17

JShell

Objectives

After completing this lesson, you should be able to:

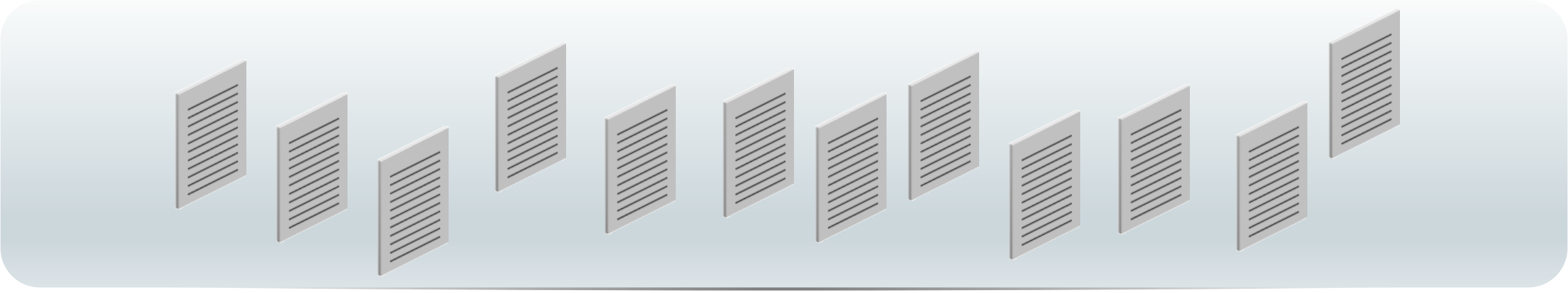
- Explain the REPL process and how it differs from writing code in an IDE
- Launch JShell
- Create JShell scratch variables and snippets
- Identify available JShell commands and other capabilities
- Identify how an IDE enhances the JShell user experience

Topics

- Testing code and APIs
- JShell Basics
- JShell in an IDE

A Million Test Classes and Main Methods

- Production code is dedicated to properly launching and running an application.
  - We'd complicate it by adding throwaway code.
  - It's a dangerous place for experimentation.
  - We'd alternatively clutter the IDE by creating little main methods or test projects.
- Creating a new main method or project sometimes feels like an unnecessary ceremony.
  - We're not necessarily interested in creating or duplicating a program.
  - We're interested in testing a few lines of code.



JShell Provides a Solution

- It's a command line interface.
- It avoids the ceremony of creating a new program and gets right into testing code.
- At any time you can:
  - Explore an API, language features, a class you wrote; do other experiments with logic, variables, or methods.
  - Prototype ideas and incrementally write more-complex code.
- You'll get instant feedback from the Read Evaluate Print Loop (REPL) process.

