CISC 3115 TY3

C04b: A Few Classes in the Java Library

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Outline

- Just discussed
  - Default constructor
  - Accessing objects via reference variables
  - Primitive and reference variables
  - Garbage collection
- A few classes in the Java Library (Java API)

Java API and Library

- Java API: Java Application Programming Interface
  - Define the interface with which an application interacts with Java
    - Classes and methods that an application programmer can use in their own programs
- Java Library: implementation of the classes and methods

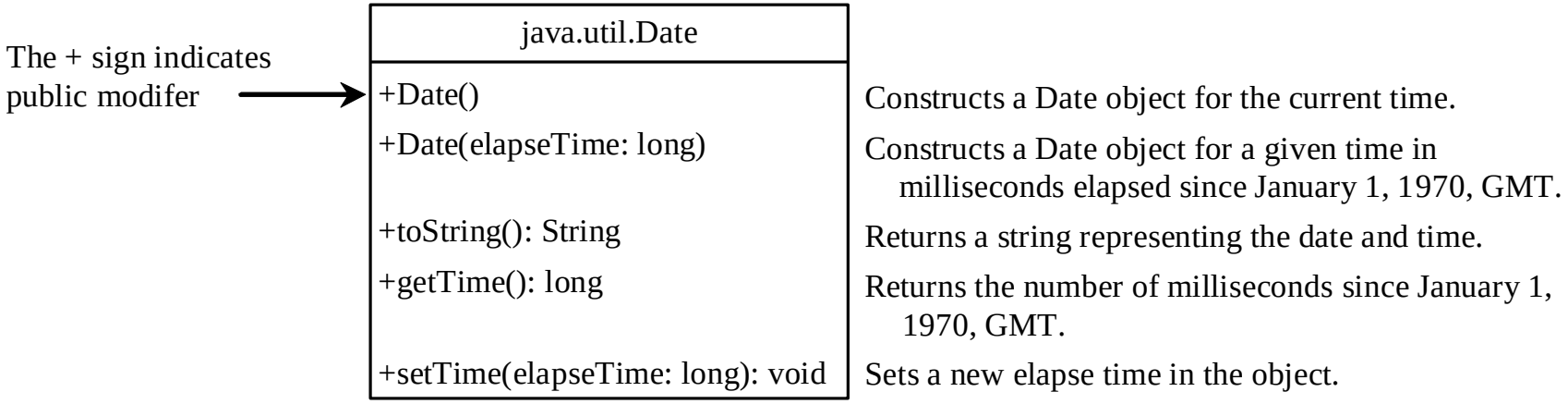
A Few Classes in Java Library

- Date
- Random
- Point2D

The Date Class

- A system-independent encapsulation of date and time in the java.util.Date class.
- Represent a specific instant in time, with millisecond precision
- Example usage:
  - You can use the Date class to create an instance for the current date and time and use its toString method to return the date and time as a string.
- API documentation (may be intimidating to some, a good read nonetheless)
  - https://docs.oracle.com/javase/10/docs/api/java/util/Date.html

The Date Class: UML Class Diagram



- We shall discuss the meaning of the "public" modifier in a moment

The Date Class: Example

- Showing current system date and time
  - the import statement
  - Java package: java.util is a package while Date is a class in the package

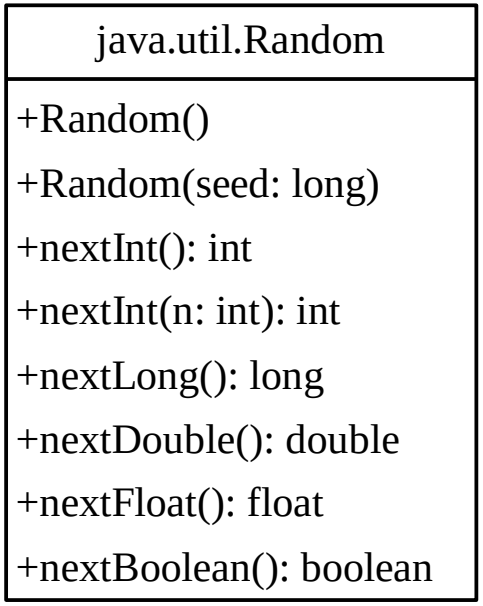
PrintDate.java

```
1  import java.util.Date;
2
3  class PrintDate {
4    public static void main(String[] args) {
5        Date date = new Date();
6        System.out.println("The date is " + date.toString());
7    }
8  }
```

The Random Class

- A pseudo-random number generator in the java.util.Random class
- Use it to generate a sequence of pseudo-random numbers
- Example usage:
  - Generate a sequence random integers
  - Generate a sequence random float point numbers
  - Generate a sequence random Boolean values
- API documentation (may be intimidating to some, a good read nonetheless)
  - https://docs.oracle.com/javase/10/docs/api/java/util/Random.html

The Random Class: UML Class Diagram



Constructs a Random object with the current time as its seed.

