Java Placement Cource (DSA) notes

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Lecture 1

22.12.2022 Thursday

1 Introduction to Java Language

1.1 Set of Instructions

- Flowchart
- Psudocode

1.2 Flowchart

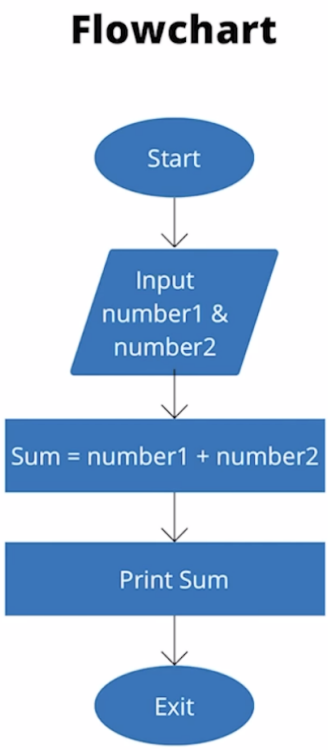

Figure 1: Flowchart

1.3 Psudocode

1. Start
2. Input 2 number
3. Calculate Sum = number1 + 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

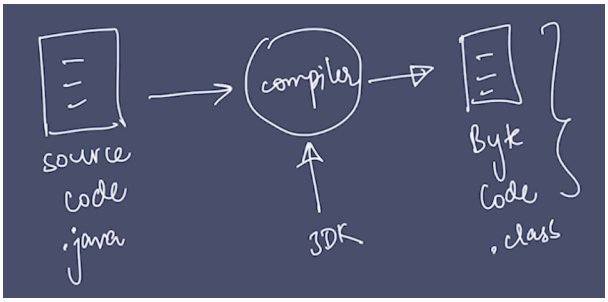

Figure 3: Java compilation

2. Execution

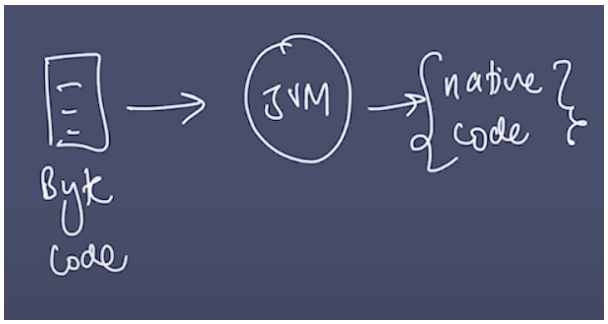

Figure 4: Java Execution

1.4.4 Code Components

1.4.4.1 Function

```
void main(){

}
```

1.4.4.2 Class

```
class Main{
  void main() {

  }
}
```

Lecture 2

22.12.2022 Thursday

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

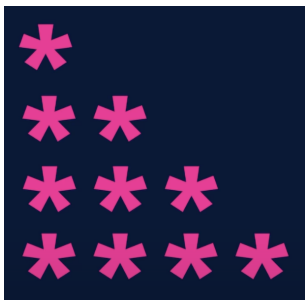

Figure 5: right triangle pattern

```java
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

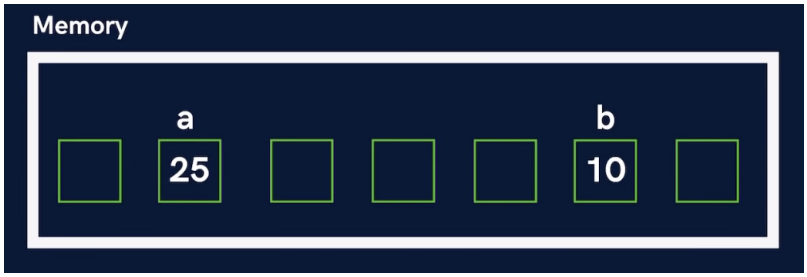

Figure 6: Variables in memory

```java
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

```java
public class Main {
  public static void main(String[] argss) {
    // 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);

  }
}
```

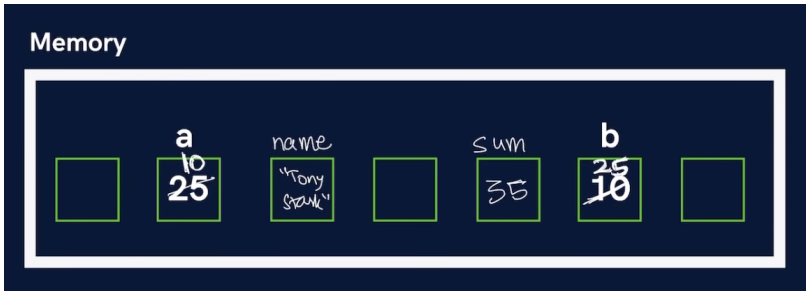

Figure 7: Memory allocation for the above program

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);
  }
}
```

Lecture 3

23.12.2022 Friday

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;
      dafault: 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.

Lecture 4

23.12.2022 Friday

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 >= Marks >= 60 -> print "This is also Good" 59 >= 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)

Lecture 5

25.12.2022 Sunday

5 Basic Pattern Questions

5.1 Nested Loops

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

  }
}
```

