

Java Placement Course (DSA) notes

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1 Introduction to Java Language

1.1 Set of Instructions

- Flowchart
- Psudocode

1.2 Flowchart

Flowchart

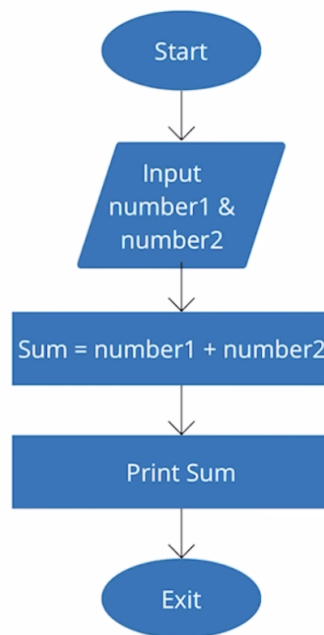


Figure 1: Flowchart

1.3 Psudocode

1. Start
2. Input 2 number
3. Calculate $\text{Sum} = \text{number1} + \text{number2}$
4. Print Sum
5. Exit

1.4 Java Class 1

1.4.1 Installation

1. Java Development Kit (JDK)
2. Code Editor / IDE
 - VS Code
 - IntelliJ
 - Eclipse

1.4.2 First Code

- Extension -> .java

1.4.2.1 Hello World

```
class FirstClass {  
    public static void main(String args[]) {  
        System.out.println("Hello World");  
    }  
}
```

1.4.3 How is code running?



Figure 2: Java Development Kit (JDK)

1. Compilation

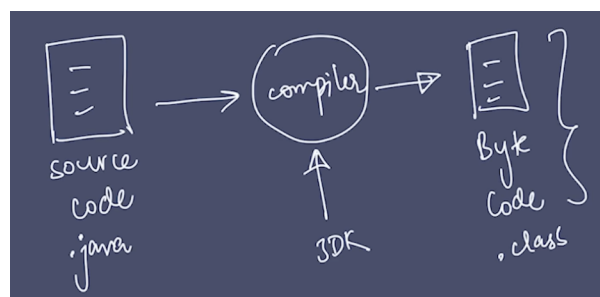


Figure 3: Java compilation

2. Execution

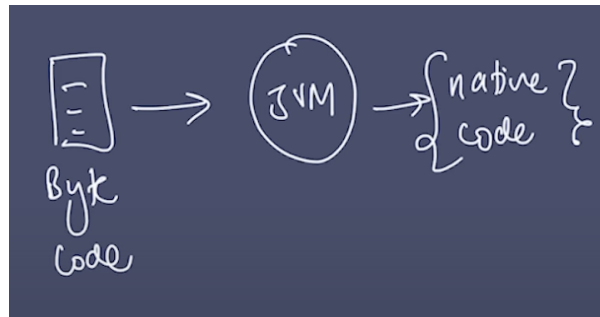


Figure 4: Java Execution

1.4.4 Code Components

1.4.4.1 Function

```
void main(){  
  
}
```

1.4.4.2 Class

```
class Main{  
    void main() {  
  
    }  
}
```

2 Variables in Java

2.1 Output

```
System.out.print("Hello World");
```

Hello world is the string which is printed.

- Use double quotes for strings

2.1.1 Boilerplate code

```
package com.apnacollege;
```

```
public class Main{  
    public static void main(String[] args) {  
        // Output  
        System.out.print("Hello World");  
    }  
}
```

Here:

- System -> class
- print -> function

```
System.out.println("Hello world with java");
```

- print -> for output on the same line
System.out.print("Hello World");
- println -> for output on the next line
System.out.println("Hello world with java");
- "\n" ->
System.out.print("Hello World\n");

2.1.2 Q. Print the pattern

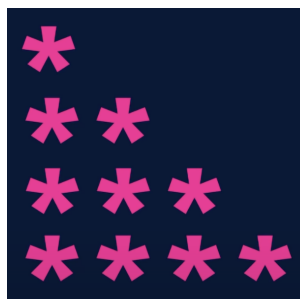


Figure 5: right triangle pattern

```

public class Main{
    public static void main(String[] args) {
        // Output
        System.out.println("*");
        System.out.println("**");
        System.out.println("***");
        System.out.println("****");
    }
}

```

2.2 Variables

Perimeter = 2 * (a + b)

here,

- 2 -> constant
- a&b -> variable



Figure 6: Variables in memory

```

public class Main{
    public static void main(String[] args) {
        // Variables
        String name = "tony stark";
        int age = 48;
        double price = 23.25;
        int a = 25;
        int b = 1;

        b = 20;
        name = "ironman";
    }
}

```

2.3 Data Type

Java is a typed language. i.e; you need to tell the datatype.

