# Refactoring to Java 17 and beyond

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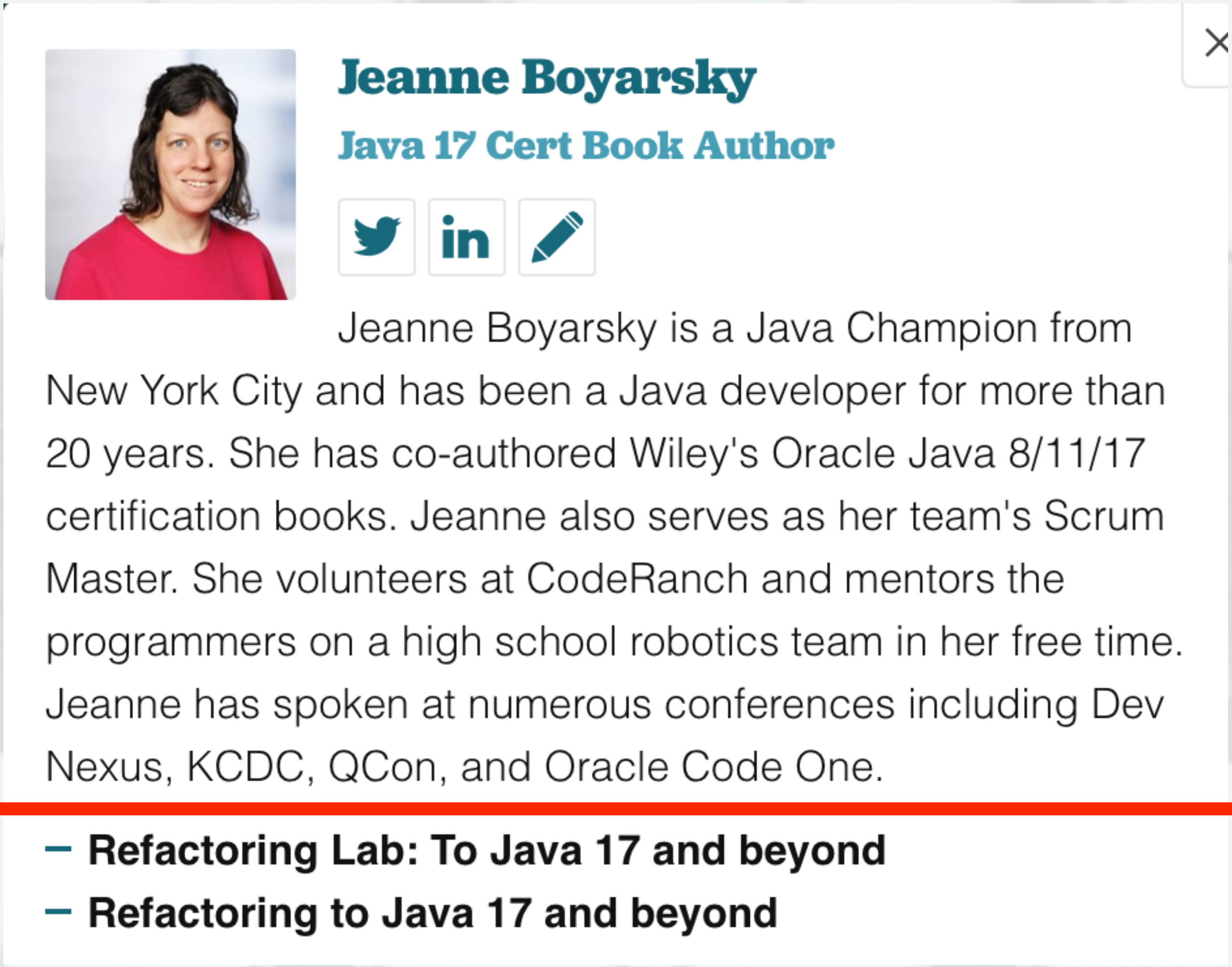
August 8, 2022
KCDC

speakerdeck.com/boyarsky



**Jeanne Boyarsky**

**Java 17 Cert Book Author**

Jeanne Boyarsky is a Java Champion from New York City and has been a Java developer for more than 20 years. She has co-authored Wiley's Oracle Java 8/11/17 certification books. Jeanne also serves as her team's Scrum Master. She volunteers at CodeRanch and mentors the programmers on a high school robotics team in her free time. Jeanne has spoken at numerous conferences including Dev Nexus, KCDC, QCon, and Oracle Code One.