Topics

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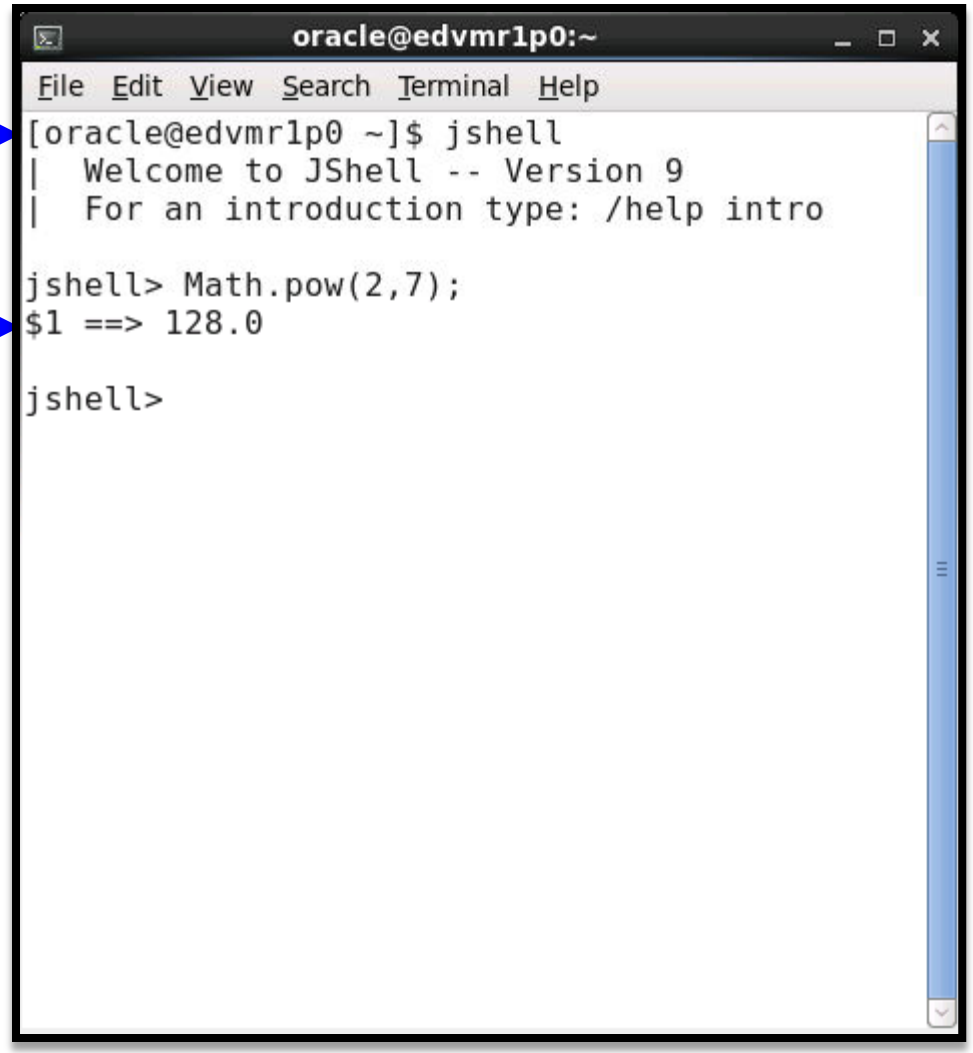
- JShell in an IDE

Comparing Normal Execution with REPL

- Normal Execution:
  - You enter all your code ahead of time.
  - Compile your code.
  - The program runs once in its entirety.
  - If after the first run you realize you've made a mistake, you need to run the entire program again.
- JShell's REPL:
  - You enter one line of code at a time.
  - You get feedback on that one line.
  - If the feedback proved useful, you can use that information to alter your next line of code accordingly.
- We'll look at simple examples to illustrate this.