2.3.1 Types of Datatypes

- Primitive
- Non-Primitive

Primitive	Non-Primitive
byte	String
short	Array
char	Class
boolean	Object
int	Interface
long	
float	
double	

2.3.2 Data Type sizes

Primitive	Size (in bytes)
byte	1
short	
char	2
boolean	1
int	4
long	8
float	4
double	8

Above sizes are for a 64-bit System

```

public class Main {
    public static void main(String[] args) {
        // Variables
        int a = 10;
        int b = 25;

        int sum = a + b;
        System.out.println(sum);

        int diff = b - a;
        System.out.println(diff);

        int mul = a * b;
        System.out.println(mul);
    }
}

```

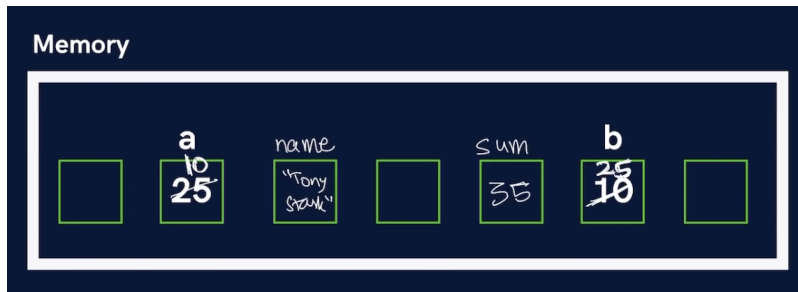


Figure 7: Memory allocation for the above program

2.4 Inputs in Java

```
import java.util.*;

public class Main {
    public static void main(String[] args) {
        // Input
        Scanner sc = new Scanner(System.in);
        String name = sc.next(); // next() -> for next token ie; next word
        String name1 = sc.nextLine(); // nextLine() -> for taking a sentence as Input
        // Similarly
        // nextInt()
        // nextFloat()
        System.out.println(name);
    }
}
```

2.5 Q. Take 2 variables 'a' & 'b' and print their sum.

```
import java.util.*;

public class Main {
    public static void main(String[] args) {
        Scanner sc = new Scanner(System.in);
        int a = sc.nextInt();
        int b = sc.nextInt();
        int sum = a + b;
        System.out.println(sum);
    }
}
```

3 Conditional Statements

Topics covered - if, else - else if - switch - break

3.1 if, else

3.1.1 Syntax

```
if (condition){  
  
}  
else {  
  
}
```

Example

3.1.2 Q. Write a program to identify if a person is an adult.

```
import java.util.*;  
  
public class Conditions {  
    public static void main(String args[]) {  
        Scanner sc = new Scanner(System.in);  
        int age = sc.nextInt();  
  
        if (age > 18) {  
            System.out.println("Adult");  
        } else {  
            System.out.println("Not Adult");  
        }  
    }  
}
```

3.1.3 Q. Write a program to check if a number is odd or even.

```
import java.util.*;  
  
public class Conditions {  
    public static void main(String args[]) {  
        Scanner sc = new Scanner(System.in);  
        int x = sc.nextInt();  
  
        if (x % 2 == 0) {  
            System.out.println("Even");  
        } else {  
            System.out.println("Odd");  
        }  
    }  
}
```

3.2 else if

3.2.1 Q. Write a program to know if a is greater of lesser than b.

```
import java.util.*;

public class Conditions {
    public static void main(String args[]) {
        Scanner sc = new Scanner(System.in);
        int a = sc.nextInt();
        int b = sc.nextInt();

        if (a == b) {
            System.out.println("Equal");
        }
        else if (a > b) {
            System.out.println("a is greater than b");
        }
        else {
            System.out.println("a is lesser than b")
        }
    }
}
```

3.3 Switch

3.3.1 Syntax

```
switch (variable) {
    case 1:
        break;
    case 2:
        break;
    default:

}
```

3.3.2 Q. Using switch write a program to greet in different languages

```
import java.util.*;

public class Conditions {
    public static void main(String args[]) {
        Scanner sc = new Scanner(System.in);
        int button = sc.nextInt();

        switch(button) {
            case 1: System.out.println("hello");
                break;
            case 2: System.out.println("namaste");
                break;
            case 3: System.out.println("bonjour");
                break;
            default: System.out.println("Invalid Button");
        }
    }
}
```

```
}  
}
```

3.3.3 Q. Make a calculator

Make a Calculator. Take 2 numbers (a & b) from the user and an operation as follows :

- : + (Addition) $a + b$
- : - (Subtraction) $a - b$
- : * (Multiplication) $a * b$
- : / (Division) a / b
- : % (Modulo or remainder) $a \% b$

Calculate the result according to the operation given and display it to the user.