- **Refactoring Lab: To Java 17 and beyond**
- **Refactoring to Java 17 and beyond**

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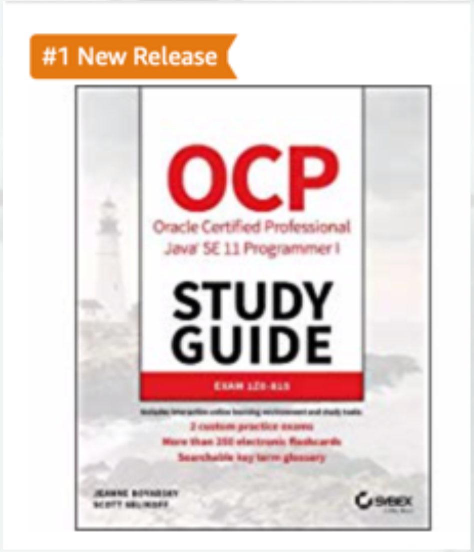

Java certs: 8/11/17

Book giveaway at end!

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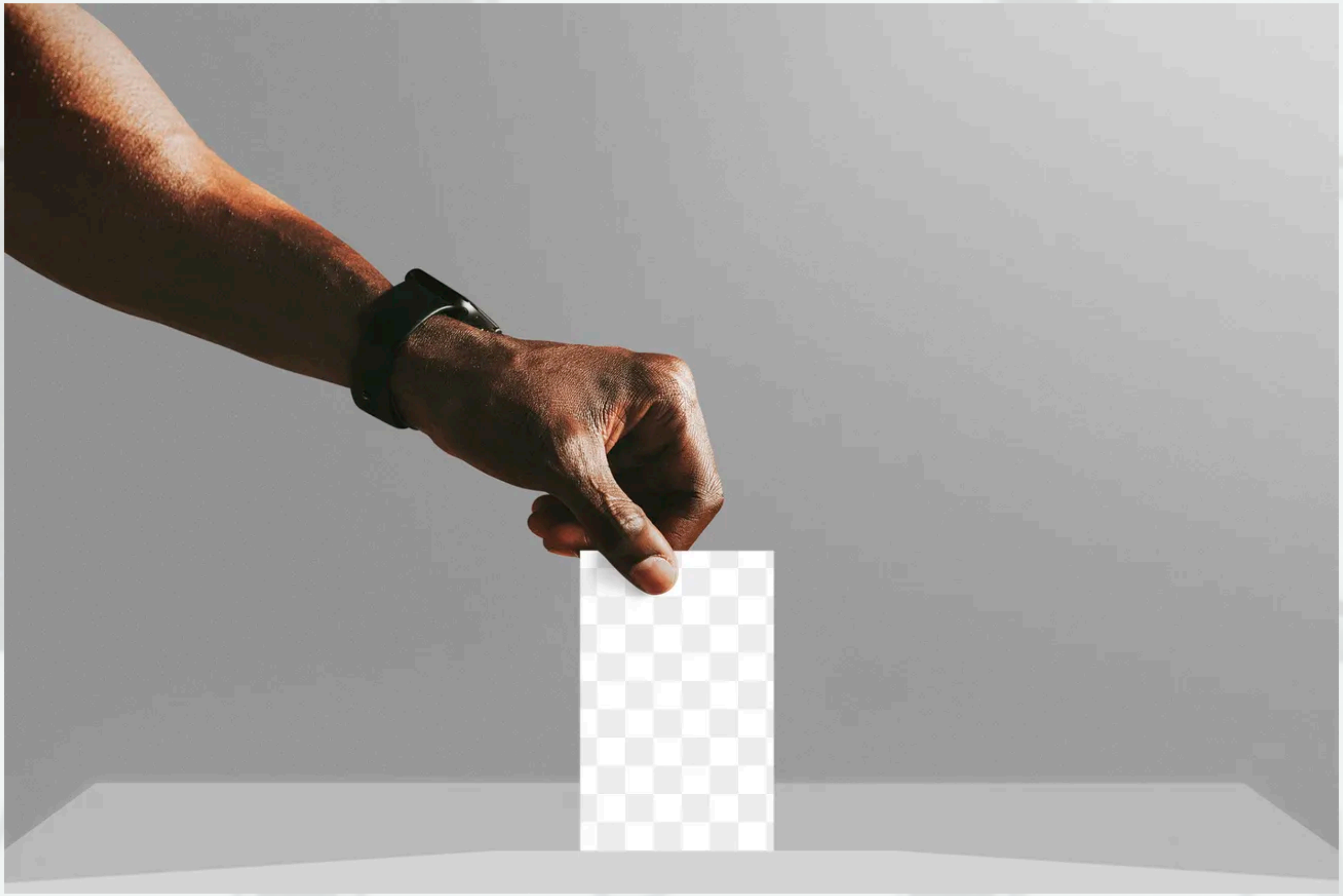
## At end of session

https://speakerdeck.com/boyarsky

## Disclaimer

- A bit of the material is from my books.