Constructs a Random object with a specified seed.

Returns a random int value.

Returns a random int value between 0 and n (exclusive).

Returns a random long value.

Returns a random double value between 0.0 and 1.0 (exclusive).

Returns a random float value between 0.0F and 1.0F (exclusive).

Returns a random boolean value.

The Random Class: Example

- What is a "seed"?

RandomNumbers.java

```java
import java.util.Random;

class RandomNumbers {
  public static void main(String[] args) {
    Random random1 = new Random(3);
    System.out.print("From random1: ");
    for (int i = 0; i < 10; i++) {
      System.out.print(random1.nextInt(1000) + " ");
    }

    Random random2 = new Random(3);
    System.out.print("\nFrom random2: ");
    for (int i = 0; i < 10; i++) {
      System.out.print(random2.nextInt(1000) + " ");
    }

    Random random3 = new Random(4);
    System.out.print("\nFrom random3: ");
    for (int i = 0; i < 10; i++) {
      System.out.print(random3.nextInt(1000) + " ");
    }

    Random random4 = new Random();
    System.out.print("\nFrom random4: ");
    for (int i = 0; i < 10; i++) {
      System.out.print(random4.nextInt(1000) + " ");
    }

    Random random5 = new Random();
    System.out.print("\nFrom random5: ");
    for (int i = 0; i < 10; i++) {
      System.out.print(random5.nextInt(1000) + " ");
    }
  }
}
```

Pseudo-Random Numbers

- The Random class generates pseudo-random numbers, i.e., the numbers are generated by an algorithm
- Implication
  - They are in fact deterministic although appear random.
  - Given two identical seeds, the sequences of "random" numbers are identical as well

Math.random()

- The Math class in the Java Library has a random method
  - Generating pseudo-random double values in interval [0.0, 1.0)
  - Described in the API documentation
    - https://docs.oracle.com/javase/10/docs/api/java/lang/Math.html#random()

"When this method is first called, it creates a single new pseudorandom-number generator, exactly as if by the expression

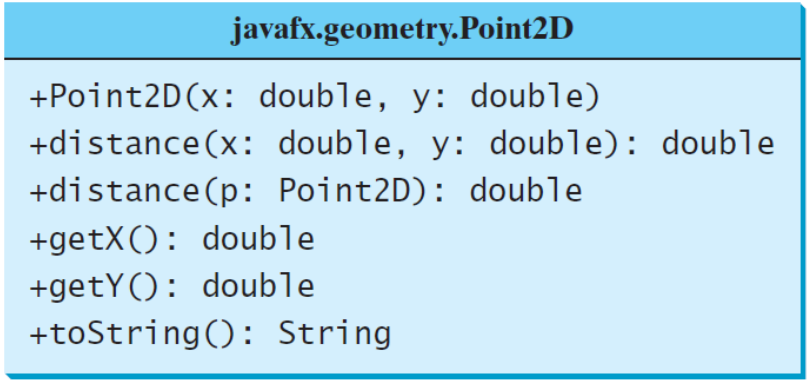
new java.util.Random()

This new pseudorandom-number generator is used thereafter for all calls to this method and is used nowhere else. "

The Point2D Class

- Representing a point in a two-dimensional plane in the javafx.geometry.Point2D class.
  - A point is represented by its coordinates (x, y) in the plane
- Example usage:
  - You can use it to compute distance between two points, and more
- API documentation (may be intimidating to some, a good read nonetheless)
  - https://docs.oracle.com/javase/10/docs/api/javafx/geometry/Point2D.html

The Point2D Class: UML Class Diagram



Constructs a `Point2D` object with the specified x- and y-coordinates.	
Returns the distance between this point and the specified point (x, y).	
Returns the distance between this point and the specified point p.	
Returns the x-coordinate from this point.	
Returns the y-coordinate from this point.	
Returns a string representation for the point.	

The Point2D Class: Example

TestPoint2D.java

```java
import java.util.Scanner;
import javafx.geometry.Point2D;

class TestPoint2D {
  public static void main(String[] args) {
    Scanner sc = new Scanner (System.in);

    System.out.println("Enter point1's x=, and y-coordinates: ");
    double x1 = sc.nextDouble();
    double y1 = sc.nextDouble();

    System.out.println("Enter point2's x=, and y-coordinates: ");
    double x2 = sc.nextDouble();
    double y2 = sc.nextDouble();

    Point2D p1 = new Point2D(x1, y1);
    Point2D p2 = new Point2D(x2, y2);
    System.out.println("p1 is " + p1.toString());
    System.out.println("p2 is " + p2.toString());
    System.out.println("The distance between p1 and p2 is " + p1.distance(p2));
    System.out.println("The midpoint between p1 and p2 is " + p1.midpoint(p2).toString());
  }
}
```

Questions?

- Concept of Java API and Java Library
- A few classes in the Java Library
  - Date
  - Random
  - Point2D
  - Math
- Java package