5.2 Q. Print the solid rectangle pattern

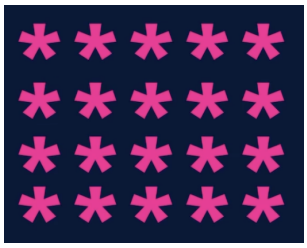

Figure 8: Solid rectangle pattern

```
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

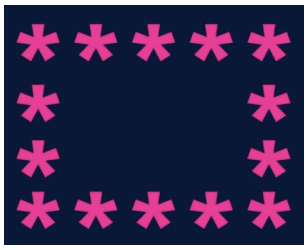

Figure 9: Hollow rectangle pattern

```
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

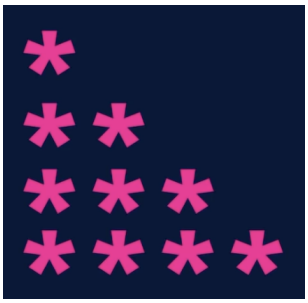

Figure 10: Half pyramid pattern

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

```java
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

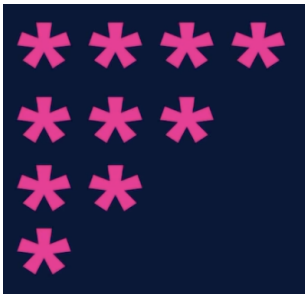

Figure 11: Inverted half pyramid pattern

```java
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)

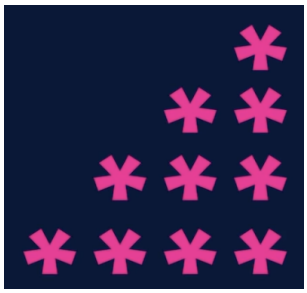

Figure 12: Inverted half pyramid rotated 180 deg

```
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

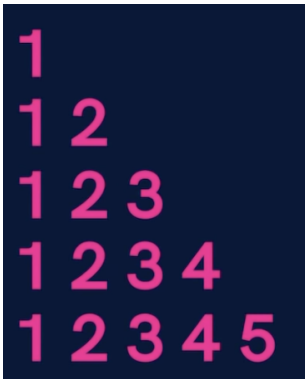

Figure 13: Half pyramid with numbers

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

```java
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

```java
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

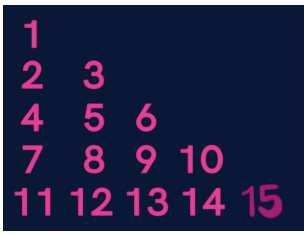

Figure 15: Floyd's triangle pattern

```java
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

Figure 16: 0-1 triangle pattern

```java
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();
    }
  }
}
```

Lecture 6

25.12.2022 Sunday

6 Advanced Pattern Questions

6.1 Q. Print the butterfly Patterns

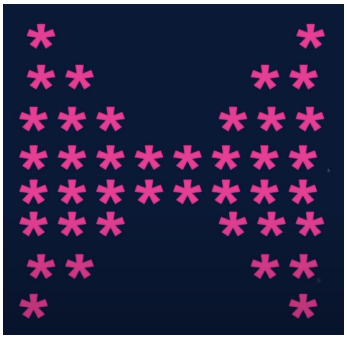

Figure 17: Butterfly pattern

```
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

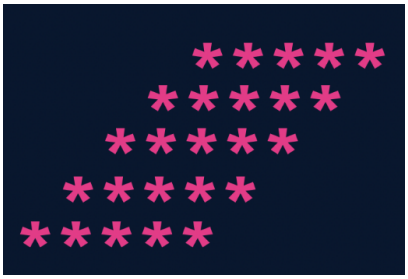

Figure 18: Solid rhombus pattern

