

CS61B Lecture #35

Today: Enumeration types

Coming Up: Graph Structures: *DSIJ*, Chapter 12

Side Trip into Java: Enumeration Types

- Problem: Need a type to represent something that has a few, named, discrete values.
- In the purest form, the only necessary operations are == and !=; the only property of a value of the type is that it differs from all others.
- In older versions of Java, used named integer constants:

```
interface Pieces {  
    int BLACK_PIECE = 0,    // Fields in interfaces are static final.  
        BLACK_KING = 1,  
        WHITE_PIECE = 2,  
        WHITE_KING = 3,  
        EMPTY = 4;  
}
```

- C and C++ provide *enumeration types* as a shorthand, with syntax like this:

```
enum Piece { BLACK_PIECE, BLACK_KING, WHITE_PIECE, WHITE_KING, EMPTY };
```

- But since all these values are basically **ints**, accidents can happen.

Enum Types in Java

- New version of Java allows syntax like that of C or C++, but with more guarantees:

```
public enum Piece {  
    BLACK_PIECE, BLACK_KING, WHITE_PIECE, WHITE_KING, EMPTY  
}
```

- Defines Piece as a new *reference type*, a special kind of class type.
- The names BLACK_PIECE, etc., are *static, final enumeration constants* (or *enumerals*) of type PIECE.
- They are automatically initialized, and are the only values of the enumeration type that exist (illegal to use **new** to create an enum value.)
- Can safely use ==, and also switch statements:

```
boolean isKing (Piece p) {  
    switch (p) {  
        case BLACK_KING: case WHITE_KING: return true;  
        default: return false;  
    }  
}
```

Making Enumerals Available Elsewhere

- Enumerals like `BLACK_PIECE` are static members of a class, not classes.
- Therefore, unlike *C* or *C++*, their declarations are not automatically visible outside the enumeration class definition.
- So, in other classes, must write `Piece.BLACK_PIECE`, which can get annoying.
- However, with version 1.5, Java has *static imports*: to import all static definitions of class `chess.Piece` (including enumerals), you write

```
import static chess.Piece.*;
```

among the import clauses.
- Alas, *cannot* use this for enum classes in the anonymous package.

Operations on Enum Types

- Order of declaration of enumeration constants significant: `.ordinal()` gives the position (numbering from 0) of an enumeration value. Thus, `Piece.BLACK_KING.ordinal ()` is 1.
- The array `Piece.values()` gives all the possible values of the type. Thus, you can write:

```
for (Piece p : Piece.values ())  
    System.out.printf ("Piece value #%d is %s%n", p.ordinal (), p);
```

- The static function `Piece.valueOf` converts a `String` into a value of type `Piece`. So `Piece.valueOf ("EMPTY") == EMPTY`.

Fancy Enum Types

- Enums are classes. You can define all the extra fields, methods, and constructors you want.
- Constructors are used only in creating enumeration constants. The constructor arguments follow the constant name:

```
enum Piece {
    BLACK_PIECE (BLACK, false, "b"), BLACK_KING (BLACK, true, "B"),
    WHITE_PIECE (WHITE, false, "w"), WHITE_KING (WHITE, true, "W"),
    EMPTY (null, false, " ");

    private final Side color;
    private final boolean isKing;
    private final String textName;

    Piece (Side color, boolean isKing, String textName) {
        this.color = color; this.isKing = isKing; this.textName = textName;
    }

    Side color () { return color; }
    boolean isKing () { return isKing; }
    String textName () { return textName; }
}
```