3.3.4 Q. Ask the user to enter the number of the month & print the name of the month.

For eg - For '1' print 'January', '2' print 'February' & so on.

4 Loops

Topics covered - for Loop - while Loop - do while Loop

4.1 For Loop

4.1.1 Syntax

```
for (initialisation; condition; updation) {  
    // do something  
}
```

- initialisation -> int counter = 0
- condition -> counter < 100
- updation -> counter = counter + 2

Example

```
public class Loops {  
    public static void main(String args[]) {  
        for (int counter = 0; counter < 100; counter += 1){  
            System.out.println("Hello world")  
        }  
    }  
}
```

Note: if any condition is not given an infinite loop will run

4.1.2 Q. Print the number from 0 to 10 using for loop

```
public class Loops {  
    public static void main(String args[]) {  
        // counter++ => counter = counter + 1  
        for ( int i = 0; i < 11; i ++ ) [  
            System.out.println(i);  
        ]  
    }  
}
```

Dry Run => When analysing code without actually coding

4.2 While Loop

4.2.1 Syntax

```
int i = 0; // initialisation  
  
while(condition){ // condition  
    // do something  
    i++; //updation  
}
```

4.2.2 Q. Print the number from 0 to 10 using while loop

```
public class Loops {  
    public static void main(String args[]) {  
        int i = 0;  
        while(i<11){  
            System.out.println(i);  
            i++;  
        }  
    }  
}
```

4.3 Do While Loop

4.3.1 Syntax

```
int i = 0; // initialisation  
  
do {  
    // do something  
    i++; // updation  
}while(condition) // condition
```

In do while loop, the loop is run at least once.

4.3.2 Q. Print the number from 0 to 10 using do while loop

```
public class Loops {  
    public static void main(String args[]) {  
        int i = 0;  
        do {  
            System.out.println(i);  
            i++;  
        } while(i<11);  
    }  
}
```

4.4 Questions

4.4.1 Q. Print the sum of first n natural numbers.

```
import java.util.*;  
  
public class Loops {  
    public static void main(String args[]){  
        Scanner sc = new Scanner(System.in);  
        int n = sc.nextInt();  
  
        int sum = 0;  
        for(int i=0; i<=n; i++) {  
            sum = sum + i;  
        }  
  
        System.out.println(sum);  
    }  
}
```

```
}  
}
```

4.4.2 Q. Print the table if a number input by the user.

```
import java.util.*;  
  
public class Loops {  
    public static void main(String args[]) {  
        Scanner sc = new Scanner(System.in);  
        int n = sc.nextInt();  
  
        for(int i=1; i<11; i++) {  
            System.out.println(i*n);  
        }  
    }  
}
```

4.4.3 Q. Print all even numbers till n.

4.4.4 Q. Make a menu driven program. The user can enter 2 numbers, either 1 or 0.

If the user enters 1 then keep taking input from the user for a student's marks(out of 100). If they enter 0 then stop. If he/ she scores : Marks ≥ 90 -> print "This is Good" 89 \geq Marks ≥ 60 -> print "This is also Good" 59 \geq Marks ≥ 0 -> print "This is Good as well" Because marks don't matter but our effort does. (Hint : use do-while loop but think & understand why)

5 Basic Pattern Questions

5.1 Nested Loops

```
for(..){  
    for(..){  
  
    }  
}
```

5.2 Q. Print the solid rectangle pattern



Figure 8: Solid rectangle pattern

```
import java.util.*;  
  
class Patterns {  
    public static void main(String args[]) {  
        int n = 4;  
        int m = 5;  
  
        // inner loop  
        for(int i=1; i<=n; i++) {  
            // inner loop  
            for (int j = 1; j <= m; j++) {  
                System.out.print("*");  
            }  
            System.out.println();  
        }  
    }  
}
```

5.3 Q. Print the hollow rectangle pattern

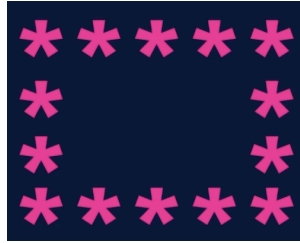


Figure 9: Hollow rectangle pattern

```
import java.util.*;

public class patterns_hollow_rectangle {
    public static void main(String[] args) {
        int n = 4;
        int m = 5;

        // Outer loop
        for (int i = 1; i <= n; i++) {
            // Inner loop
            for (int j = 1; j <= m; j++) {
                // cell -> (i,j)
                if (i == 1 || j == 1 || i == n || j == m) {
                    System.out.print("*");
                } else {
                    System.out.print(" ");
                }
            }
            System.out.println();
        }
    }
}
```

