

Overview

We will review the following statements in this lab:

- Scanner
- Variables (access types)
- System.out.print/println
- Conditional statements (if, else, else if)
- Arrays
- Loops

Getting Started

After starting Eclipse, create a new project called Lab 21_3. Import `Error.java` from the assignment page.

Examine at the code given in `Error.java`. It will run as is, so go ahead and run it. You should see the following output:

```
We sell 10 kinds of Cheese
Dalaran Sharp: $1.25 per pound
Stormwind Brie: $10.0 per pound
Alterac Swiss: $40.0 per pound
Cheese Type D: $9.15 per pound
Cheese Type E: $2.5 per pound
Cheese Type F: $8.74 per pound
Cheese Type G: $9.88 per pound
Cheese Type H: $2.91 per pound
Cheese Type I: $6.66 per pound
Cheese Type J: $0.36 per pound
```

Let us analyze the code to figure out how it is working. To begin with, we see a new kind of declaration for a variable:

```
final int MAXCHEESE = 10;
```

Final (**final**) is an access modifier that prevents the variable's value from changing after its initialization. Such an initialized variable, called a **constant variable**, is typically used when we want a value that cannot be accidentally overwritten in the rest of the program. Thus, the value of a constant variable is set only once [cf. Section 2.6].

Next we declare 3 arrays:

```
String[] names = new String[MAXCHEESE];
double[] prices = new double[MAXCHEESE];
int[] amounts = new int[MAXCHEESE];
```

Next, we set values corresponding to Dalaran Sharp cheese (from Lab 02) as the first entry in the **names** and **prices** arrays:

```
names[0] = "Dalaran Sharp";
prices[0] = 1.25; ...
```

The code repeats for the other two special cheeses. Note the meaningful variable names that self-describe their purpose [cf. Section 2.3]. The program then prints out how many types of cheese are currently being sold, and a list of names and prices:

```
System.out.println("We sell " + MAXCHEESE + " kinds of Cheese");
```

```

System.out.println(names[0] + ": $" + prices[0] + " per pound");
System.out.println(names[1] + ": $" + prices[1] + " per pound");
System.out.println(names[2] + ": $" + prices[2] + " per pound");

```

The code so far handles the first three cheeses. But this time, we want to sell up to **MAXCHEESE (=10)** cheeses. We assume the remaining cheeses besides the first three are generic cheeses whose names and prices aren't too important. We first need to come up with a way to set the prices of these generic cheeses. Instead of having predetermined prices, we decide to set them randomly at the beginning. To do this we use a random number generator object [cf. Section 2.14] that will help us (like a Scanner) generate the prices. And to ensure that the Random object generates the same random sequence of integers each time the program is run (so that our randomly chosen prices stay the same), we specify a seed -- the input to the equation that generates the random values -- of 100. This is done as follows:

```
Random ranGen = new Random(100);
```

We can now output information about the rest of the cheeses with the following for-loop.

```

for (int i = 3; i < MAXCHEESE; i++) {
    names[i] = "Cheese Type " + (char)('A' + i);
    prices[i] = ranGen.nextInt(1000)/100.0;
    amounts[i] = 0;
    System.out.println(names[i] + ": $" + prices[i] + " per pound");
}

```

In the code above, the name for a generic cheese is created from a typecast [cf. Section 2.8] of an integer to a character with the `(char)(...)` command. The typecast takes the expression `('A' + i)`, which first adds `i` to the **value** of character `A` (65) [cf. Section 2.10] due to an implicit type conversion of `char` to `int`. So, `A + 3` (notice, `i`'s initial value is 3) results in 68, which is cast to a `char` to get the character `D`. Hence, you see the **Cheese Type D** in the console output. We then set the price by first calling `ranGen.nextInt(1000)` that generates an integer between 0 and 999, then dividing the random number by 100.0 to get a floating-point number between 0 and 9.99 that is set as the price. The next statement initializes the order amounts to 0. And finally, the print statement outputs the name and price of each of the generic cheeses.

Now CHANGE the line `final int MAXCHEESE = 10;` to `final int MAXCHEESE = 0;`. You should see the following error:

```

Exception in thread "main" java.lang.ArrayIndexOutOfBoundsException: 0
    at Lab21_3_Error.main(Error.java:14)

```

The error is in line 14 of the file. It is of the error type "out of bounds" when indexing the array. You can click on the line 14 link and Eclipse will highlight the error for you. If not, the following line causes the error:

```
names[0] = "Dalaran Sharp";
```

The reason is that when **MAXCHEESE** is 0, the arrays are of size 0, and access in line 14 to the first entry of the array at index 0 fails. So, think about the **CONDITION** that has to be true **BEFORE** we should access the array, and do the following exercise.

Part 1: Fix Error.java

Fix the code so the program will run correctly for **MAXCHEESE** values of 0 to 20 (inclusive). Note that the value of **MAXCHEESE** is set by changing the value in the code itself. If you are not sure of how it should work then look at the **Sample Output** of the next part. This part handles the beginning where it lists all the cheese types available and their prices. Note: it is a very simple fix that needs to be added to all the statements that have an array access.

