Object Interaction

Creating cooperating objects

Abstraction

- **Abstraction** is the ability to ignore details of parts to focus attention on a higher level of a problem.

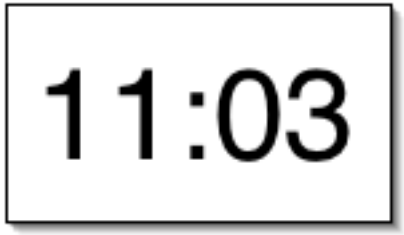
Modularization

- **Modularization** is the process of dividing a whole into well-defined parts, which can be built and examined separately, and which interact in well-defined ways.

A digital clock

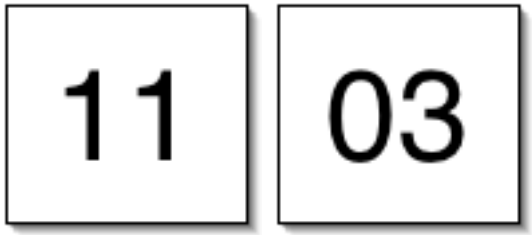
11:03

Modularizing the clock display



One four-digit display?

Or two two-digit displays?



Implementation - NumberDisplay

```
public class NumberDisplay {

    private int limit;
    private int value;

    Constructor and
    methods omitted.
}
```

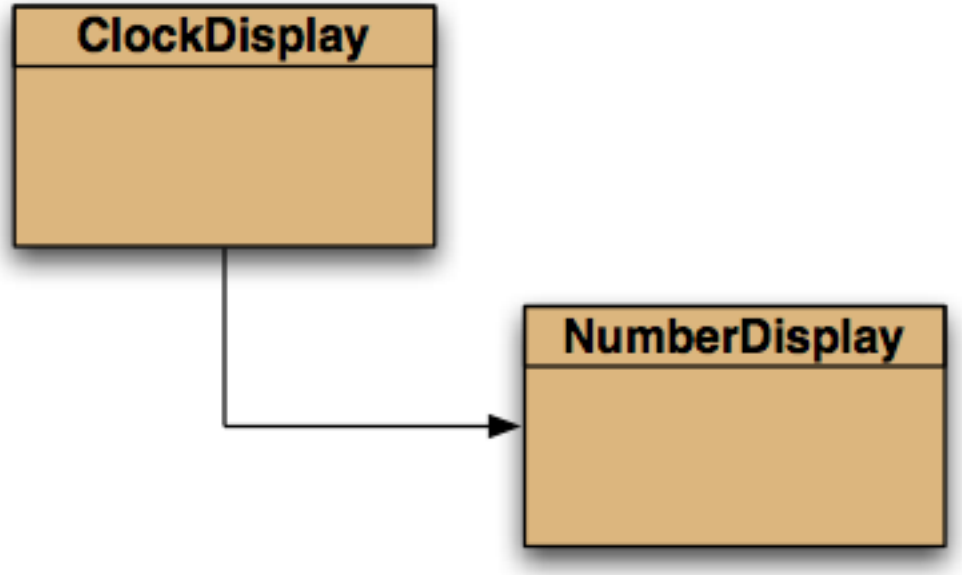
Implementation – ClockDisplay

```
public class ClockDisplay {

    private NumberDisplay hours;
    private NumberDisplay minutes;

    Constructor and
    methods omitted.
}
```

Class diagram



Source code: NumberDisplay

```
public NumberDisplay(int rollOverLimit) {
    limit = rollOverLimit;
    value = 0;
}

public void increment() {
    value = (value + 1) % limit;
}
```