5.4 Q. Print the half pyramid pattern

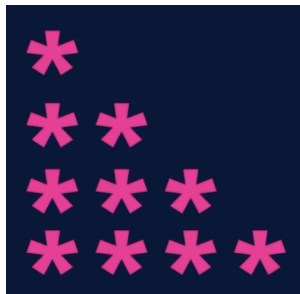


Figure 10: Half pyramid pattern

```
import java.util.*;
```

```

public class patterns_half_pyramid {
    public static void main(String[] args) {
        int n = 4;

        // Outer loop
        for ( int i = 1; i <= n; i++) {
            // Inner Loop
            for (int j = 1; j <= i; j++ ) {
                System.out.print("*");
            }
            System.out.println();
        }
    }
}

```

5.5 Q. Print the inverted half pyramid pattern



Figure 11: Inverted half pyramid pattern

```

import java.util.*;

public class patterns_half_pyramid {
    public static void main(String[] args) {
        int n = 4;

        // Outer loop
        for ( int i = n; i >= 1; i--) {
            // Inner Loop
            for (int j = 1; j <= i; j++ ) {
                System.out.print("*");
            }
            System.out.println();
        }
    }
}

```

5.6 Q. Print the inverted half pyramid pattern (rotated by 180 deg)

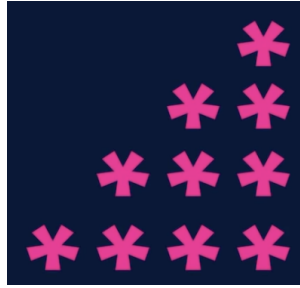


Figure 12: Inverted half pyramid rotated 180 deg

```
import java.util.*;

public class patterns_inverted_half_pyramid_180 {
    public static void main(String[] args) {
        int n = 4;

        // Outer loop
        for (int i = 1; i <= n; i++) {
            // Inner loop
            for (int j = 1; j <= n; j++) {
                if (j > n - i)
                    System.out.print("*");
                else
                    System.out.print(" ");
            }
            System.out.println();
        }
    }
}
```

5.7 Q. Print the half pyramid with numbers pattern



Figure 13: Half pyramid with numbers

```
import java.util.*;
```

```

public class patterns_half_pyramid_numbers {
    public static void main(String[] args) {
        int n = 5;

        // Outer loop
        for (int i = 1; i <= n; i++) {
            // Inner loop
            for (int j = 1; j <= i; j++) {
                System.out.print(j);
            }
            System.out.println();
        }
    }
}

```

5.8 Q. Print the Inverted half pyramid with numbers pattern

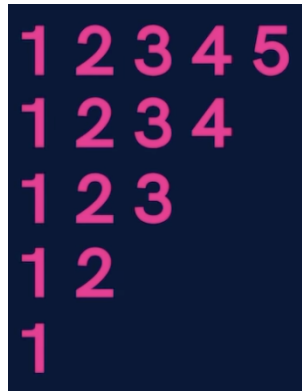


Figure 14: Inverted half pyramid with numbers

```

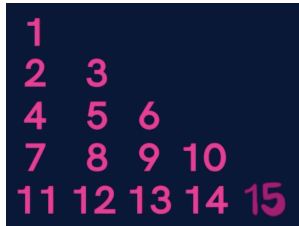
import java.util.*;

public class patterns_inverted_half_pyramid_numbers {
    public static void main(String[] args) {
        int n = 5;

        // Outer loop
        for (int i = 1; i <= n; i++) {
            // Inner loop
            for(int j = 1; j <= n-i+1; j++) {
                System.out.print(j);
            }
            System.out.println();
        }
    }
}

```

5.9 Q. Print the Floyd's triangle pattern



A Floyd's triangle pattern consisting of 5 rows of numbers. The first row has 1 number (1), the second row has 2 numbers (2, 3), the third row has 3 numbers (4, 5, 6), the fourth row has 4 numbers (7, 8, 9, 10), and the fifth row has 5 numbers (11, 12, 13, 14, 15). The numbers are arranged in a right-angled triangular shape.

