Computational Expression
Variables, Primitive Data Types, Expressions

Janyl Jumadinova

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Variables

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- **Variable Declaration** allows the compiler to reserve space in the main memory that is large enough for the specified type.

```java
int count;
```

```java
int count = 0;
```
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- **Variable Assignment** assigns a value to the variable
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  count = 0;
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- **Must give a value to the variable before using it in the main method.**
Java Identifiers

- reserved keywords (class, public, static, void)
- Java classes, methods, variables: words we chose or make up when writing a program
  System, println, main, args
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Identifier

a letter followed by zero or more letters (including $ and _) and digits
Identifiers

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- Ex: Average, count, num1, $test, this_is_fine
Identifiers

- Identifiers must start with a letter, a currency character ($), or a connecting character such as the underscore (_).

Identifiers cannot start with a number.

After the first character, identifiers can contain any combination of letters, currency characters, connecting characters, or numbers.

There is no limit to the number of characters an identifier can contain.

You can’t use a Java keyword as an identifier.

Identifiers in Java are case-sensitive; foo and FOO are two different identifiers.
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# Java keywords

<table>
<thead>
<tr>
<th>abstract</th>
<th>boolean</th>
<th>break</th>
<th>byte</th>
<th>case</th>
<th>catch</th>
</tr>
</thead>
<tbody>
<tr>
<td>char</td>
<td>class</td>
<td>const</td>
<td>continue</td>
<td>default</td>
<td>do</td>
</tr>
<tr>
<td>double</td>
<td>else</td>
<td>extends</td>
<td>final</td>
<td>finally</td>
<td>float</td>
</tr>
<tr>
<td>for</td>
<td>goto</td>
<td>if</td>
<td>implements</td>
<td>import</td>
<td>instanceof</td>
</tr>
<tr>
<td>int</td>
<td>interface</td>
<td>long</td>
<td>native</td>
<td>new</td>
<td>package</td>
</tr>
<tr>
<td>private</td>
<td>protected</td>
<td>public</td>
<td>return</td>
<td>short</td>
<td>static</td>
</tr>
<tr>
<td>strictfp</td>
<td>super</td>
<td>switch</td>
<td>synchronized</td>
<td>this</td>
<td>throw</td>
</tr>
<tr>
<td>throws</td>
<td>transient</td>
<td>try</td>
<td>void</td>
<td>volatile</td>
<td>while</td>
</tr>
<tr>
<td>assert</td>
<td>enum</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Literal

A constant value in Java is created by using a literal representation of it.

- 100 (integer literal)
- 98.6 (float literal)
- 'X' (character literal)
- "This is a test" (String literal)
Constants

- Constants hold the same value during their existence.
- Can use a keyword `final` before the type and name of the variable:
  - always contains the same value.
- `final int MAX_BUDGET = 1000`
Data Types

- Data stored in memory is a string of bits (0 or 1)
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- Data stored in memory is a string of bits (0 or 1)
- How the computer interprets the string of bits depends on the context.
- In Java, we must make the context explicit by specifying the type of the data.
Data Types

- Java has two categories of data: **primitive data** (e.g., number, character) and **object data** (programmer created types).
- There are 8 primitive data types: `byte`, `short`, `int`, `long`, `float`, `double`, `char`, `boolean`.
- Primitive data are only single values; they have no special capabilities.
Primitive Data Types

- integers: byte, short, int, long
- floating point: float, double
- characters: char
- booleans: boolean
## Common Primitive Data Types

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>Example of Literals</th>
</tr>
</thead>
<tbody>
<tr>
<td>int</td>
<td>integers (whole numbers)</td>
<td>42, 60634, -8</td>
</tr>
<tr>
<td>double</td>
<td>real numbers</td>
<td>0.039, -10.2</td>
</tr>
<tr>
<td>char</td>
<td>single characters</td>
<td>'a', 'B', '&amp;', '6'</td>
</tr>
<tr>
<td>boolean</td>
<td>logical values</td>
<td>true, false</td>
</tr>
</tbody>
</table>
## Range of Values

<table>
<thead>
<tr>
<th>Type</th>
<th>Storage</th>
<th>Range of Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>int</td>
<td>32 bits</td>
<td>-2,147,483,648 to 2,147,483,647 ±10^{-45} to ±10^{38}</td>
</tr>
<tr>
<td>double</td>
<td>64 bits</td>
<td></td>
</tr>
<tr>
<td>char</td>
<td>16 bits = 2 bytes</td>
<td>0 to 2^{16} or \u0000 to \uFFFF</td>
</tr>
<tr>
<td>boolean</td>
<td>1 bit</td>
<td>NA</td>
</tr>
</tbody>
</table>
Expression

Expression is a combination of one or more operators (+, −, %, ...) and operands (literals, constants, variables,...)
Order of Precedence

- Operators are evaluated in an expression according to the rules of precedence.
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- Operators within ( ) are evaluated first.
- *, /, % evaluated next (L to R).
- +, - evaluated last (L to R).