# Version of Java?



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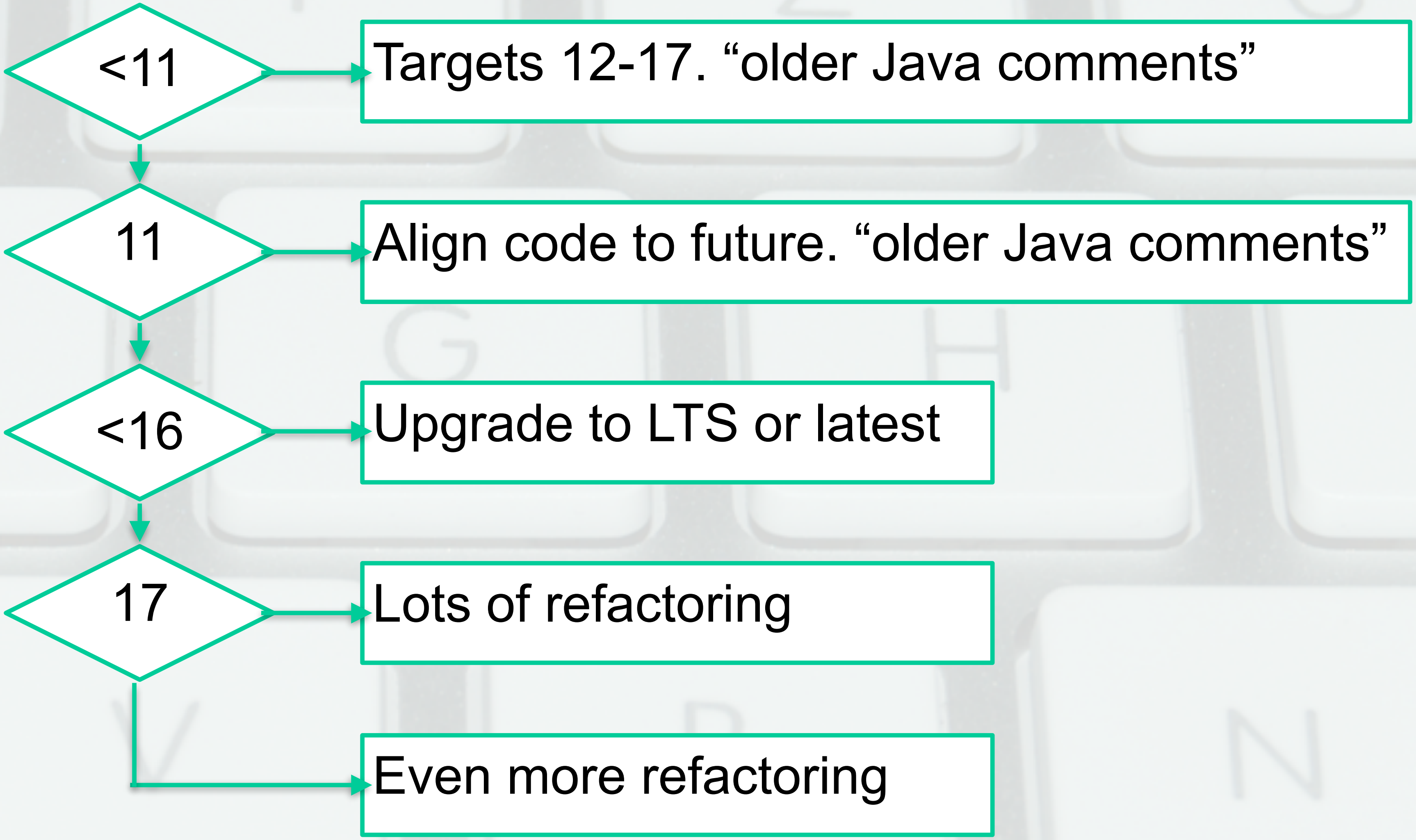
# Version of Java?


<11
Targets 12-17. “older Java comments”
11
Align code to future. “older Java comments”
<16
Upgrade to LTS or latest
17
Lots of refactoring
Even more refactoring

## For each Topic

- Example
- About the feature
- Opportunities
- IDE Support
- What to do if on older Java

- What will be explored in more detail in the lab version Wednesday….

## Refactoring

- We are writing legacy code now!
- Refactor for future compatibility

## Text blocks and Strings

## Example: REST API Params

```
public String getJson(String search) {
    String json = "{" +
            "   \"query\": \"%s\"" +
            "   \"start\": \"1\"," +
            "   \"end\": \"10\"" +
            "}";
    return String.format(json, search);
}
```

This is hard to read

# Take Two

```
public String getJson(String search) {
    Path path = Path.of(
       “src/main/resources/query.json");
    String json = null;
    try {
        json = Files.readString(path);
    } catch (IOException e) {
        throw new UncheckedIOException(e);
    }
    return String.format(json, search);
}
```

Now the String is far away

## Text Block

15

```
public String getJson(String search) {
    String json = """
            {
            "query": "%s"
            "start": "1"
            "end": "10"
            }""";
    return String.format(json, search);
}
```

It's a string literal!