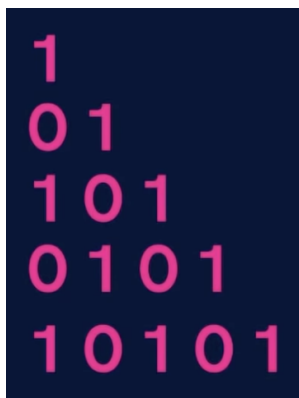
Figure 15: Floyd's triangle pattern

```
import java.util.*;

public class patterns_floyds_triangle {
    public static void main(String[] args) {
        int n = 5;
        int a = 1;

        // Outer loop
        for (int i = 1; i <= n; i++) {
            // Inner loop
            for (int j = 1; j <= i; j++) {
                System.out.print(a);
                a++;
            }
            System.out.println();
        }
    }
}
```

5.10 Q. Print the 0-1 triangle pattern



A 0-1 triangle pattern consisting of 5 rows of binary digits. The first row has 1 digit (1), the second row has 2 digits (0, 1), the third row has 3 digits (1, 0, 1), the fourth row has 4 digits (0, 1, 0, 1), and the fifth row has 5 digits (1, 0, 1, 0, 1). The digits are arranged in a right-angled triangular shape.

Figure 16: 0-1 triangle pattern

```
import java.util.*;

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

```
int n = 5;
int a = 1;

// Outer loop
for (int i = 1; i <= n; i++) {
    // Inner loop
    for (int j = 1; j <= i; j++) {
        int sum = i+j;
        if (sum % 2 == 0) { //even
            System.out.print("1 ");
        } else { // odd
            System.out.print("0 ");
        }
    }
    System.out.println();
}
}
```

6 Advanced Pattern Questions

6.1 Q. Print the butterfly Patterns

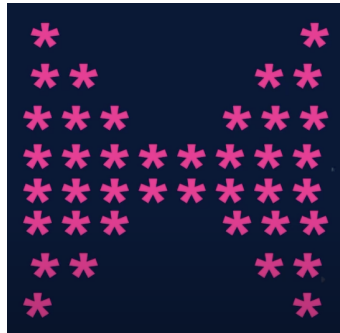


Figure 17: Butterfly pattern

```
import java.util.*;

public class patterns_butterfly {
    public static void main(String[] args) {
        int n = 4;

        //upper part
        for(int i=1; i<=n; i++) {
            for(int j=1; j<=i; j++) {
                System.out.print("*");
            }

            int spaces = 2 * (n-i);
            for(int j=1; j<=spaces; j++) {
                System.out.print(" ");
            }

            for(int j=1; j<=i; j++) {
                System.out.print("*");
            }
            System.out.println();
        }

        //lower part
        for(int i=n; i>=1; i--) {
            for(int j=1; j<=i; j++) {
                System.out.print("*");
            }

            int spaces = 2 * (n-i);
            for(int j=1; j<=spaces; j++) {
                System.out.print(" ");
            }
        }
    }
}
```



```

    }

    for(int j=1; j<=i; j++) {
        System.out.print("*");
    }
    System.out.println();
}
}

```

6.2 Q. Print the solid rhombus Patterns

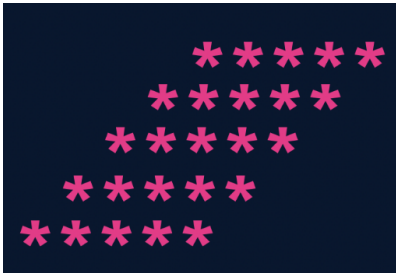


Figure 18: Solid rhombus pattern

```

import java.util.*;

public class patterns_solid_rhombus {
    public static void main(String[] args) {
        int n = 5;

        for ( int i = 1; i <= n ; i++) {
            // spaces
            for (int j = 1; j <= n-i; j++) {
                System.out.print(" ");
            }

            // stars
            for (int j = 1; j <= 5; j++) {
                System.out.print("*");
            }
            System.out.println();
        }
    }
}

```

6.3 Q. Print the number pyramid pattern

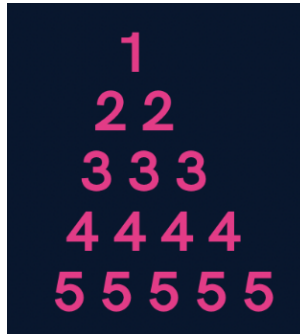


Figure 19: Number pyramid pattern

```
import java.util.*;

public class patterns_number_pyramid {
    public static void main(String[] args) {
        int n = 5;

        // Outer loop
        for (int i = 1; i <= n; i++) {
            // spaces
            for (int j = 1; j <= n-i; j++) {
                System.out.print(" ");
            }
            // numbers => print row no., row no. times
            for (int j = 1; j <= i; j++) {
                System.out.print(i + " ");
            }
            System.out.println();
        }
    }
}
```

6.4 Q. Print a palindrome number pyramid pattern

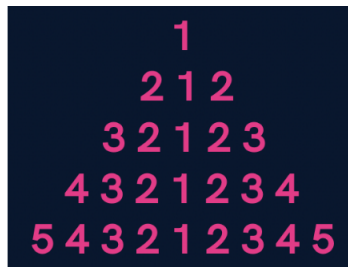


Figure 20: Palindrome number pyramid pattern

