wage</td>
</tr>
</tbody>
</table>

Using the table below, write the Java code fragment that inputs the average student rating of a teacher and prints the correct message.

<table>
<thead>
<tr>
<th>Average Rating</th>
<th>Message</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under 2</td>
<td>You suck!</td>
</tr>
<tr>
<td>Over 2 and under 4</td>
<td>You need help.</td>
</tr>
<tr>
<td>Over 4 and under 5</td>
<td>Good Job!</td>
</tr>
<tr>
<td>5</td>
<td>YOU GET A RAISE!</td>
</tr>
</tbody>
</table>