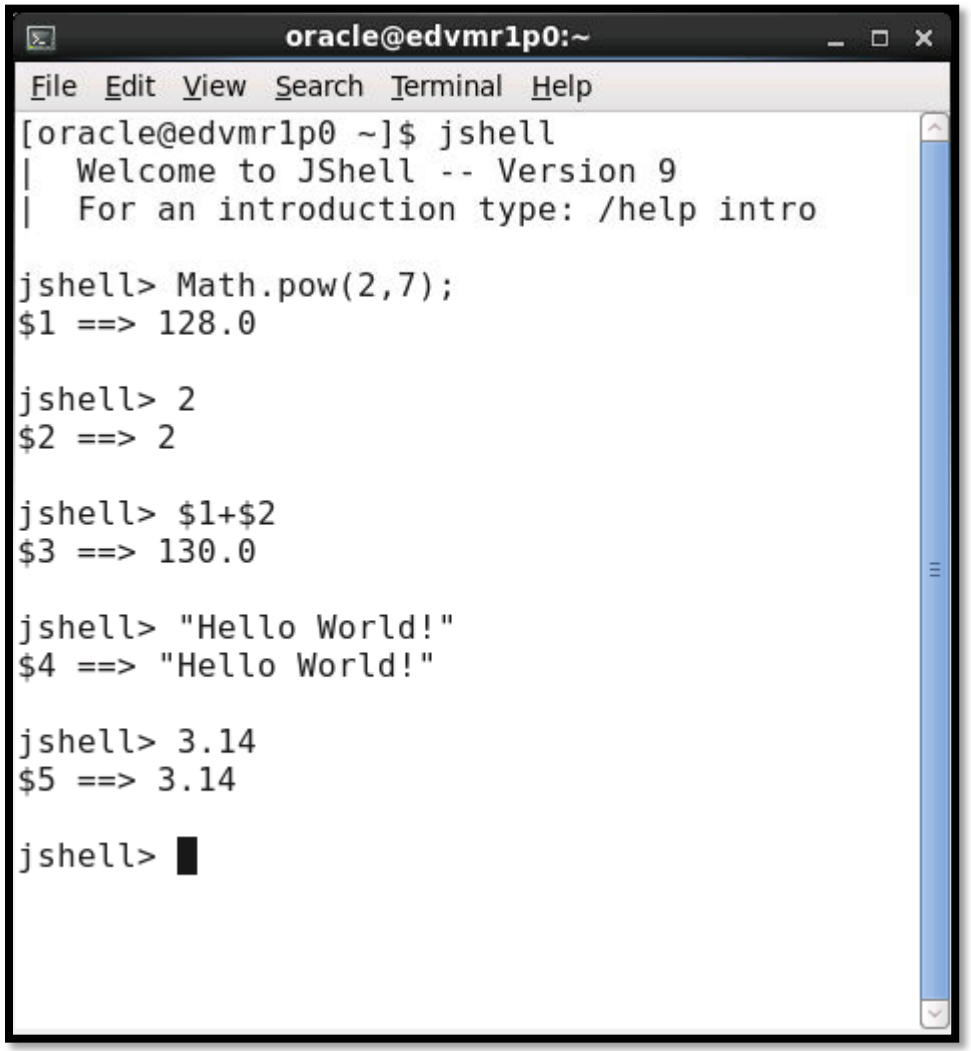
Getting Started with JShell and REPL

- To launch JShell:
  - Open a terminal.
  - Enter `jshell`.
- Start entering code, for example:
  - R. The expression `Math.pow(2,7)` is **read** into JShell.
  - E. The expression is **evaluated**.
  - P. Its value is **printed**.
  - L. The state of JShell **loops** back to where it began.
  - Repeat the process and enter more expressions.



Scratch Variables

- `Math.pow(2,7)` evaluates to 128.
- 128 is reported back as `$1`.
- `$1` is a JShell **scratch variable**.
- Like most other variables, a scratch variable can:
  - Store the result of a method call
  - Be referenced later
  - Have its value changes
  - Be primitives or Object types
- Names are auto generated.
- Great for testing unfamiliar methods or other short experiments.



Declaring Traditional Variables

- Too many scratch variables lead to confusion.
  - You may create an unlimited number of scratch variables.
  - Their names aren't descriptive.
  - It becomes hard to remember the purpose of each one.
- Traditional variables have names which provides context for their purpose.
- JShell allows you to declare, reference, and manipulate variables as you normally would.

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```
$1 ==> 128.0

jshell> 2
$2 ==> 2

jshell> $1+$2
$3 ==> 130.0

jshell> "Hello World!"
$4 ==> "Hello World!"

jshell> 3.14
$5 ==> 3.14

jshell> String name = "Duke";
name ==> "Duke"

jshell> int days;
days ==> 0

jshell> days = 365;
days ==> 365

jshell>
```

Code Snippets

The term **snippet** refers to the code you enter in a single JShell loop.

- Declarations
  - `String s = "hello"`
  - `int twice(int x) {return x+x;}`
  - `class Pair<T> {T a, b; Pair(…`
  - `interface Reusable {}`
  - `import java.nio.file.*`
- Expressions
  - `Math.pow(2,7)`
  - `twice(12)`
  - `new Pair<>("red","blue")`
  - `transactions.stream()`
    `.filter(t->t.getType() ==trans.PIN)`
    `.map(trans::getID)`
    `.collect(toList())`
- Statements
  - `while(mat.find()){…`
  - `if(x < 0){…`
  - `switch(val){`
    `case FMT:`
    `format();`
    `break;…`
- Not Allowed
  - `package foo;`
  - Top-level access modifiers
    - `static final`
  - Top-level statements of:
    - `break continue return`

Completing a Code Snippet

- Some snippets are best written across many lines.
  - Methods
  - Classes
  - `for` loop statements

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jshell> for(int i=0; i<5; i++){
   ...>
```

