CS5000: Foundations of Programming

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Generating random numbers

- Obtain a random double value between 0.0 and 1.0, excluding 1.0
  - Math.random()

- Random single-digit integer
  - (int)(Math.random() * 10)

- Let’s check other function in class java.lang.Math
Statement

- Smallest standalone element of programming language
- Statements control the flow of program execution.
  - Declaration statements
  - Assignment statements
  - Function Call statements
  - Compound statements
  - IF statements
  - WHILE/DO-WHILE statements
  - FOR statements
  - SWITCH statements
Braces { and } are used to group declarations and statements together into a compound statement, or block, so that they are syntactically equivalent to a single statement.

```java
{
    int i = 2, j = 5;
    System.out.print(i);
    System.out.print(j);
}
```
Flow of Control

- **Branching and looping**
  - **Branching:**
    - *If-else, if*
    - *Switch*
  - **Looping**
    - *While, do-while, for*
- *Most branching and looping statements are controlled by Boolean expressions*
Boolean type and operators

- **Boolean type**
  - Compare two values
  - The result of the comparison is a Boolean value:
    - True or False

Boolean b = 1 > 2;
## Relational Operators

<table>
<thead>
<tr>
<th>Java Operator</th>
<th>Mathematics Symbol</th>
<th>Name</th>
<th>Example</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;</td>
<td>&lt;</td>
<td>less than</td>
<td>radius &lt; 0</td>
<td>false</td>
</tr>
<tr>
<td>&lt;=</td>
<td>≤</td>
<td>less than or equal to</td>
<td>radius &lt;= 0</td>
<td>false</td>
</tr>
<tr>
<td>&gt;</td>
<td>&gt;</td>
<td>greater than</td>
<td>radius &gt; 0</td>
<td>true</td>
</tr>
<tr>
<td>&gt;=</td>
<td>≥</td>
<td>greater than or equal to</td>
<td>radius &gt;= 0</td>
<td>true</td>
</tr>
<tr>
<td>==</td>
<td>=</td>
<td>equal to</td>
<td>radius == 0</td>
<td>false</td>
</tr>
<tr>
<td>!=</td>
<td>≠</td>
<td>not equal to</td>
<td>radius != 0</td>
<td>true</td>
</tr>
</tbody>
</table>
If-Else Statement

- Used to express Decisions
- Flowchart for decisions
If-Else Statement

- Used to express decisions
- “else if” and “else” parts are optional

```python
if (Boolean_expression)
    statement
else if (Boolean_expression)
    statement
else if (Boolean_expression)
    statement
...
else
    statement
```
If-Else Statement

- Integers cannot be evaluated for Boolean_expression

```plaintext
if (x > 1) ... (O)
if (x == 1) ... (O)
if (1) ... (X)
```
If-Else Statement

- For multiple statements

```plaintext
if (Boolean_expression)
{
   multiple statements
}
else if (Boolean_expression)
{
   multiple statements
}
else
{
   multiple statements
}
```
The **else** clause matches the most recent **if** clause in the same block.

```
int i = 1, j = 2, k = 3;
if (i > j)
  if (i > k)
    System.out.println("A");
else
  System.out.println("B");
```

(a)

Equivalent

```
int i = 1, j = 2, k = 3;
if (i > j)
  if (i > k)
    System.out.println("A");
else
  System.out.println("B");
```

(b)
Nothing is printed from the preceding statement. To force the `else` clause to match the first `if` clause, you must add a pair of braces:

```java
int i = 1;
int j = 2;
int k = 3;
if (i > j) {
    if (i > k)
        System.out.println("A");
}
else
    System.out.println("B");
```

This statement prints B.
If-Else Statement

- Check whether the variable ‘c’ is a digit or an alphabet

Scanner keyboard = new Scanner(System.in);
String strInput = keyboard.next();
char c = strInput.charAt(0);

if (c >= '0' && c <= '9')
    System.out.printf("%c is a digit", c);
else if (c >= 'a' && c <= 'z')
    System.out.printf("%c is an alphabet", c);
else if (c >= 'A' && c <= 'Z')
    System.out.printf("%c is an alphabet", c);
else
    System.out.printf("%c is neither a digit nor an alphabet", c);
If-Else Statement

- Convert c to lower case (assume that c is an alphabet character)

```java
if (c >= 'A' && c <= 'Z')
    c = c + 'a' - 'A';
```
Common mistakes in If statement

```java
char c = 'a';
if (c == 'b')
    System.out.print("Statement A ");
    System.out.print("Statement B ");
    System.out.print("Test me ");
```