```
import java.util.*;

public class patterns_palindrome_pyramid {
```

```

public static void main(String[] args) {
    int n = 5;

    for (int i = 1; i <= n; i++) {
        // spaces
        for (int j = 1; j <= n-i; j++) {
            System.out.print(" ");
        }

        // 1st half numbers
        for (int j = i; j >= 1; j--) {
            System.out.print(j);
        }

        // 2nd half numbers
        for (int j = 2; j <= i; j++) {
            System.out.print(j);
        }
        System.out.println();
    }
}

```

6.5 Q. Print the diamond pattern

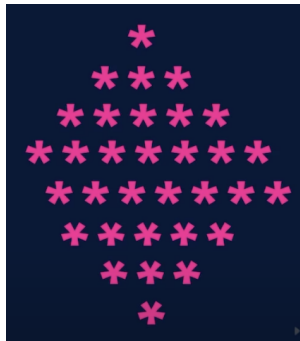


Figure 21: Diamond pattern

```

import java.util.*;

public class patterns_diamond {
    public static void main(String[] args) {
        int n = 4;

        // upper half
        for (int i = 1; i <= n; i++) {
            // spaces
            for (int j = 1; j <= n-i; j++) {
                System.out.print(" ");
            }

            // stars

```

```

    for (int j = 1; j <= 2*i-1; j++) {
        System.out.print("*");
    }
    System.out.println();
}
// lower half
for (int i = n; i >= 1; i--) {
    // spaces
    for (int j = 1; j <= n-i; j++) {
        System.out.print(" ");
    }

    // stars
    for (int j = 1; j <= 2*i-1; j++) {
        System.out.print("*");
    }
    System.out.println();
}
}
}

```

6.6 Print a hollow butterfly



Figure 22: Hollow butterfly pattern

6.7 Print a hollow rhomubus

```
*****  
  
*      *  
  
*      *  
  
*      *  
  
*****
```

Figure 23: Hollow rhombus pattern

6.8 Print Pascal's triangle

```
1  
1 1  
1 2 1  
1 3 3 1  
1 4 6 4 1
```

Figure 24: Pascal's triangle

6.9 Print Inverted half pyramid pattern

1111
222
33
4

Figure 25: Inverted half pyramid pattern

7 Functions & Methods

Functions is a block of code with takes input, performs some operations and returns output.

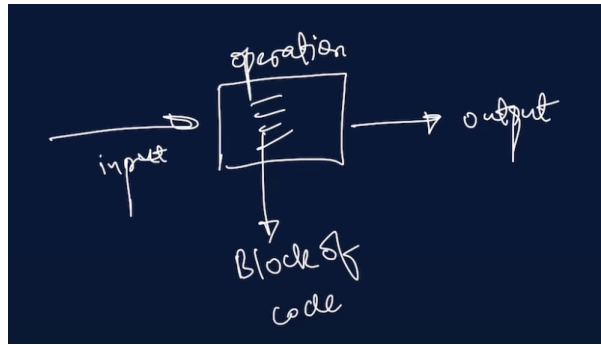


Figure 26: Function working

7.1 Syntax

```
returnType functionName(type arg1, type arg2 ..){
    // operations
}
```

- returnType -> int, float, String, ...
 - returnType void -> no return
- public static -> oops, for now prefix of every function
- type -> int, float, String, ...

7.2 Q. Print a given name in a function

```
import java.util.*;

public class Functions {
    public static void printMyName(String name) {
        System.out.println(name);
        return;
    }
    public static void main(String[] args) {
        Scanner sc = new Scanner(System.in);
        String name = sc.next();

        printMyName(name); // function is invoked
    }
}
```

7.3 What happens in memory?

- All functions are saved in memory in stack form.
 - a single unit in a stack is a **stack frame**.
- function no. ↑, stack size ↑

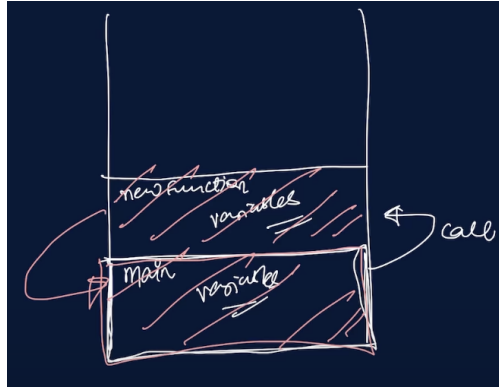


Figure 27: Functions in memory

- When main function is running is created in the memory
- When it invokes some other function that function is created in the memory and saved as a stack
- When the invoked function is executed it is removed from the memory
- And after the completion of the main function it is also removed
- Variables in a particular function are stored in the same stack frame as the function

More about memory in the OOPs Chapter

7.4 Q. Make a function to add 2 numbers and return the sum

