 

**Java Lesson: Looping
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**Objective:** The objective of this lesson is to introduce the student to the java commands for looping to accomplish a particular algorithm.

We are often finding ourselves defining algorithms where a certain set of steps is repeated over and over again. This is known in computer science as iteration

Various commands are available

the for loop, the do..while loop and the while loop are typical in programming languages.

Perhaps we want to read in free throw results from a user and compute the ft %. Or maybe we want to print out the headings for a calendar.

## **Contents**

1. Looping a fixed number of times
2. Looping an unknown number of times
3. Using the break command
4. Using counters and accumulators
5. Nested Loops
6. The precious for loop
7. **Fixed number of iterations**

Suppose we want to repeat a command a definite number of times
Example 1: Printing 10 integers to the console starting at 1

|  |  |
| --- | --- |
|  | int i = 1;//loop controlwhile(i <= 10) { System.out.println(i); i = i + 1;} |

**Practice 1: You try:** Write commands for java to output 100 numbers starting with 1 and increasing by 1.

int i = 1;//loop control

while(i <= 100) {
 System.out.println(i);
 i = i + 1;
}

**Practice 2: You try:** Print your name out to the screen 50 times

int i = 1;//loop control

while(i <= 50) {
 System.out.println(“Tom Anderson”);
 i = i + 1;
}

**Practice 3: You try:** Print the numbers from 30 down to -2 to the screen on the same line with a space in between
int i = 30;//loop control

while(i >= -2) {
 System.out.print(i+” “);
 i = i - 1;
}

1. **Sometimes we don’t know how many times we want to iterate**

For example, reading in a data file of unknown size.

|  |  |
| --- | --- |
|  | **Must have a file in the project folder called whatever****The variable filename is (example rates.txt)**Euro.95Chinese Yuan Renminbi6.91Canadian Dollar1.35**Java:** try { //Attempt to open the file File f = new File(fileName); //Assuming its open, let's grab the currencies Scanner input = new Scanner(f);  while (input.hasNext()) { //Read the currency String descript; descript = input.nextLine(); String temp = input.nextLine(); double convertRate = Double.parseDouble(temp); //Now create a new Currency object Currency c = new Currency(descript, convertRate); //Add into the array if (numRates < 100) { rates[numRates] = c; numRates++; } } input.close(); } catch (Exception e) { System.out.println(" ----------------"); System.out.println("| FILE problem |"); System.out.println(" ----------------"); System.out.println(e); //print the excepti } |

Practice 4: You try: Ask the user for a number. Print all the even numbers from 0 up til and including that number

Scanner input = new Scanner(System.in); //Create a Scanner to read user input

int limit, i;

sout(“enter limit”);

limit = input.nextInt();

i = 0;

while(i <= limit) {
 System.out.println(i);
 i = i + 2;
}

You can also cause the loop to count up by a different number or count down if you like

int i = 0;

while(i<20) {

 System.out.println(“ i = “ + i);

 i = i + 5;

}

will print

i = 0

i = 5

i = 10

i = 15

**Practice 5: you try**:

Print the numbers 1,8,15,22,29 with an empty space in between them using a while loop

int i = 1;//loop control

while(i<=29) {
 System.out.print(i+” “);
 i = i +7;
}

1. **Using the break command**

The break command terminates nearest loop

Using the break command to exit a menu

while (true) {

 System.out.println("$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$");

 System.out.println(" TO U S $ F R O M ");

 System.out.println();

 System.out.println(“\u001B[31m”); //This is red, see the cookbook

 System.out.println(" 1 = Euros");

 System.out.println(“\u001B[34m”); //This is blue, see the cookbook

 System.out.println(" 2 = GB Pounds");

 System.out.println(“\u001B[36m”); //This is cyan, see the cookbook

 System.out.println(" 3 = Japanese Yen");

 System.out.println(“\u001B[33m”); //This is yellow, see the cookbook

 System.out.println(" 4 = Chinese Yuan Renminbi");

 System.out.println(“\u001B[35m”); //This is purple, see the cookbook

 System.out.println(" 5 = Mexican Pesos");

 System.out.println(“\u001B[32m"”); //This is green, see the cookbook

 System.out.println(“\u001B[0m"); //Resets console back to orig color

 System.out.println();

 System.out.println(" 0 = BACK TO MAIN");

 System.out.println("$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$");

 System.out.println("Enter Choice ->");

 char ch = input.next();

 if (ch.charAt(0).==(‘0') {

 break;

 }

} //end while

1. **Using counters and accumulators**

An accumulator: variable that accumulates over time

A counter: var that counts up by one

#### Practice 6: Redo project AlgoPract1\_2, the free throw problem. Alter the problem so that the user can type in any number of free throw results and get the % made. Use –1 as a sentinel.

