Lecture (02)
Variables

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Agenda

- Introduction
- Integers
- The Double variable
- Short and Float
- Simple arithmetic
- Operator Precedence

Introduction

- Programs work by manipulating data placed in memory. The data can be numbers, text, objects, pointers to other memory areas, and more besides.
- The data is given a name, so that it can be re-called whenever it is need.
- The name, and its value, is known as a Variable.

Integers

- So to tell Java that you want to store a whole number, you first type the word **int,** followed by a space (32 bits).
- You then need to come up with a name for your integer variable.
- So to set up a whole number (integer),

int first_number;

1. Variable names can't start with a number.
   - So first_number is OK, but not 1st_number.
   - You can have numbers elsewhere in the variable name, just not at the start.
2. Variable names can't be the same as Java keywords.
3. There are quite a lot of these, and they will turn blue in NetBeans, like **int** above**.**
4. You can't have spaces in your variable names.

- The variable declaration

int first number

will get you an error.

- **We've used the underscore character,** but it's common practise to have the first word start with a lowercase letter and the second or subsequent words in uppercase:

firstNumber,

myFirstNumber

5. Variable names are case sensitive.
   - So firstNumber and FirstNumber are different variable names.

- To store something in the variable called first_number, you type an equals sign and then the value you want to store

int first_number;

first_number = 10;

- If you prefer, you can do all this on one line

int first_number = 10;

- To print the integer value saved in a certain variable use concatenation sign, type variable name inside println statement, or use concatenation sign to print value after a string.

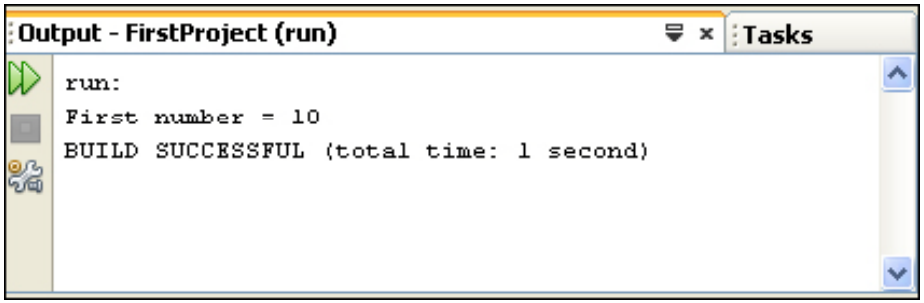
System.out.println(first_number);

System.out.println("First number = " + first_number);

FirstProject02 example;

```
package firstproject;

public class FirstProject {

  public static void main(String[] args) {

      int first_number;
      first_number = 10;

      System.out.println("First number = " + first_number );

    }

}
```

- Run your program and you should see the following in the Output window at the bottom:



- Let's try some simple addition. Add two more int variables to your code, one to store a second number, and one to store an answer:

int first_number, second_number, answer;

- Notice how we have three variable names on the same line.
- You can do this in Java, if the variables are of the same type (the **int type, for us).**
- Each variable name is then separated by a comma.
- We can then store something in the new variables:

first_number = 10;

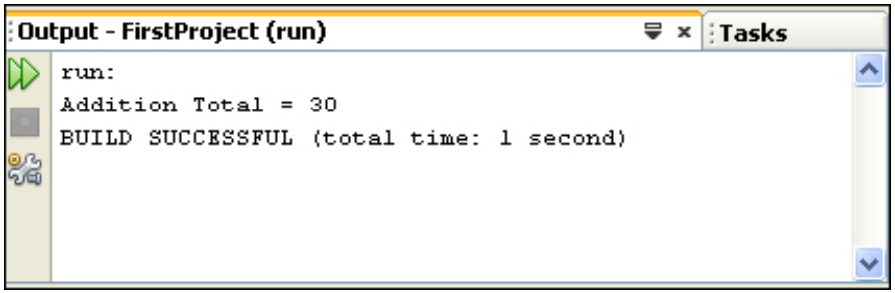
second_number = 20;

answer = first_number + second_number;

FirstProject03 example:

```
public static void main(String[] args) {

    int first_number, second_number, answer;

    first_number = 10;
    second_number = 20;
    answer = first_number + second_number;

    System.out.println("Addition Total = " + answer );
}
```

- When you run your program you should get the following in the output window:



- You can also use numbers directly.
- Change the **answer line to this:**

  answer = first_number + second_number + 12;
- Create FirstProject04 example, to find the answer.
- You can store quite large numbers in the **int variable type.** **The maximum value is** 2147483647 (32 bits).