Source code: NumberDisplay

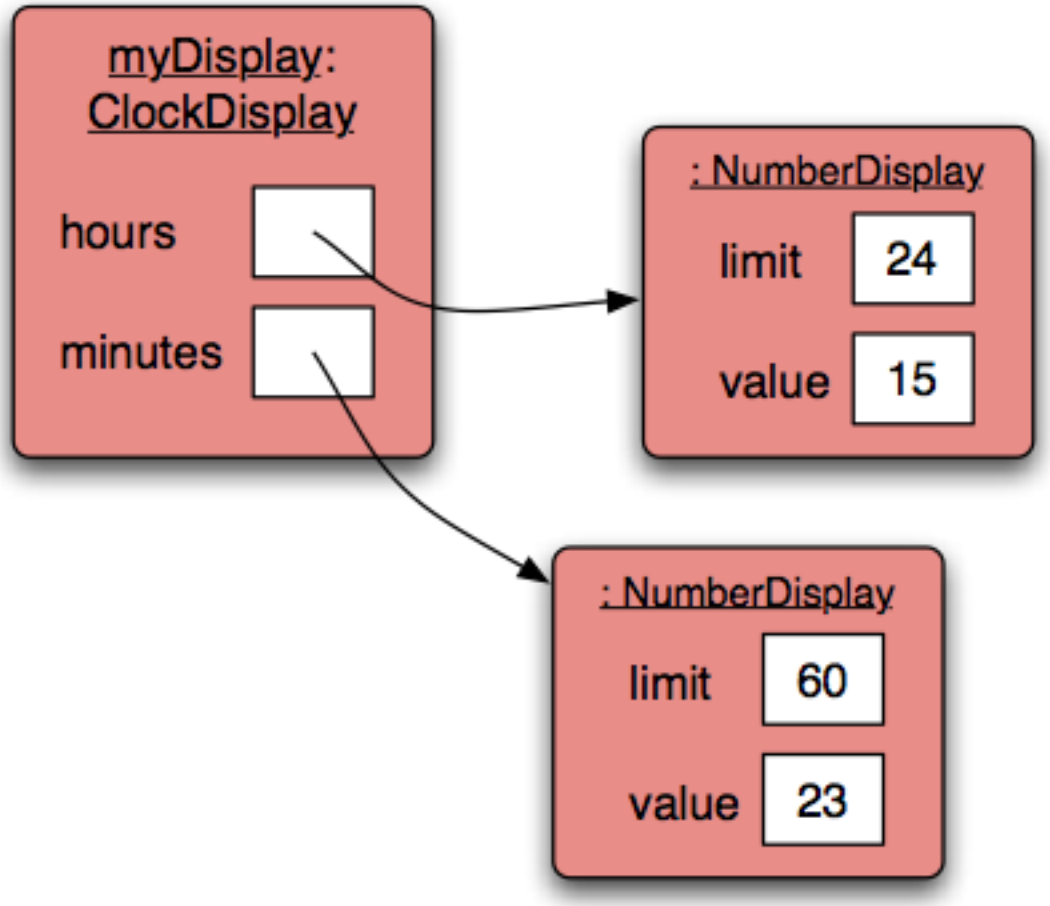
```
public String getDisplayValue() {
    if (value < 10) {
        return "0" + value;
    } else {
        return "" + value;
    }
}
```

Objects creating objects

```
public class ClockDisplay {
    private NumberDisplay hours;
    private NumberDisplay minutes;
    private String displayString;

    public ClockDisplay() {
        hours = new NumberDisplay(24);
        minutes = new NumberDisplay(60);
        updateDisplay();
    }
}
```