Scanner input = new Scanner(System.in); //Create a Scanner to read user input

double sum, count;

int result;

sum = count = 0;

while(true) {

 System.out.println(“Enter 1, 0 or -1”);
 result = input.nextInt();
 if(result == -1) {
 break;
 }
 if(result == 0){
 count++;
 }
 if(result == 1){
 sum++; //one more ft is made
 count++;

 }

}
double avg = sum/count \* 100;
System.out.println(avg);

1. **Nested Loops**

By nesting one loop inside another, you can accomplish much

int i = 0;

while (i <= 4){

 System.out.println(“ i = “ + i);

 int j = 0;

 while (j < 3){

 System.out.println(“ j = “ + j);

 j++;

 }

 i++;

}

will print(fill in the blanks)

i = 0

j = 0

j = 1

j = 2

i = 1

j = 0

j =

j =

i = 2

j = 0

j =

j = 2

i =

j = 0

j = 1

j = 2

i =

j =

j =

j =

**Practice 7: you try** Use nested loops to draw the following image

\*\*\*\*

\*\*\*\*

\*\*\*\*

//rows

int r = 0;

while(r < 3) {
 int c = 0; //cols
 while(c < 4) {
 System.out.print(“\*”);
 c++;
 }
 System.out.println();//drop down
 r++;
} **Practice 8: you try** Use nested loops to make the following image

^^^^

**\*\*\*\***

**^^^^**

**\*\*\*\***

**^^^^**

**\*\*\*\***

//rows=6
//cols=4

int r = 0;

while(r < 6){
 int c = 0;
 while (c < 4) {
 if (r % 2 == 0){ //even
 System.out.print(“\*”);

 }

 else{ //odd

 System.out.print(“^”);

 }

 c++;

 } //inner loop

 r++;

 System.out.println();

} //outer loop

**Practice 9: you try** Print a scalable box as follows;

1

&

2

&&

&&

3

&&&

& &

&&&

4

&&&&

& &

& &

&&&&

Scanner input = new Scanner(System.in);

System.out.println(“Please enter size”);

int size = input.nextInt();

int r = 0;

while(r < size){ //loop for rows according

//to size

 int c = 0;
 while (c < size) {
 if (r == 0 || r == size-1 || c == 0

 ||c == size-1 ){ //outside
 System.out.print(“&”);

 }

 else{ //inside

 System.out.print(“ ”);

 }

 c++;

 } //inner loop

 r++;

 System.out.println();

} //outer loop

**Practice 10: Displaying a maze the user can see in 2 dimensions**

If we want to display a 2d maze on the console, we can use nested loops

Example

int [] [] maze = new int [10][10]; //creates a 2d array of 100 integers, 0 is default value

final int WALL = 1;

final int DOOR = 2;

//Place some walls and doors to make this picture

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| 3 | 0 | 0 | 0 | 1 | 0 | 2 | 0 | 0 | 0 | 0 |
| 4 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 |
| 5 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

//Do the commands here to place walls

maze[2][3]=WALL; maze[2][4]=WALL; maze[2][5]=WALL; maze[2][6]=DOOR;

maze[3][3]=WALL; maze[4][3]=WALL;

How can we display the maze contents to the screen?

int r=0;

while(r<10){

 int c=0;

 while(c<10){
 System.out.print(maze[r][c]);

 c++;
 }
 r++;
 System.out.println();

}

**The precious for loop**

for (*initializer statements; control expression; step expression)*

*{*

*body of loop*

*}*

Since everything is on one line, this is simply a delicious command!

To print the first 10 positive integers(beginning with 1) to the screen, use

for(int i=1; i<11; i++)

{

 System.out.println(i);

}

You can also leave any of the parts blank or put multiple statements in the first and third separated by ,

**Practice 11: you try** Write a for loop to print out the numbers from 0 to 1000, every 10 numbers print out a \*

for(int i =1; i<=1000; i++){

 System.out.println(i);
 if(i%10==0) {
 System.out.println(“\*”);
 }

}

**Practice 12: you try** Write a for loop that will print first 50 powers of 2, ie

1

2

4

8

16

32

…

for(long i=1,sum=1; i<=50; i++){

 System.out.println(sum);
 sum = sum \* 2;
}

 OR

for(int p=0, p<50; p++){
 System.out.println(Math.pow(2,p));
}