  (0111 1111 1111 1111 1111 1111 1111 1111)
- If you want a minus number the lowest value you can have is

  -2147483648

  (1000 0000 0000 0000 0000 0000 0000 0000)

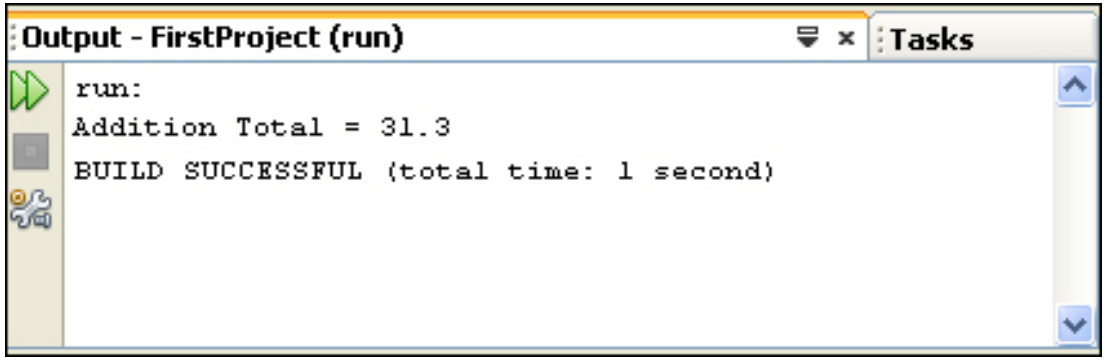
The Double variable

- The double variable (64 Bits) is used to hold floating point values.
- A floating point value is one like 8.7, 12.5, 10.1. In other words, it has a “point something” at the end.
- If you try to store a floating point value in an **int variable, NetBeans will** underline the faulty code.
- If you try to run the program, the compiler will throw up an error message.

FirstProject05

```
public static void main(String[] args) {

    double first_number, second_number, answer;

    first_number = 10.5;
    second_number = 20.8;
    answer = first_number + second_number;

    System.out.println("Addition Total = " + answer );
}
```

Run your program again. The output window should look like this:



Short and Float

- Short (16BITS) is used to store smaller number, and its range is between - 32,768 (1000 0000 0000 0000)

  and +32,767 (0111 1111 1111 1111).
- Instead of using double, float can be used (32 bits).
- When storing a value in a float variable, you need the letter “f” at the end. Like this:

```
float first_number, second_number, answer;
first_number = 10.5f;
second_number = 20.8f;
```

Simple arithmetic

- With the variables you've been using, you can use the following symbols to do
- calculations:
- + (the plus sign)
- - (the minus sign)
- * (the multiplication sign is the asterisk)
- / (the divide sign is the forward slash)

- FirstProject06

```
public static void main(String[] args) {

    float first_number, second_number, answer;

    first_number = 10.5f;
    second_number = 20.8f;
    answer = first_number / second_number;

    System.out.println("Total = " + answer );
}
```

- When you run the above code, the answer is now 0.5048077.

Operator Precedence

- You can, of course, calculate using more than two numbers. But you need to take care of what exactly is being calculated. Take the following as an example:

first_number = 100;

second_number = 75;

third_number = 25;

answer = first_number – second_number + third_number;

- If you did the calculation left to right it would be 100 – 75, which is 25. Then add the third number, which is 25. The total would be 50. However, what if you didn't mean that?

- What if you wanted to add the second and third numbers together, and then deduct the total from the first number? So 75 + 25, which is 100. Then deduct that from the first number, which is 100. The total would now be 0.
- To ensure that Java is doing what you want, you can use round brackets. So the first calculation would be:

answer = (first_number – second_number) + third_number;

- FirstProject08

```
public static void main(String[] args) {

    int first_number, second_number, third_number, answer;

    first_number = 100;
    second_number = 75;
    third_number = 25;
    answer = (first_number - second_number) + third_number;

    System.out.println("Total = " + answer );
}
```

- Answer = 50

- FirstProject09

```
public static void main(String[] args) {

    int first_number, second_number, third_number, answer;

    first_number = 100;
    second_number = 75;
    third_number = 25;
    answer = first_number - (second_number + third_number);

    System.out.println("Total = " + answer );
}
```

- Answer = 0

FirstProject10

- Change your math symbols (called Operators) to plus and multiply:

  answer = first_number + second_number * third_number;

- With no brackets, you'd think Java would calculate from left to right.
- So you'd think it would add the first number to the second number to get 175.
- Then you'd think it would multiply by the third number, which is 25.
- So the answer would be 4375. Run the program, though. The answer that you actually get is 1975! So what's going on?

- The reason Java got the “wrong” answer was because of Operator Precedence
- Java treats some mathematical symbols as more important than others.
- It sees multiplication as having a priority over addition, so it does this first.
- It then does the addition. So Java is doing this:

FirstProject11

answer = first_number + (second_number * third_number);

- With the round brackets in place, you can see that second number is being multiplied by third number.
- The total is then added to the first number. So 75 multiplied by 25 is 1875. Add 100 and you get 1975.

FirstProject12

- If you want it the other way round, don't forget to "tell" Java by using round brackets:

answer = (first_number + second_number) * third_number;

- Division is similar to multiplication: Java does the dividing first, then the addition or subtraction. Change your answer line to the following:

FirstProject13

- **answer = first_number + second_number / third_number;**
- The answer you get is 103. Now add some round brackets:

FirstProject14

- **answer = (first_number + second_number) / third_number;**
- The answer this time will be 7.
- So without the round brackets, Java does the dividing first, and then adds 100 to the total – it doesn't work from left to right.

- Here’s a list on Operator Precedence
  - Multiply and Divide – Treated equally, but have priority over Additionand Subtraction
  - Add and Subtract – Treated equally but have a lower priority thanmultiplication and division
- So if you think Java is giving you the wrong answer, remember that Operator Precedence is important, and add some round brackets.

Thanks,

See you next Lecture, isA