```
public static void calculateSum(int a, int b) {
    int sum = a + b;
    return sum;
}
```

7.5 Q. Make a function to multiply 2 numbers and return the product

```
public static int calculateProduct(int a, int b) {
    return a * b;
}
```

7.6 Q. Find a factorial of a number

```
public static void printFactorial(int n) {
    if(n<0){
        System.out.println("Invalid Number");
        return;
    }

    int factorial = 1;

    // loop
    for(int i = n; i >= 1; i--){
        factorial = factorial * i;
    }
}
```


7.7 Difference between functions & methods

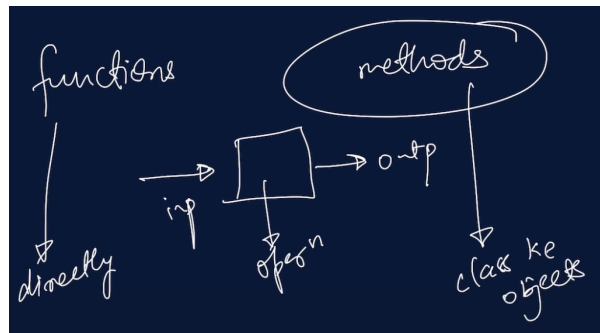


Figure 28: Difference b/w functions & methods

- we call functions directly
 - and methods through objects of class
-

8 Functions practice questions

[Link to the pdf document](#)

- 8.1 Enter 3 numbers from the user & make a function to print their average.
- 8.2 Write a function to print the sum of all odd numbers from 1 to n.
- 8.3 Write a function which takes in 2 numbers and returns the greater of those two.
- 8.4 Write a function that takes in the radius as input and returns the circumference of a circle.
- 8.5 Write a function that takes in age as input and returns if that person is eligible to vote or not. A person of age > 18 is eligible to vote.
- 8.6 Write an infinite loop using do while condition.
- 8.7 Write a program to enter the numbers till the user wants and at the end it should display the count of positive, negative and zeros entered.
- 8.8 Two numbers are entered by the user, x and n. Write a function to find the value of one number raised to the power of another i.e. x^n .
- 8.9 Write a function that calculates the Greatest Common Divisor of 2 numbers. (BONUS)
- 8.10 Write a program to print Fibonacci series of n terms where n is input by user:

0 1 1 2 3 5 8 13 21 In the Fibonacci series, a number is the sum of the previous 2 numbers that came before it. (BONUS)

9 Basics of Time & Space Complexity

9.1 Time Complexity

Relation between **Input Size** & **Running Time** (operations).

9.1.1 Example

```
public static void main(String args[]){
    Scanner sc = new Scanner(System.in);
    int n = sc.nextInt();

    for(int i = 0; i < n; i++) {
        System.out.println("hello");
    }
}
```

- input $n \rightarrow$ time n
- time complexity \propto input n
- Linear relation

9.1.2 Types of time complexity

1. Best case $\rightarrow \Omega()$
 2. Average case $\rightarrow \theta()$
 3. Worst case $\rightarrow O()$ bigO
- We always assume worst case time complexity *i.e.* $O()$

9.1.3 Example

```
public static void main(String args[]) {
    Scanner sc = new Scanner(System.in);
    int n = sc.nextInt();

    for(int i = 0 ; i < n ; i++) {
        for(int j = 0; j < n; j++) {
            System.out.println("hello");
        }
    }
}
```

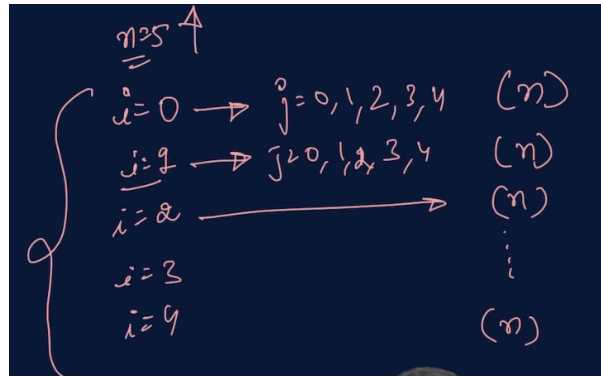


Figure 29: Total time the print operation is done

$$n \times n = n^2$$

worst case time complexity $\rightarrow O(n^2)$

9.1.4 Comparing Time Complexities

Compare	$O(n)$	$O(n^2)$	$O(n^3)$
n=1	1	1	1
n=2	2	4	8
n=3	3	9	27
n=10 ⁵	10 ⁵	10 ¹⁰	10 ³⁰
	Best	2ndBest	Worst

9.2 Space Complexity

Space complexity depends on the space the program occupies in the memory.

- input int n \rightarrow space complexity constant
- Array \rightarrow space complexity depends on input

10 Introduction to Arrays

- List of same datatype variables.
- zero-indexed

10.1 Syntax