- JShell waits for the snippet to be complete.
  - It detects the final closing curly brace.
  - Then it performs any evaluation.

```
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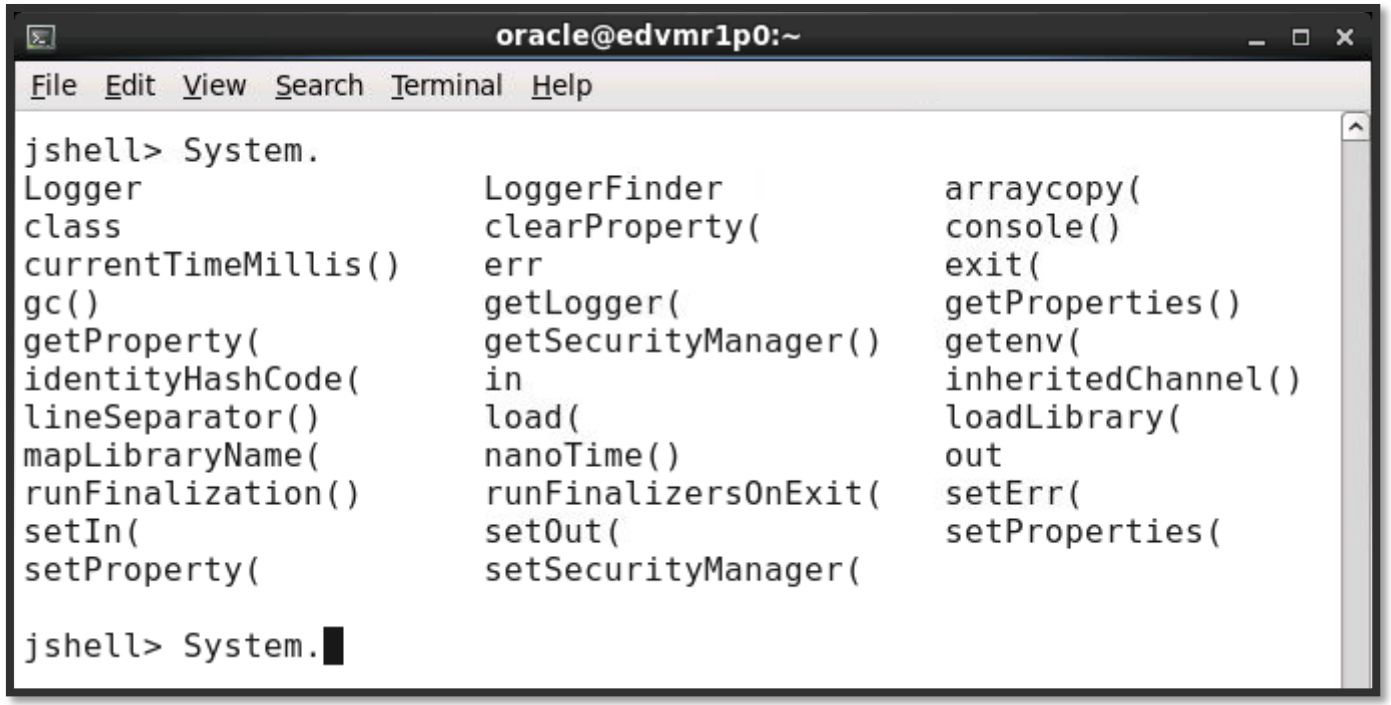
jshell> for(int i=0; i<5; i++){
   ...> System.out.print(i +" ");
   ...> }
0 1 2 3 4
jshell>
```