```
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

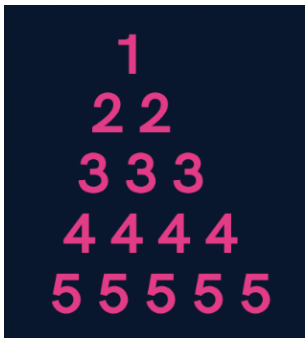

Figure 19: Number pyramid pattern

```java
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

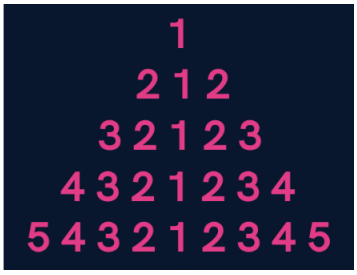

Figure 20: Palindrome number pyramid pattern

```java
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

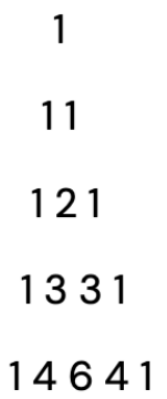

Figure 24: Pascal's triangle

6.9 Print Inverted half pyramid pattern

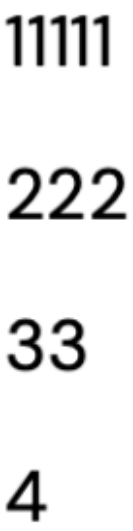

Figure 25: Inverted half pyramid pattern

Lecture 7

27.12.2022 Tuesday

7 Functions & Methods

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

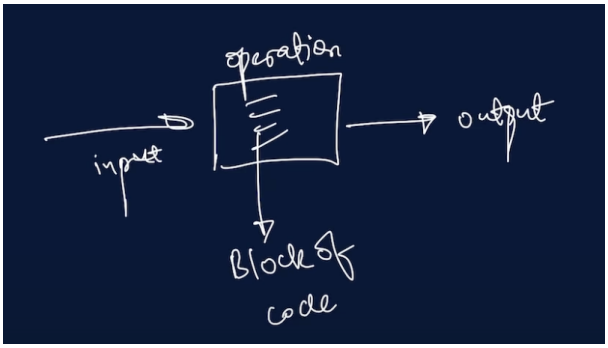

Figure 26: Function working

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 ↑

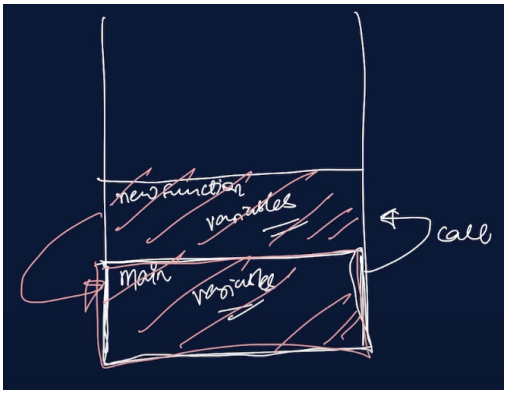

Figure 27: Functions in memory

- When main function is running is 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 funcions & methods

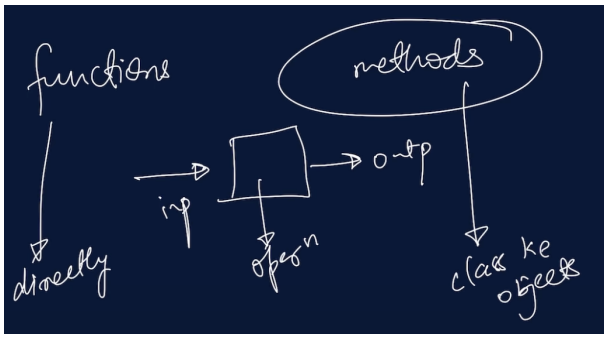

Figure 28: Difference b/w functions & methods

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

Lecture 8

27.12.2022 Tuesday

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. xn.

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)

Lecture 9

27.12.2022 Tuesday

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 -> time n
- time complexity α input n
- Linear relation

9.1.2 Types of time complexity

1. Best case -> $\Omega()$
2. Average case -> $\theta()$
3. Worst case -> $O()$ `bigO`

- We always assume worst case time complexity *i.e;* 0()

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");
    }
  }
}
```

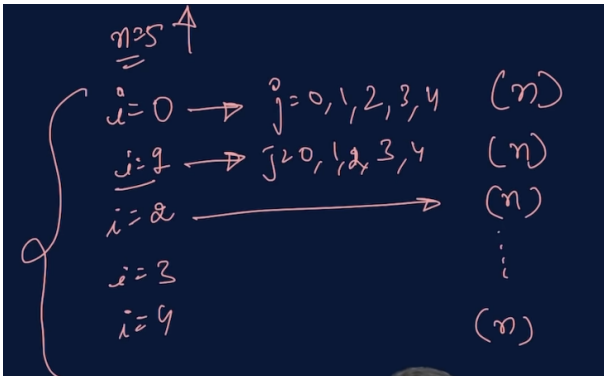

Figure 29: Total time the print operation is done

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

worst case time complexity -> $O(n^2)$

9.1.4 Comparing Time Complexities

Compare	$O(n)$	$O(n^2)$	$O(n^3)$
n=1	1	1	12
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 -> space complexity constant
- Array -> space complexity depends on input

Lecture 10

29.12.2022 Thursday

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]+" ");
       }
   }
}
```

- algorigtm -> **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.