Adds line breaks, but still works

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# Text Block Syntax

15

start block

```
String textBlock = """
                   kcdc,Kansas City,"session,workshop"
                   meetup,Various,lecture
                   """;
```

incidental whitespace

end block

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# Essential Whitespace

15

```
String textBlock = """
    <session>
        <speaker>
            Jeanne Boyarsky
        </speaker>
    </session>
    """;
```

incidental whitespace

essential whitespace

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## Ending lines

15

new escape character keeps trailing whitespace

```
String textBlock = """
        <session>
            <speaker>
                Jeanne Boyarsky    \s
            </speaker>
            <title>
                Becoming one of the first Java 17 \
                certified programmers \
                (and learning new features)
            </title>
        </session>
        """;
```

tab

continue on next line without a line break

# New lines

15

```
String textBlock = """
        <session>\n
            <speaker>
                Jeanne\nBoyarsky
            </speaker>
        </session>""";
```

Two new lines
(explicit and implicit)

One new line (explicit)

no line break at end

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# Escaping Three Quotes

15

```
String textBlock = """
        better \"""
        but can do \"\"\"
        """;
```

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## Opportunities

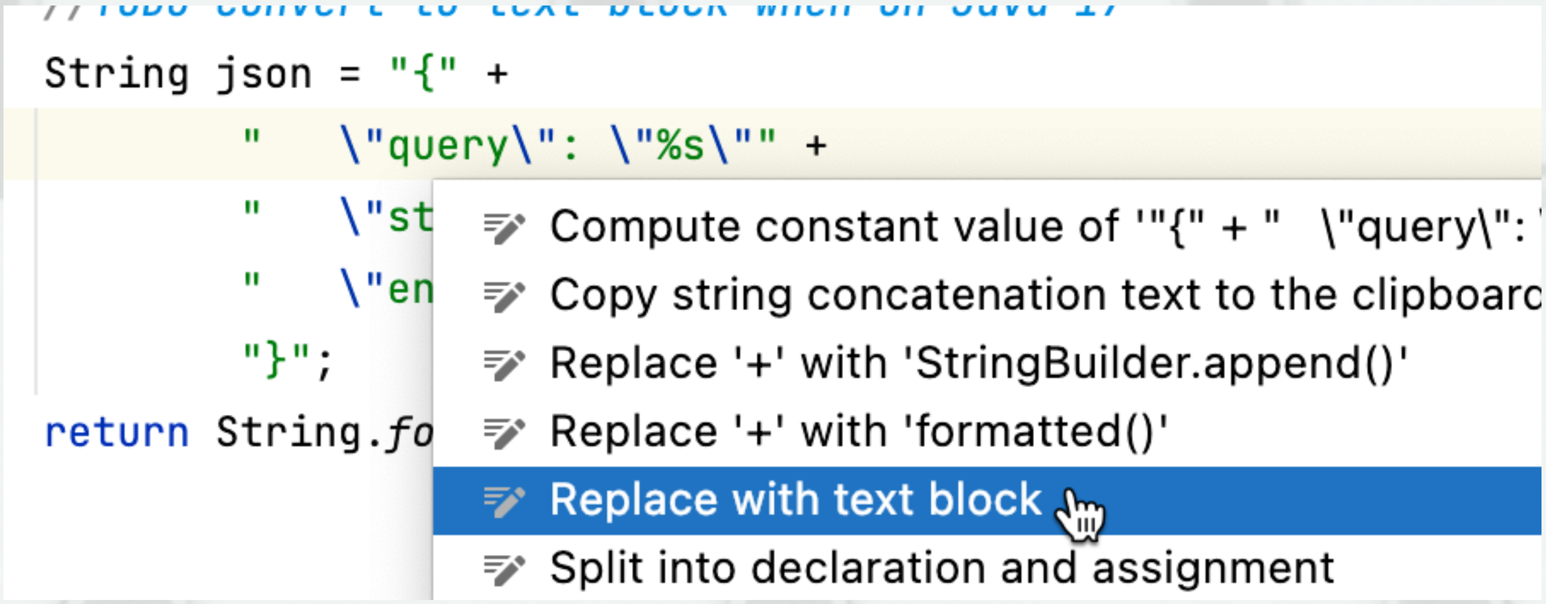
15

- Externalized data
- Expected values in JUnit

- Formats - CSV, GraphQL, JSON, SQL, Text, XML, YAML, etc

- Others?

# IDE Support



```
// TODO convert to text block when on Java 17
String json = "{" +
        "   \"query\": \"%s\"" +
        "   \"st
        "   \"en
        "}";
return String.fo
```

Compute constant value of '"{" + "   \"query\": '
Copy string concatenation text to the clipboarc
Replace '+' with 'StringBuilder.append()'
Replace '+' with 'formatted()'
Replace with text block
Split into declaration and assignment

```
String json = """
           {    "query": "%s"    "start": "1",    "end": "10"}""";
```