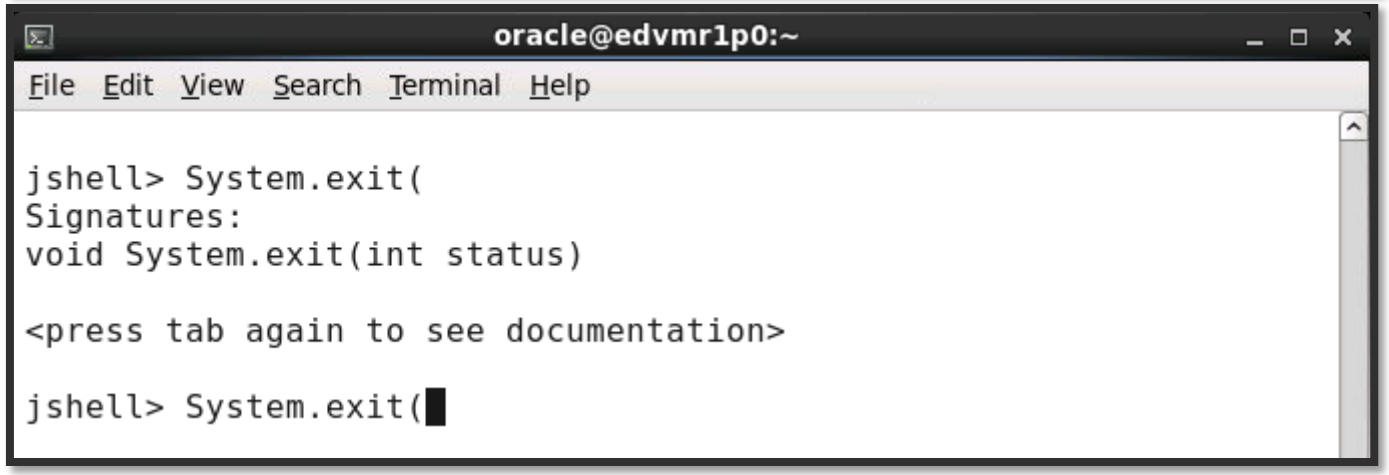
Tab Completion and Tab Tips

Confused about your options?

- After the dot operator, press tab to see a list of available fields, variables, or classes.



- Press tab as you call a method to view possible signatures.
- Press tab again to see documentation.



Semicolons

```
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jshell> Math.pow(2,7);
$1 ==> 128.0

jshell> Math.pow(2,7)
$2 ==> 128.0

jshell> for(int i=0; i<5; i++){
   ...> System.out.print(i +" ");
   ...> }
0 1 2 3 4
jshell> for(int i=0; i<5; i++){
   ...> System.out.print(i +" ")
   ...> }
|  Error:
|  ';' expected
|  System.out.print(i +" ")
|                          ^

jshell>
```

The semicolon which ends a snippet is optional.

All other semicolons are mandatory.

JShell Commands

- Commands allow you to do many things. For example:
  - Get snippet information.
  - Edit a snippet.
  - Affect the JShell session.
  - Show history.
- They're distinguished by a leading slash `/`
- Enter the `/help` command to reveal a list of all commands.

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File Edit View Search Terminal Help

```
jshell> /help
|  Type a Java language expression, statement, or declaration.
|  Or type one of the following commands:
|  /list [<name or id>|-all|-start]
|       list the source you have typed
|  /edit <name or id>
|       edit a source entry referenced by name or id
|  /drop <name or id>
|       delete a source entry referenced by name or id
|  /save [-all|-history|-start] <file>
|       Save snippet source to a file.
|  /open <file>
|       open a file as source input
|  /vars [<name or id>|-all|-start]
|       list the declared variables and their values
|  /methods [<name or id>|-all|-start]
|       list the declared methods and their signatures
|  /types [<name or id>|-all|-start]
|       list the declared types
|  /imports
|       list the imported items
|  /exit
|       exit jshell
|  /env [-class-path <path>] [-module-path <path>] [-add-modules <modules>] ...
```

You'll explore commands throughout the practices.

Importing Packages

- Several packages are imported into JShell by default.
  - Type `/imports` to reveal the list.
- To test other APIs:
  - Write an import statement for the relevant packages.
  - Ensure the classpath is set appropriately.
    - JShell reports the classpath when it launches.
    - Use the `/classpath` command to set it manually.