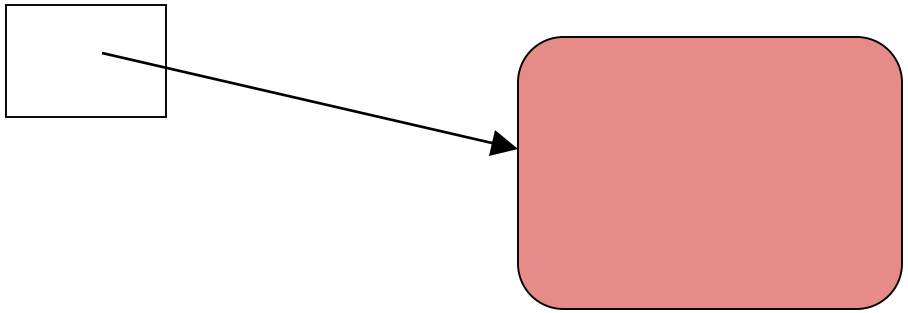
ClockDisplay object diagram



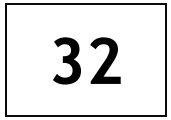
Primitive types vs. object types

```
SomeClass obj;
```

object type



```
int i;
```



primitive type

Quiz: What is the output?

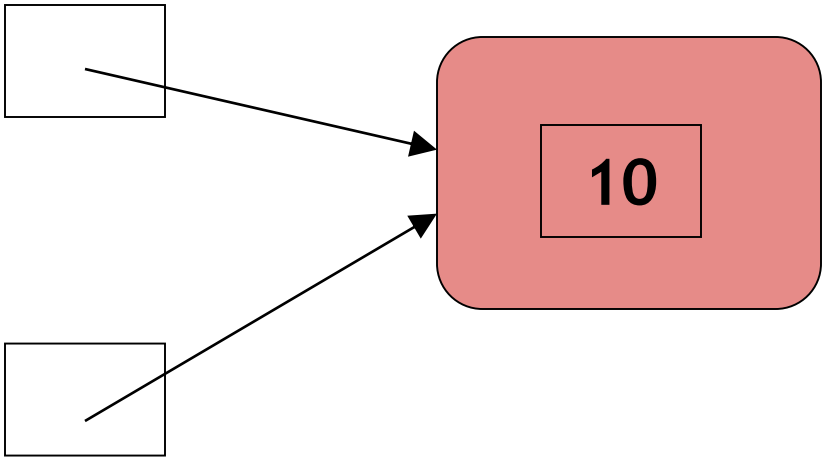
- ```
  int a;
  int b;
  a = 10;
  b = a;
  a = a + 1;
  System.out.println(b);
  ```

- Write a class named ‘Int’ and try above again.

  What changed?
  ```

Primitive types vs. object types

```
Int a = new Int(10);
```




```
Int b = a;
```

null

- **`null`** is a special value in Java
- All object variables are initialized to **`null`**.
- You can assign and test for **`null`**:

```
private NumberDisplay hours;
if (hours == null) { ... }
hours = null;
```

Internal Method calls

```
methodName ( parameter-list )
```

External Method calls

```
object . methodName ( parameter-list )
```

Method calls

- internal method calls

```
updateDisplay();
...
private void updateDisplay()
```

- external method calls

```
minutes.increment();
```

Method calling

```
public void timeTick() {
    minutes.increment();
    if (minutes.getValue() == 0) {
        // it just rolled over!
        hours.increment();
    }
    updateDisplay();
}
```

Method calling

```
/**
 * Update the internal string that
 * represents the display.
 */
private void updateDisplay() {
    displayString =
        hours.getDisplayValue() + ":" +
        minutes.getDisplayValue();
}
```

Method / Constructor Overloading

- **Overloading:**
  with a different set of parameters:

```
public ClockDisplay() {
    hours = new NumberDisplay(24);
    minutes = new NumberDisplay(60);
    updateDisplay();
}

public ClockDisplay(int hour, int minute) {
    hours = new NumberDisplay(24);
    minutes = new NumberDisplay(60);
    setTime(hour, minute);
}
```

Quiz: is this correct ?!

```
private int value;

public void setValue(int value) {
     value = value;
}
```

‘this’ keyword

```
private int value;

public void setValue(int value) {
    this.value = value;
}
```

Concepts

- abstraction
- modularisation
- classes define types
- class diagram
- object diagram
- object references
- primitive types
- object creation
- overloading
- internal/external method call
- this keyword