```
type[] arrayName = new type[size];
```

or

```
type arrayName[] = {1,2,3,4,5,6};
```

e.g;

```
int[] marks = new int[20];
```

10.1.1 for storing

```
marks[0] = 92;
```

```
marks[1] = 88;
```

10.2 Q. Take an array as input from the user.

Search for a given number x and print the index at which it occurs.

```
import java.util.*;
```

```
public class Arrays {
    public static void main(String args[]) {
        Scanner sc = new Scanner(System.in);
        int size = sc.nextInt();
        int numbers[] = new int[size];

        for(int i=0; i<size; i++) {
            numbers[i] = sc.nextInt();
        }

        //print the numbers in array
        for(int i=0; i<arr.length; i++) {
            System.out.print(numbers[i]+" ");
        }
    }
}
```

- algorithm -> **Linear Search**

10.3 Q. Take an array of names as input from the user and print them on the screen

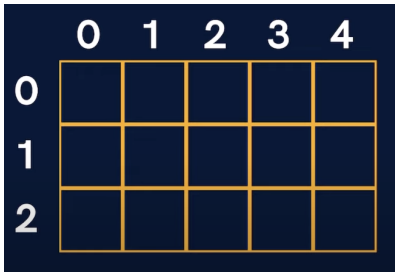
10.4 Q. Find the maximum & minimum number in an array of integers

[HINT : Read about Integer.MIN_VALUE & Integer.MAX_VALUE in Java]

10.5 Q. Take an array of numbers as input and check if it is an array sorted in ascending order

Eg : { 1, 2, 4, 7 } is sorted in ascending order. {3, 4, 6, 2} is not sorted in ascending order.

11 2-D Arrays



	0	1	2	3	4
0					
1					
2					

Figure 30: Matrix representation of 2D array

rows = 3 ; columns = 5

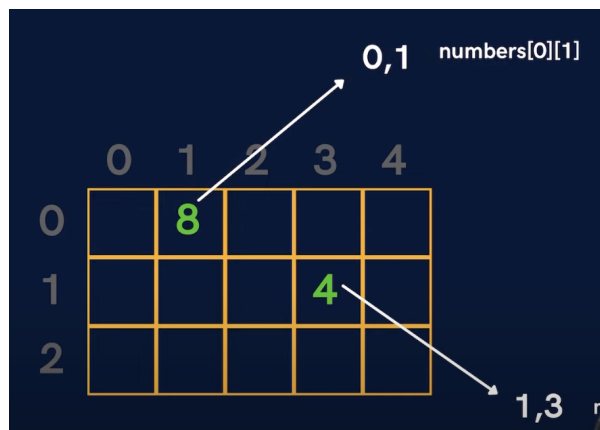
Total memory consumption of a 2d array = (rows x cols) x datatype-size

11.1 Syntax

```
type[] [] arrayName = new type[rows][columns];
```

eg.

```
int[] [] numbers = new int[3][5];
```



	0	1	2	3	4
0		8			
1				4	
2					

Figure 31: Position of 2D matrix

11.2 Q. Take a matrix as input from the user

Search for a given number x and print the indices at which it occurs

```
public class TwoDArrays {
    public static void main(String args[]) {
        Scanner sc = new Scanner(System.in);
        int rows = sc.nextInt();
        int cols = sc.nextInt();
```

```

int[] [] numbers = new int[rows][cols];

//input
//rows
for(int i=0; i<rows; i++) {
    //columns
    for(int j=0; j<cols; j++) {
        numbers[i][j] = sc.nextInt();
    }
}

int x = sc.nextInt();

for(int i=0; i<rows; i++) {
    for(int j=0; j<cols; j++) {
        //compare with x
        if(numbers[i][j] == x) {
            System.out.println("x found at location (" + i + ", " + j + ")");
        }
    }
}
}
}

```

For more problems refer this