Quiz 17-1

Do you need to make an import statement before creating an `ArrayList` in JShell?

a. Yes

b. No

Topics

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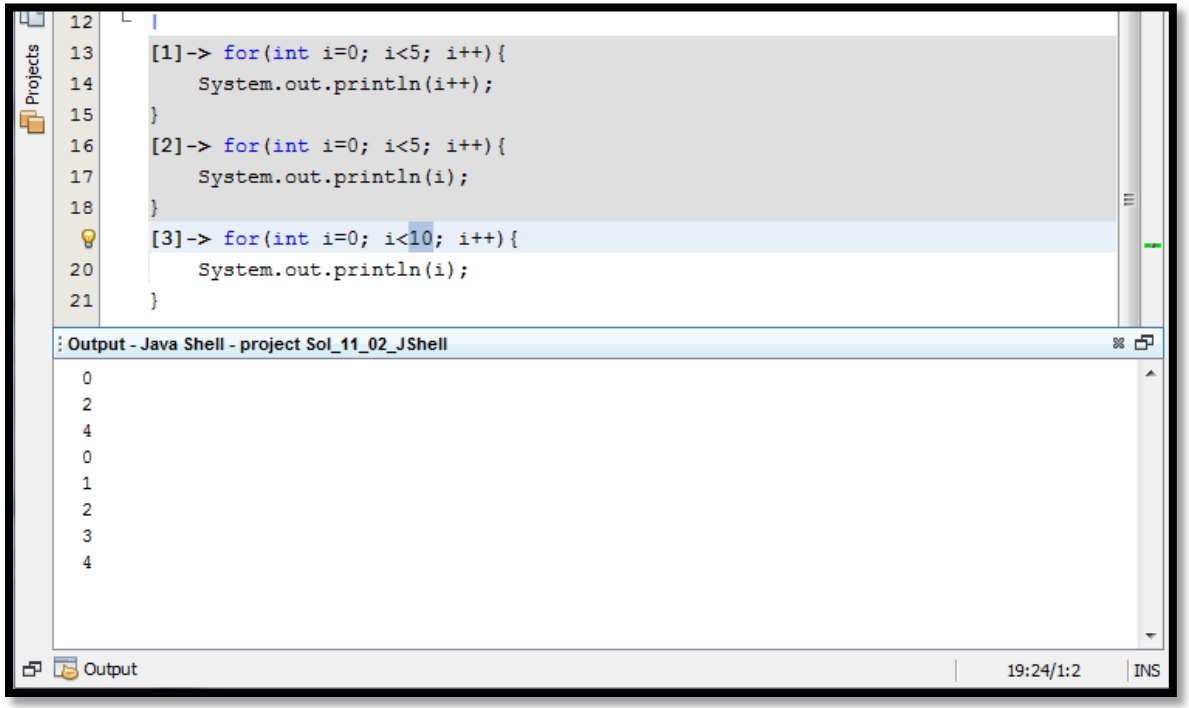
Why Incorporate JShell in an IDE?

- IDEs perform a lot of work on behalf of developers.
- IDEs are designed to help developers with complex projects.
  - Precision code editing
  - Shortcuts (for example, `sout` +**Tab** for `System.out.println()`)
  - Auto-complete
  - Tips for fixing broken code
  - Java documentation integration
  - Matching curly braces
- Combine the benefits of two tools.
  - Quick feedback from JShell's REPL
  - Robust assistance from an IDE