1. Statement A Statement B Test me
2. Statement B Test me
3. Test me
Common mistakes in If statement

```java
char c = 'a';
if (c == 'b') {
    System.out.print("Statement A ");
    System.out.print("Statement B ");
    System.out.print("Test me ");
}
```

1. Statement A Statement B Test me
2. Statement B Test me
3. Test me
Common mistakes in If statement

```java
int nx = 10;
if (nx > 3)
    System.out.print("Statement A ");
else if (nx > 5)
    System.out.print("Statement B ");
else if (nx > 9)
    System.out.print("Statement C");
```
Note

if (even == true)
    System.out.println("It is even.");

(a) Equivalent

if (even)
    System.out.println("It is even.");

(b)
Example

- Write a program that checks (i) whether a number is divisible by 2 and 3, (ii) whether a number is divisible by 2 or 3, and (iii) whether a number is divisible by 2 or 3 but not both:

  Hint) &&, ||, and ^
Determining leap year?

Prompts the user to enter a year as an int value and checks if it is a leap year.

A year is a leap year if it is divisible by 4 but not by 100, or it is divisible by 400.
Write a program that prompts the user to enter a point \((x, y)\) and checks whether the point is within the circle centered at \((0, 0)\) with radius 10.

Enter a point with two coordinates: 4 5
Point\((4.0, 5.0)\) is in the circle

Hint) the formula for computing the distance is
\[
\sqrt{(x_2-x_1)^2 + (y_2-y_1)^2}
\]
Write a program that displays the scissor-rock-paper game. The program prompts the user to enter a number 0, 1, or 2 and displays a message indicating whether the user or the computer wins, loses, or draws.

Scissor(0), rock(1), paper(2) : 1

The computer is scissor. You are rock. You won
Example

- Write a program that simulates (randomly) picking a card from a deck of 52 cards. Your program should display the rank (Ace, 2, 3, 4, 5, 6, 7, 8, 9, 10, Jack, Queen, King) and suit (Clubs, Diamonds, Hearts, Spades) of the card.

The card you picked is Jack of Hearts.
The conditional operator evaluates an expression returning a value if that expression is true and different one if the expression is evaluated as false.

```
condition? Result1: Result2
```

- `10 == 5 ? 11 : 12` // return 12
- `12 > 8 ? nA : nB` // return the value of nA
- `nA = nA > 0 ? nA : 0;`
Conditional Operator vs IF

```c
int nResult;
nResult = Condition ? Result1 : Result2;
```

```c
if (Condition)
    nResult = Result1;
else
    nResult = Result2;
```
Conditional Operator

Example

```java
int a = 10, b = 11;
int c;
c = (a < b)? a : b;
System.out.println(c);
```
Example

```java
int a = 10, b = 0;
if ((a < b)? true : false)
    System.out.print(b);
else
    System.out.print(a);
```
if (number % 2 == 0)
    even = true;
else
    even = false;

Equivalent

boolean even
    = number % 2 == 0;
Switch Statement

- Multi-way decision that tests whether an expression matches one of a number of constant values of integer or char, and branches accordingly.
- The controlling expression must evaluate to a char, int, short, byte, or string (from JDK 7).
Switch Statement

```
switch(expression)
{
    case const_expr: statements
        break;
    case const_expr: statements
        break;
    default: statements
}
```
Scanner keyboard = new Scanner(System.in);
int nInput = keyboard.nextInt();
switch(nInput)
{
    case 0:
        System.out.print("zero");
        break;
    case 1:
        System.out.print("one");
        break;
    case 2:
        System.out.print("two");
        break;
    default:
        System.out.print("others");
}
Random rand = new Random();
int n = rand.nextInt();
switch(n)
{
  case 0:
    System.out.print("Rock!!\n");
    break;
  case 1:
    System.out.print("Paper!!\n");
    break;
  case 2:
    System.out.print("Scissor!!\n");
    break;
  default:
    System.out.print("A wrong number is generated: " + n);
    break;
}
Example

```java
switch (day) {
    case 1:
    case 2:
    case 3:
    case 4:
    case 5: System.out.println("Weekday"); break;
    case 0:
    case 6: System.out.println("Weekend");
}
```
Example

- Write a program that prompts the user to enter a year and displays the animal for the year.

```
year % 12 =
0: monkey
1: rooster
2: dog
3: pig
4: rat
5: ox
6: tiger
7: rabbit
8: dragon
9: snake
10: horse
11: sheep
```