Lecture 11

29.12.2022 Thursday

11 2-D Arrays

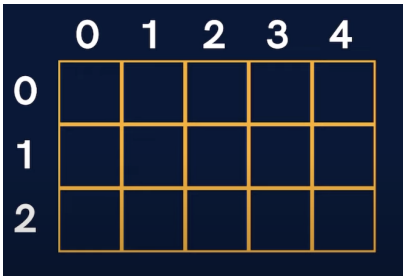

Figure 30: Matrix representation of 2D array

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];
```

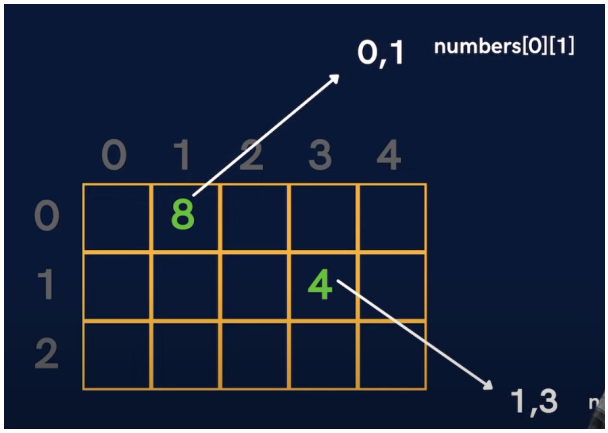

Figure 31: Position of 2D matrix

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

Lecture 12

01.01.2023 Sunday

12 Strings

12.1 String Declaration

```
public class Strings {
    pubic static void main(String args[]) {
        // String Declaration
        String name = "Tony";
        String fullName = "Tony Stark";
        String sentence = "My name is Tony Stark";
    }
}
```

12.2 String input

```
public class Strings {
    pubic static void main(String args[]) {
        Scanner sc = new Scanner(System.in);
        String name = sc.nextLine();
        System.out.println("Your name is : " + name);
    }
}
```

- sc.next -> for word
- sc.nextLine -> for sentence

12.3 String Functions

12.3.1 Concatenation

+

```
String fullName = firstName + " " + lastName
```

12.3.2 Length

```
.length()
```

12.3.3 charAt()

```
for(int i=0 ; i < fullName.length() ; i++) {
    System.out.println(fullName.charAt(i));
}
```

12.3.4 Compare (.compareTo())

```
name1.compareTo(name2);
```

- value of b is more than value of a; value of z is greater than l
- always use `.compareTo` when comparing strings instead of `==`

12.3.5 Substring (.substring)

```
String sentence = "My name is Tony";
String name = sentence.substring(11, sentence.length());
System.out.println(name);
```

12.4 Strings are immutable

Lecture 13

01.01.223 Sunday

13 String Builder

String Builder is a class to make string processing faster

Strings in Java are *Immutable*

13.1 Declaration

```
public class Strings {
    public static void main(String args[]) {
        StringBuilder sb = new StringBuilder("Tony");
        System.out.println(sb);
    }
}
```

13.2 StringBuilder functions

13.2.1 .charAt(index)

13.2.2 .setCharAt(index, 'char')

```
sb.setCharAt(0, "P");
```

13.2.3 .insert(index, 'char')

```
sb.insert(0, 'S');
```

13.2.4 .delete(start, end)

```
sb.delete(2,3);
```

13.2.5 .append("char")

```
sb.append("e")
```

13.2.6 .length()

```
sb.length()
```

13.3 Q. Write a program to reverse a string

```
public class StringBuilder {
    public static void main(String args[]){
        StringBuilder sb = new StringBuilder("hello");

        for(i = 0; i < sb.lenght()/2; i ++){
            int front = i ;
            int back = sb.lenght() - 1 - i;

            char frontChar = sb.charAt(front);
            char backChar = sb.charAt(back);