Literal refactoring - no \n

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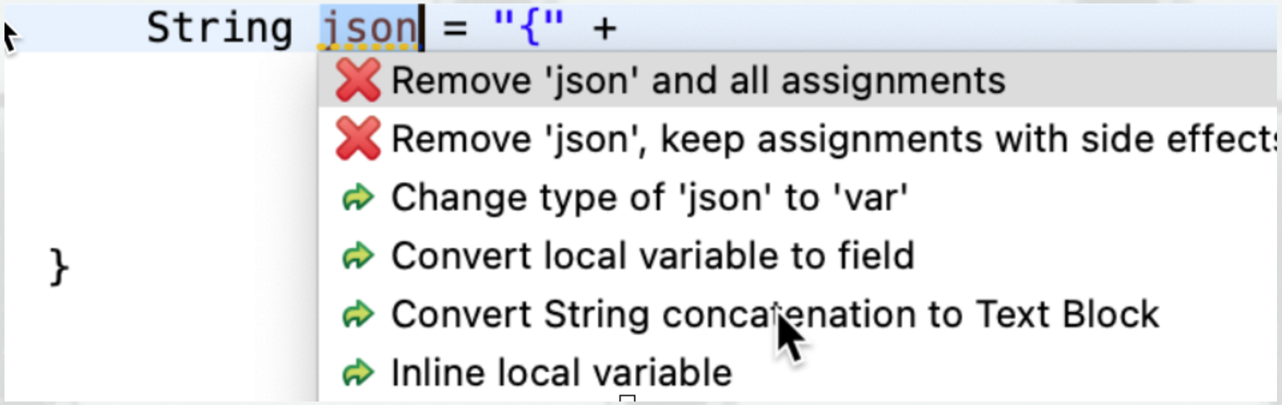
# IDE Support



```
String json = "{" +

}
```

- Remove 'json' and all assignments
- Remove 'json', keep assignments with side effects
- Change type of 'json' to 'var'
- Convert local variable to field
- Convert String concatenation to Text Block
- Inline local variable

```
String json = """
        {\
            "query": "%s"\
            "start": "1",\
            "end": "10"\
        }""";
```

Preserve lines but still no \n

# On older Java?

```
public String getJson(String search) {
    //TODO convert to text block when on Java 17
    String json = "{" +
            "    \"query\": \"%s\"" +
            "    \"start\": \"1\"," +
            "    \"end\": \"10\"" +
            "}";
    return String.format(json, search);
}
```

Hard to read but positions for future

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## Wed Lab Version

- Practice identifying valid/invalid text blocks
- Related String APIs
- Hands on practice

## Instanceof

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## Casting

```
if (num instanceof Integer) {
    Integer numAsInt = (Integer) num;
    System.out.println(numAsInt);
}
if (num instanceof Double) {
    Double numAsDouble = (Double) num;
    System.out.println(numAsDouble.intValue());
}
```

## Casting

16

```
if (num instanceof Integer numAsInt) {
    System.out.println(numAsInt);
}
if (num instanceof Double numAsDouble) {
    System.out.println(numAsDouble.intValue());
}
```

Pattern variable

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## Flow Scope

16

```
if (num instanceof Double d1
    && d1.intValue() % 2 == 0) {

    System.out.println(d1.intValue());
}

if (num instanceof Double d2
    || d2.intValue() % 2 == 0) {

    System.out.println(d2.intValue());
}
```

Compiles

Does not compile because d2 might not be double

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# Does this compile?

16

```
if (num instanceof Double n)
    System.out.println(n.intValue());

if (num instanceof Integer n)
    System.out.println(n);
```

Yes. Only in scope for if statement

# Does this compile?

```
if (num instanceof Double n)
    System.out.println(n.intValue());

System.out.println(n.intValue());
```

No. If statement is over

## Does this compile?

16

```
if (!(num instanceof Double n)) {
     return;
}
System.out.println(n.intValue());
```

Yes. Returns early so rest is like an else

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# Does this compile?

16

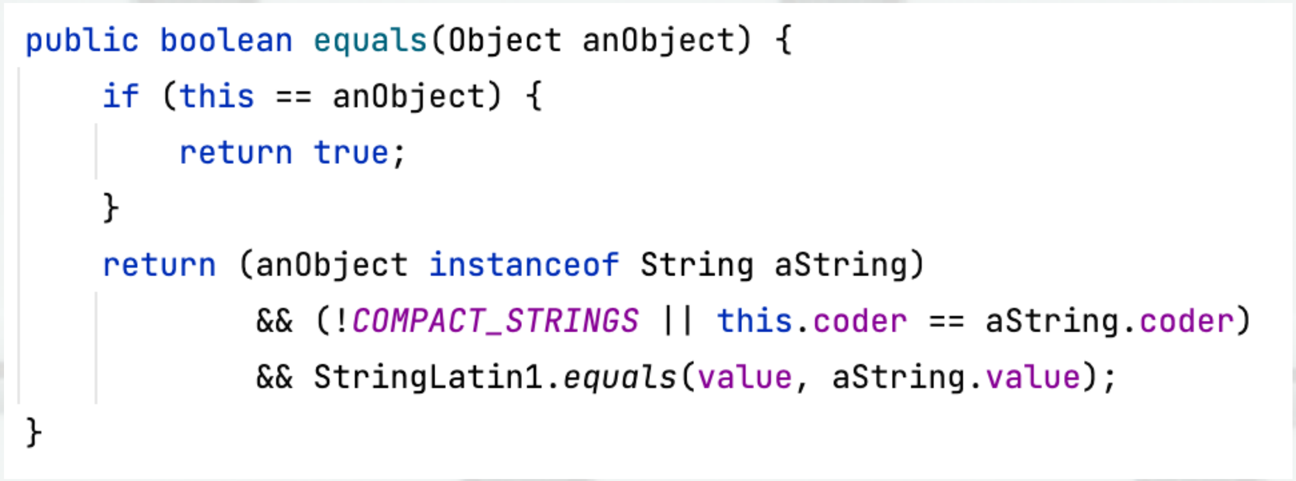
```
if (!(num instanceof Double n)) {
     return;
}
System.out.println(n.intValue());

if (num instanceof Double n)
     System.out.println(n.intValue());
```

