Enumerated Types

CSE160, Computer Science A: Honors
Stony Brook University

http://www.cs.stonybrook.edu/~cse160
Enumerated Types

- An enumerated type defines a list of enumerated values
  - Each value is an identifier

```java
enum Day { SUNDAY, MONDAY, TUESDAY, WEDNESDAY, THURSDAY, FRIDAY, SATURDAY; }
enum TrafficLight { RED, GREEN, YELLOW }
```

- A value of an enumerated type is like a constant and so, by convention, is spelled with all uppercase letters
- Also, by convention, an enumerated type is named like a class with first letter of each word capitalized
- Once a type is defined, you can declare a variable of that type:
  ```java
  Day day;
  TrafficLight t;
  ```
  - The variable `day` can hold one of the values defined in the enumerated type `Day` or `null`, but nothing else
Enumerated Types

- The enumerated values can be accessed using the syntax `EnumeratedTypeName.valueName`
- For example, the following statement assigns enumerated value `Monday` to variable `day`:
  ```java
  Day day = Day.MONDAY;
  ```
- Using enumerated values (e.g., `Day.MONDAY`) rather than literal integer values (e.g., `0, 1, 2, 3`, and so on) can make program easier to read and maintain

- An enumerated type is treated as a special class, so an enumerated type variable is therefore a reference variable
- An enumerated type is a subtype of the `Object` class (inherits all the methods in the `Object` class) and the `Comparable` interface (has the `compareTo` method in the `Comparable` interface)
Enumerated Types

The following methods are defined for any enumerated object:

```java
public String name();
```

- Returns a **name** of the value for the object (e.g. `SUNDAY`)

```java
public int ordinal();
```

- Returns the ordinal value associated with the enumerated value (e.g., `0`, `1`, `2`, `3`, and so on)
  - The first value in an enumerated type has an ordinal value of `0`, the second has an ordinal value of `1`, the third one `3`, and so on
public class EnumeratedTypeDemo {
    static enum Day {SUNDAY, MONDAY, TUESDAY, WEDNESDAY, THURSDAY, 
                    FRIDAY, SATURDAY};

    public static void main(String[] args) {
        Day day1 = Day.FRIDAY;
        Day day2 = Day.THURSDAY;
        System.out.println("day1's name is " + day1.name());
            // day1's name is FRIDAY
        System.out.println("day2's name is " + day2.name());
            // day2's name is THURSDAY
        System.out.println("day1's ordinal is " + day1.ordinal());
            // day1's ordinal is 5
        System.out.println("day2's ordinal is " + day2.ordinal());
            // day2's ordinal is 4
        System.out.println("day1.equals(day2) returns " +
                day1.equals(day2));  // false
        System.out.println("day1.toString() returns " +
                day1.toString());  // FRIDAY
        System.out.println("day1.compareTo(day2) returns " +
                day1.compareTo(day2));  // 1
    }
}
public class EnumeratedTypeDemo {
    public static void main(String[] args) {
        Day day1 = Day.FRIDAY;
        Day day2 = Day.THURSDAY;

        System.out.println("day1's name is " + day1.name());
        System.out.println("day2's name is " + day2.name());

        System.out.println("day1's ordinal is " + day1.ordinal());
        System.out.println("day2's ordinal is " + day2.ordinal());

        System.out.println("day1.equals(day2) returns " +
                day1.equals(day2));
        System.out.println("day1.toString() returns " +
                day1.toString());
        System.out.println("day1.compareTo(day2) returns " +
                day1.compareTo(day2));
    }
}

enum Day {SUNDAY, MONDAY, TUESDAY, WEDNESDAY, THURSDAY, FRIDAY, SATURDAY};
day1's name is FRIDAY  
day2's name is THURSDAY  
day1's ordinal is 5  
day2's ordinal is 4  
day1.equals(day2) returns false  
day1.toString() returns FRIDAY  
day1.compareTo(day2) returns 1
Enumerated Types

- An enumerated type can be defined inside a class or standalone
  - When an enumerated type is declared inside a class, the type must be declared as a `static` member of the class and cannot be declared inside a method
    - After the first program is compiled, a class named `EnumeratedTypeDemo$Day.class` is created
    - `static` may be omitted

- When an enumerated type is declared `standalone`, the type is treated as a standalone class, so after the program is compiled, a class named `Day.class` is created
Using if or switch Statements with an Enumerated Variable

- Often your program needs to perform a specific action depending on the value
  - For example, if the value is Day.MONDAY, play soccer; if the value is Day.TUESDAY, take piano lesson, and so on

```java
if (day.equals(Day.MONDAY)) {
    // process Monday
} else if (day.equals(Day.TUESDAY)) {
    // process Tuesday
} else
    ...
```
Using if or switch Statements with an Enumerated Variable

```java
switch (day) {
    case MONDAY:
        // process Monday
        break;
    case TUESDAY:
        // process Tuesday
        break;
    ...
}
```

- In a `switch` statement, the case label is an unqualified enumerated value (e.g., `MONDAY`, but not `Day.MONDAY`).
Processing Enumerated Values
Using a Foreach Loop

- Each enumerated type has a static method `values()` that returns all enumerated values for the type in an array:

```java
Day[] days = Day.values();
for (int i = 0; i < days.length; i++)
    System.out.println(days[i]);
```

// is equivalent with:
```java
for (Day day: days)
    System.out.println(day);
```
Enumerated Types with Data Fields, Constructors, and Methods

```java
public enum TrafficLight {
    RED ("Please stop"), GREEN ("Please go"),
    YELLOW ("Please caution");

    private String description;
    private TrafficLight(String description) {
        this.description = description;
    }
    public String getDescription() {
        return description;
    }
}
```

- The constructor is invoked whenever an enumerated value is accessed
  - The enumerated value’s argument is passed to the constructor, which is then assigned to `description`
public class TestTrafficLight {
    public static void main(String[] args) {
        TrafficLight light = TrafficLight.RED;
        System.out.println(light.getDescription());
    }
}

• An enumerated value TrafficLight.RED is assigned to variable light
• Accessing TrafficLight.RED causes the JVM to invoke the constructor with argument “please stop”