Part 2: Create GenCheeseShop.java

The machine should dispense ANY types of cheese, in one-pound packages. Your program will STILL do the following:

- A. List all the cheese types available and the prices
- B. Asks the user how many pounds of each type of cheese to purchase
- C. Calculate Sub Total (price*amount of each cheese added together)
- D. Discount of Sub Total -
 - o A \$10 discount if their purchase is \$50 or over
 - o An additional \$15 discount (\$25 total) if \$100 or over
- E. Ask the user if they would like to see a list of what they purchased
 - o If yes, a list comes up showing how much of each type of cheese they bought and the cost of each cheese
 - o Display only the cheese they actually bought
 - o If no, then no itemized information is displayed
- F. Display Sub Total, Discount and Total Price

Sample Output:

```
We sell 0 kinds of Cheese
```

```
Sub Total: $0.0
-Discout: $0.0
Total    : $0.0
```

```
-----
We sell 1 kinds of Cheese
```

```
Dalaran Sharp: $1.25 per pound
Enter the amount of Dalaran Sharp : 1
Display the itemized list? (1 for yes) 1
1 lbs of Dalaran Sharp @ 1.25 = $1.25
```

```
Sub Total: $1.25
-Discout: $0.0
Total    : $1.25
```

```
-----
We sell 2 kinds of Cheese
```

```
Dalaran Sharp: $1.25 per pound
Stormwind Brie: $10.0 per pound
Enter the amount of Dalaran Sharp : 1
Enter the amount of Stormwind Brie : 1
Display the itemized list? (1 for yes) 1
1 lbs of Dalaran Sharp @ 1.25 = $1.25
1 lbs of Stormwind Brie @ 10.0 = $10.0
```

```
Sub Total: $11.25
-Discout: $0.0
Total    : $11.25
```

```
-----
We sell 3 kinds of Cheese
```

```
Dalaran Sharp: $1.25 per pound
Stormwind Brie: $10.0 per pound
Alterac Swiss: $40.0 per pound
Enter the amount of Dalaran Sharp : 1
Enter the amount of Stormwind Brie : 1
Enter the amount of Alterac Swiss : 1
Display the itemized list? (1 for yes) 1
1 lbs of Dalaran Sharp @ 1.25 = $1.25
1 lbs of Stormwind Brie @ 10.0 = $10.0
1 lbs of Alterac Swiss @ 40.0 = $40.0
```

Sub Total: \$51.25
-Discount: \$10.0
Total : \$41.25

We sell 4 kinds of Cheese
Dalaran Sharp: \$1.25 per pound
Stormwind Brie: \$10.0 per pound
Alterac Swiss: \$40.0 per pound
Cheese Type D: \$9.15 per pound
Enter the amount of Dalaran Sharp : 1
Enter the amount of Stormwind Brie : 1
Enter the amount of Alterac Swiss : 1
Enter the amount of Cheese Type D : 1
Display the itemized list? (1 for yes) 1
1 lbs of Dalaran Sharp @ 1.25 = \$1.25
1 lbs of Stormwind Brie @ 10.0 = \$10.0
1 lbs of Alterac Swiss @ 40.0 = \$40.0
1 lbs of Cheese Type D @ 9.15 = \$9.15

Sub Total: \$60.4
-Discount: \$10.0
Total : \$50.4

We sell 4 kinds of Cheese
Dalaran Sharp: \$1.25 per pound
Stormwind Brie: \$10.0 per pound
Alterac Swiss: \$40.0 per pound
Cheese Type D: \$9.15 per pound
Enter the amount of Dalaran Sharp : 0
Enter the amount of Stormwind Brie : 0
Enter the amount of Alterac Swiss : 0
Enter the amount of Cheese Type D : 0
Display the itemized list? (1 for yes) 1

Sub Total: \$0.0
-Discount: \$0.0
Total : \$0.0

We sell 10 kinds of Cheese
Dalaran Sharp: \$1.25 per pound
Stormwind Brie: \$10.0 per pound
Alterac Swiss: \$40.0 per pound
Cheese Type D: \$9.15 per pound
Cheese Type E: \$2.5 per pound
Cheese Type F: \$8.74 per pound
Cheese Type G: \$9.88 per pound
Cheese Type H: \$2.91 per pound
Cheese Type I: \$6.66 per pound
Cheese Type J: \$0.36 per pound
Enter the amount of Dalaran Sharp : 1
Enter the amount of Stormwind Brie : 1
Enter the amount of Alterac Swiss : 1
Enter the amount of Cheese Type D : 1
Enter the amount of Cheese Type E : 1
Enter the amount of Cheese Type F : 1
Enter the amount of Cheese Type G : 1
Enter the amount of Cheese Type H : 1
Enter the amount of Cheese Type I : 1
Enter the amount of Cheese Type J : 1
Display the itemized list? (1 for yes) 1