No. n is still in scope

## Opportunities

16

- Library code
- Equals methods



```
public boolean equals(Object anObject) {
    if (this == anObject) {
        return true;
    }
    return (anObject instanceof String aString)
            && (!COMPACT_STRINGS || this.coder == aString.coder)
            && StringLatin1.equals(value, aString.value);
}
```

- Others?

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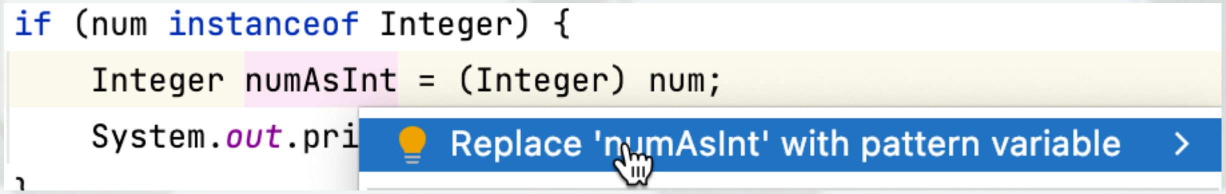
# IDE Support



```
if (num instanceof Integer) {
    Integer numAsInt = (Integer) num;
    System.out.pri
```

```
if (num instanceof Integer numAsInt) {
    System.out.println(numAsInt);
}
```

## On older Java?

```
//TODO convert to pattern var when on Java 17

if (num instanceof Double) {
    Double numAsDouble = (Double) num;
    System.out.println(numAsDouble.intValue());
}
```

Positions for future

## Wed Lab Version

- Explore edge cases
- Sealed classes
- Hands on practice

## Switch expressions

## Originally

```
public String getLocation(String store) {
    String result = "";
    switch (store) {
        case "Hallmark":
            result = "KC";
            break;
        case "Crayola":
            result = "PA";
            break;
        default:
            result = "anywhere";
    }
    return result;
}
```

You remembered the breaks, right?

## Switch Expressions

14

```
public String getLocation(String store) {
    return switch (store) {
        case "Hallmark" -> "KC";
        case "Crayola" -> "PA";
        default -> "anywhere";
    };
}
```

Arrow labels

No break keyword

## Missing value

14

```
enum Position { TOP, BOTTOM };


Position pos = Position.TOP;

int stmt = switch(pos) {
    case TOP: yield 1;
};

int expr = switch(pos) {
    case BOTTOM -> 0;
};
```

Does not compile because assigning value

(poly expression)

# Pattern matching for switch

19
preview

```
public int toInt(Object obj) {
    return switch (obj) {
        case Integer i -> i;
        case Double d -> d.intValue();
        case String s -> Integer.parseInt(s);

        default -> throw new
            IllegalArgumentException("unknown type");
    };
}
```

Reminder: Syntax can change

# But wait, there's more

19
preview

```
static void printOddOrEven(Object obj) {
    switch (obj) {

        case Integer i when i % 2 == 1 ->
           System.out.println("odd");

        case Integer i when i % 2 == 0 ->
           System.out.println("even");

        default -> System.out.println("not an int");
    };
}
```

Reminder: Feature can still change

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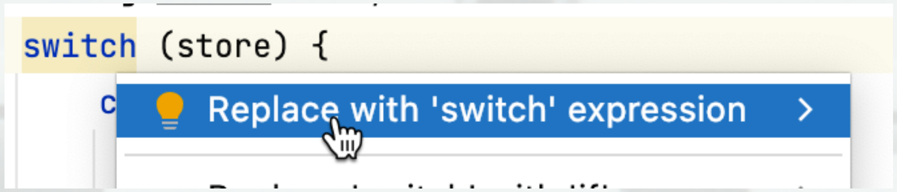
## Opportunities

17

- Many if/else chains!
- Switch statements with many breaks
- Sets the stage for advanced matching

- Others?