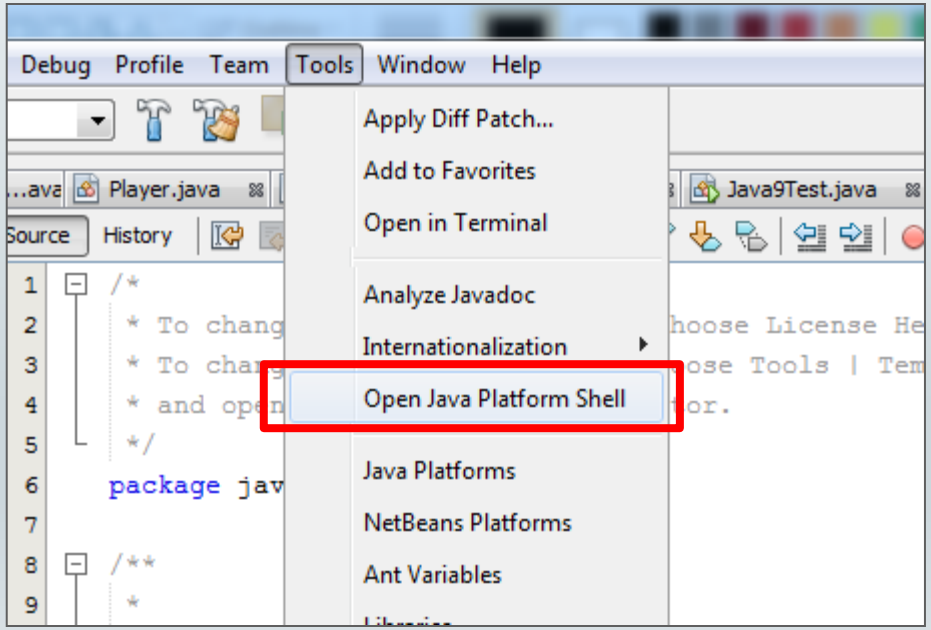


Use Cases

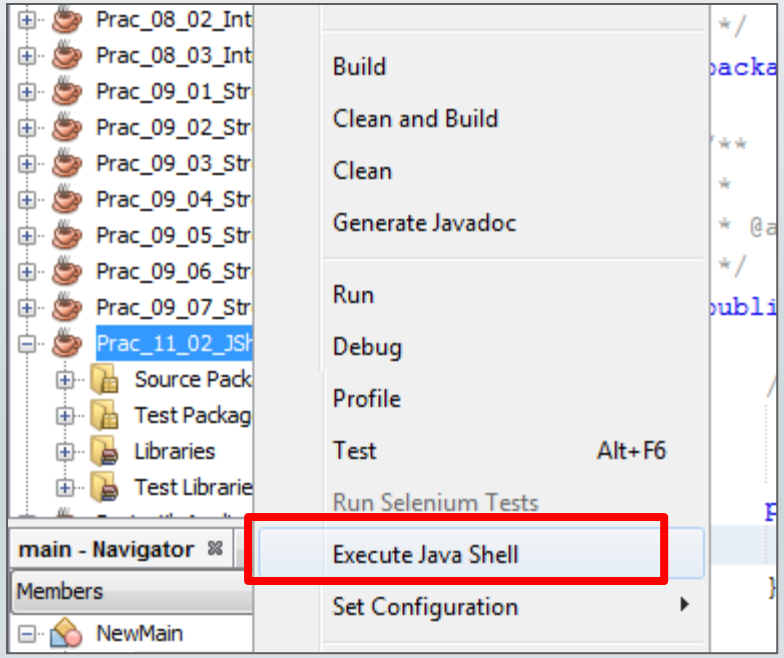
- Experiment with unfamiliar code:
  - A class your colleague wrote
  - A Java API
  - A third party library or module
- Bypass and preserve the existing program.
  - Run quick tests without breaking existing code.
  - Simulate a scenario.
- Test ideas on how to build out your program.
  - Start with simple tests.
  - Gradually build up complexity.
  - Eventually integrate a workable solution with the rest of your program.

Two Ways to Open JShell in NetBeans

1. Open a general JShell session.
   - Select **Tools**.
   - **Open Java Platform Shell**.



2. Open JShell on a specific project.
   - Right-click your project.
   - Select **Execute Java Shell**.
   - Make any necessary imports.



Summary

In this lesson, you should have learned how to:

- Explain the REPL process and how it differs from writing code in an IDE
- Launch JShell
- Create JShell scratch variables and snippets
- Identify available JShell commands and other capabilities
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Practices

- 17-1: Variables in JShell
- 17-2: Methods in JShell
- 17-3: Forward-Referencing