1 lbs of Dalaran Sharp @ 1.25 = \$1.25
1 lbs of Stormwind Brie @ 10.0 = \$10.0
1 lbs of Alterac Swiss @ 40.0 = \$40.0
1 lbs of Cheese Type D @ 9.15 = \$9.15
1 lbs of Cheese Type E @ 2.5 = \$2.5
1 lbs of Cheese Type F @ 8.74 = \$8.74
1 lbs of Cheese Type G @ 9.88 = \$9.88
1 lbs of Cheese Type H @ 2.91 = \$2.91
1 lbs of Cheese Type I @ 6.66 = \$6.66
1 lbs of Cheese Type J @ 0.36 = \$0.36

Sub Total: \$91.44999999999999
-Discount: \$10.0
Total : \$81.44999999999999

We sell 10 kinds of Cheese

Dalaran Sharp: \$1.25 per pound
Stormwind Brie: \$10.0 per pound
Alterac Swiss: \$40.0 per pound
Cheese Type D: \$9.15 per pound
Cheese Type E: \$2.5 per pound
Cheese Type F: \$8.74 per pound
Cheese Type G: \$9.88 per pound
Cheese Type H: \$2.91 per pound
Cheese Type I: \$6.66 per pound
Cheese Type J: \$0.36 per pound

Enter the amount of Dalaran Sharp : 1
Enter the amount of Stormwind Brie : 1
Enter the amount of Alterac Swiss : 1
Enter the amount of Cheese Type D : 1
Enter the amount of Cheese Type E : 1
Enter the amount of Cheese Type F : 1
Enter the amount of Cheese Type G : 1
Enter the amount of Cheese Type H : 1
Enter the amount of Cheese Type I : 1
Enter the amount of Cheese Type J : 1
Display the itemized list? (1 for yes) 0

Sub Total: \$91.44999999999999
-Discount: \$10.0
Total : \$81.44999999999999

We sell 10 kinds of Cheese

Dalaran Sharp: \$1.25 per pound
Stormwind Brie: \$10.0 per pound
Alterac Swiss: \$40.0 per pound
Cheese Type D: \$9.15 per pound
Cheese Type E: \$2.5 per pound
Cheese Type F: \$8.74 per pound
Cheese Type G: \$9.88 per pound
Cheese Type H: \$2.91 per pound
Cheese Type I: \$6.66 per pound
Cheese Type J: \$0.36 per pound

Enter the amount of Dalaran Sharp : 1
Enter the amount of Stormwind Brie : 0
Enter the amount of Alterac Swiss : 2
Enter the amount of Cheese Type D : 0
Enter the amount of Cheese Type E : 3
Enter the amount of Cheese Type F : 0
Enter the amount of Cheese Type G : 4
Enter the amount of Cheese Type H : 0

```
Enter the amount of Cheese Type I : 5
Enter the amount of Cheese Type J : 0
Display the itemized list? (1 for yes) 1
1 lbs of Dalaran Sharp @ 1.25 = $1.25
2 lbs of Alterac Swiss @ 40.0 = $80.0
3 lbs of Cheese Type E @ 2.5 = $7.5
4 lbs of Cheese Type G @ 9.88 = $39.52
5 lbs of Cheese Type I @ 6.66 = $33.3

Sub Total: $161.57
-Discount: $25.0
Total      : $136.57
```

Part 3: (Assessment) Logic Check for `Error.java` and `GenCheeseShop.java`

- 1) Answer the following questions about `Error.java`
 - a. What happens if you add the following line to the program after the declaration of `MAXCHEESE`, where it is set to `10` (in line 7):
`MAXCHEESE = 20;`
 - b. What are the data types of the arrays `names`, `prices` and `amounts`?
 - c. How many entries get created for each of the arrays, `names`, `prices` and `amounts`?
 - d. State whether the following statements are valid or invalid:
`names[3] = 1;`
`prices[3] = 1;`
`amounts[3] = 1;`
 - e. Give the output of the following statements:
`System.out.println("Cheese " + 'A' + 10);`
`System.out.println("Cheese " + (char)'A' + 10);`
`System.out.println("Cheese " + (int)'A' + 10);`
`System.out.println("Cheese " + (char)('A' + 10));`
`System.out.println("Cheese " + (int)('A' + 10));`
 - f. Why is the initial value of `i = 3`?
- 2) What parts did you copy from Lab 02 (A-F)?
- 3) What parts did you copy from fixed `Error.java` (A-F)?
- 4) How many loops did you use in `GenCheeseShop.java`?
- 5) What types of loops did you use in `GenCheeseShop.java`?

What to hand in

When you are done with this lab assignment, submit all your work through CatCourses.

Before you submit, make sure you have done the following:

- Verified your solution with your TA or instructor
- Included the answers to Assessment questions (1 – 5) in a Word document or text file named **Part3**
- Attached the created `GenCheeseShop.java` file and corrected `Error.java` file
- Included a list of collaborators in the file **Part3**