# IDE Support



```
switch (store) {
```

```
String result = switch (store) {
    case "Hallmark" -> "KC";
    case "Crayola" -> "PA";
    default -> "anywhere";
};
return result;
```

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## On older Java?

```
public String getLocation(String store) {
    //TODO convert to switch expression on Java 17
    String result = "";
    switch (store) {
        case "Hallmark":
            result = "KC";
            break;
        case "Crayola":
            result = "PA";
            break;
        default:
            result = "anywhere";
    }
    return result;
}
```

## Wed Lab Version

- Blocks and yield
- Switch with records
- More edge cases
- Hands on practice

## Records

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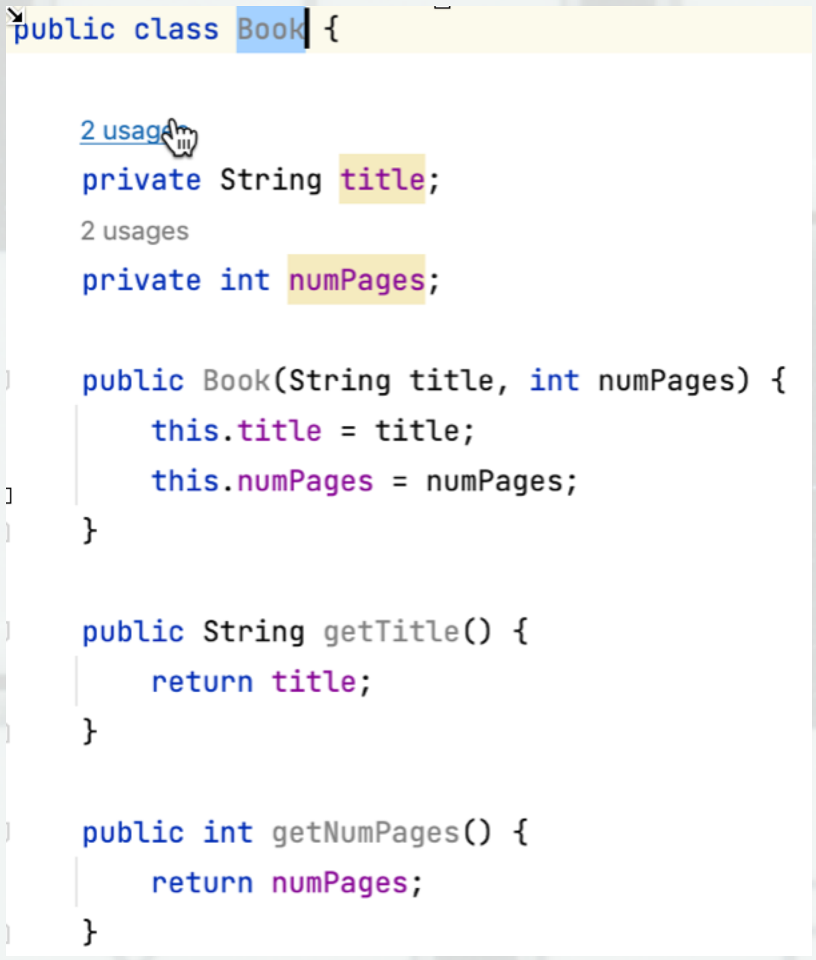
# Originally



```
public class Book {

    2 usages
    private String title;
    2 usages
    private int numPages;

    public Book(String title, int numPages) {
        this.title = title;
        this.numPages = numPages;
    }

    public String getTitle() {
        return title;
    }

    public int getNumPages() {
        return numPages;
    }
```

Ran out of room on screen!

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# Record

16

```
public record Book (String title, int numPages) {
}
```

New type

Automatically get
* final record
* private final instance variables
* public accessors
* constructor taking both fields
* equals
* hashCode

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## Using the Record

16

```
Book book = new Book("Breaking and entering", 289);

System.out.println(book.title());
System.out.println(book.toString());
```

← No “get”

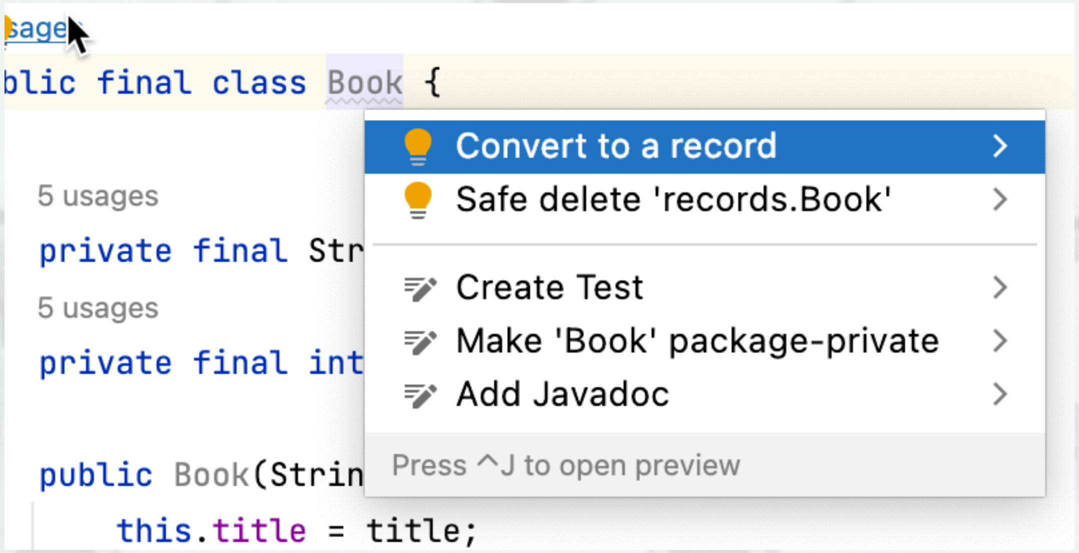
Outputs:
```
Breaking and entering
Book[title=Breaking and entering, numPages=289]
```