            sb.setCharAt(front, backChar);
```

```
            sb.setCharAt(back, frontChar);
        }
    }
}
```

- time complextity of the above code is $O(n)$

Lecture 14

01.01.2023 Sunday

14 Operators

Symbols that tell compiler to perform some opeerations

- operators -> +, -, /, *, ...
- operands -> a, b, 3, 6, ... (on which the operation is done)

14.1 Types of Operators

14.1.1 Arithmetic Operators

Binary	Unary
+	++
-	–
*	
/	
%	

- A `binaryoperator` B ; eg, A + B
- A `unaryoperator` ; eg. A++, B–

14.1.1.1 Increment Operators

- Pre Increment -> first change value then use
- Post Increment -> first use value then change it

Pre Increment	Post Increment
++a	a++

Similarly for decrement operators

14.1.2 Relational Operators

- '=='
- '!='
- '>'
- '<'
- '>='
- '<='

14.1.3 Logical Operators

- && -> Logical AND
- || -> Logical OR
- ! -> Logical NOT

14.1.4 Bitwise Operators

- '&' -> Binary AND
- '|' -> Binary OR
- '^' -> Binary XOR
- '~' -> Binary One's Complement
- '«' -> Binary Left Shift
- '»' -> Binary Right Shift

14.1.5 Assignment Operators

- '='
- '+='
- '-='
- '*='
- '/='

a = a + b ; a += b

15 Binary Number System (*base 2*)

- Decimal number system -> regular numbers
- 4 to Binary

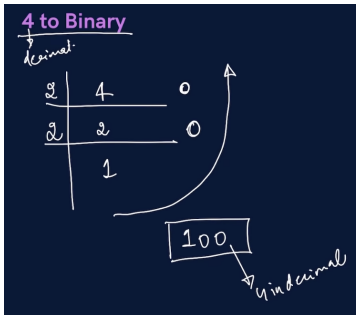

Figure 32: 4 to binary

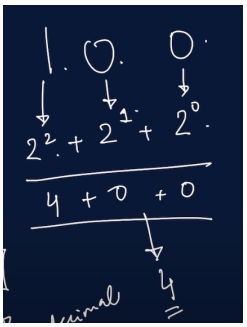

Figure 33: binary to decimal

- 101 to Decimal

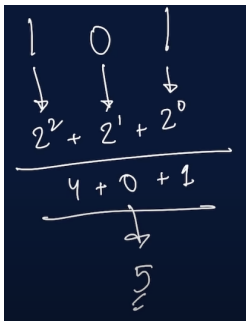

Figure 34: Binary to decimal

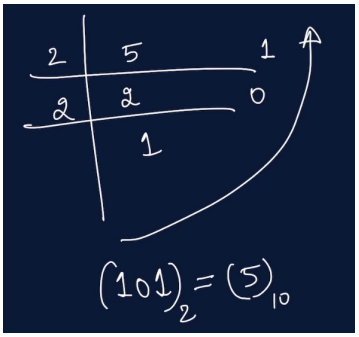

Figure 35: Decimal to binary

15.1 Other systems

- Octal *Base 8*
- Hexadecimal *Base 16*

Lecture 15

02.01.2023 Monday

16 Bit Manipulation

16.1 Revision

- Left Shift -> `N<<i`

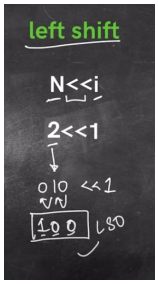

Figure 36: Left Shift working

- Right Shift -> `N>>i`

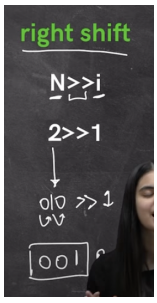

Figure 37: Right Shift working

Concepts Covered

1. Greatest
2. Set
3. Clear
4. Update

16.2 Get Bit

16.2.1 Q. Get the 3rd bit (position = 2) of a number n. (n = 0101)

Bit Mask : 1«it Operation : AND

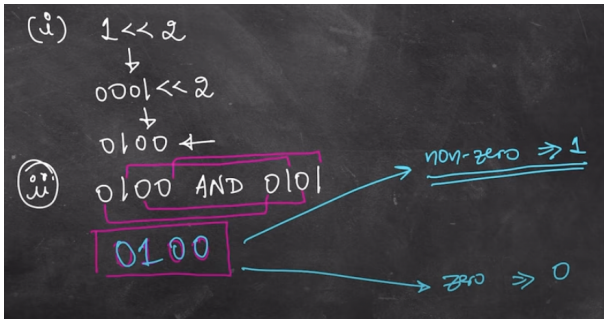

Figure 38: ans

```
public class Bits {
    public static void main(String args[]) {
        int n = 5;
        int pos = 2;
        int bitMask = 1<<pos;

        if ((bitMask & n ) == 0 ) {
            System.out.println("bit was zero");
        } else {
            System.out.println("bit was one");
        }

    }
}
```