## Opportunities

17

- Immutable POJOs
- Don't have to write equals/ hashCode
- Vs reflection - EqualsBuilder
- Make code coverage tool happy
- Others?

# IDE Support



```
sages
blic final class Book {

  5 usages
  private final Str
  5 usages
  private final int

  public Book(Strin
      this.title = title;
```

```
public record Book(String title, int numPages) {
}
```

Had to make instance variables final. Also didn't remove my equals() even though generated by IntelliJ

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## On older Java?

```java
//TODO convert to record when on Java 17
public final class Book {
    private String title;
    private int numPages;

    public Book(String title, int numPages) {
        this.title = title;
        this.numPages = numPages;
    }
    public String title() {
        return title;
    }
    public int numPages() {
        return numPages;
    }
    // hash code, equals
```

Be sure to use al fields for equals/ hashCode

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## Wed Lab Version

- Compact constructors
- Custom methods
- More edge cases
- Hands on practice

## APIs

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## toList()

16

```java
public List<String> listLonger(
    Stream<String> stream) {

     return stream.collect(Collectors.toList());
}

public List<String> listShorter(
    Stream<String> stream) {

     return stream.toList();
}
```

# Teeing Collector

12

```
record Separations(String spaceSeparated,
   String commaSeparated) {}

var list = List.of("x", "y", "z");
Separations result = list.stream()
        .collect(Collectors.teeing(
              Collectors.joining(" "),
              Collectors.joining(","),
              (s, c) -> new Separations(s, c)));

System.out.println(result);
```

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## Formatting a String

12

```
String firstName = "Jeanne";
String lastName = "Boyarsky";
String str = String.format(
   "Hi %s %s!", firstName, lastName);
System.out.println(str);

System.out.println("Hi %s %s!".formatted(
    firstName, lastName));
```

Outputs:
Hi Jeanne Boyarsky!
Hi Jeanne Boyarsky!

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# Common Conversions

| Conversion | What it does |
|---|---|
| %s | Formattable as String |
| %d | Decimal integer (no dot) |
| %c | Char |
| %f | Float (decimal) |
| %n | New line |

Many more out of scope. Examples:

- %e - scientific notation
- %t - time
- %S - converts to all uppercase

# Conversion Examples

12

| Code | Output |
|---|---|
| `"%d%%".formatted(1.2)` | exception |
| `"%d%%".formatted(1)` | 1% |
| `"%s%%".formatted(1)` | 1% |
| `"%s%%".formatted(1.2)` | 1.2% |
| `“%f%%".formatted(1.2)` | 1.200000f |

# Formatting a Number

| Char | What it does |
|---|---|
| - | Left justified |
| + | Always include +/- |
| space | Leading space if positive |

| Char | What it does |
|---|---|
| 0 | Zero padded |
| , | Group numbers |
| ( | Negative # in parens |

## Flag Examples

| Code | Output |
|---|---|
| `"%,d".formatted(1234)` | 1,234 |
| `"%+d".formatted(1234)` | 1234 |
| `“% d".formatted(1234)` | 1234 |
| `“%,(d”.formatted(-1234)` | (1,234) |
| `“%,f”.formatted( 1.23456789)` | 1.234568 |

# Compact Number

12

```
NumberFormat defaultFormat =
NumberFormat.getCompactNumberInstance();
NumberFormat shortFormat = NumberFormat
    .getCompactNumberInstance(
         Locale.US, NumberFormat.Style.SHORT);
NumberFormat longFormat = NumberFormat
    .getCompactNumberInstance(
         Locale.US, NumberFormat.Style.LONG);

System.out.println(defaultFormat.format(1_000_000));
System.out.println(shortFormat.format(1_000_000));
System.out.println(longFormat.format(1_000_000));
```

```
1M
1M
1 million
```

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## New Files.mismatch()

12

```
Path kcdc = Path.of("files/kcdc.txt");
Path kc = Path.of("files/kc.txt");

System.out.println(Files.mismatch(kcdc, kc));
System.out.println(Files.mismatch(kcdc, kcdc));
```

11 (index of first character different)
-1 (same file contents regardless of whether exists)

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## Wed Lab Version

- Hands on practice

## Book Giveaway

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