Date-20.05.24

Tender Heart High School, Sector-33 B, Chandigarh

Class IX Subject Computer Application

Topic- Operators in Java (Ch-4) Teacher- Prabhdeep Kaur

Good Morning
This lesson is of class 10th for the subject of Computer Application topic operators in Java. In this chapter we learn about how to use datatypes and values in expressions.

Forms of operators: There are three forms of operators in Java as described in following way

1. Unary operator: An operator that has just one operand is known as a unary operator. Examples of unary operator. Example- +, -, ++, --, ! etc.
2. Binary operator: An operator that has two operands is known as a binary operator. Examples of binary operator. Example- +, %, >, &&.
3. Ternary Operator: An operator that has three operands is known as a ternary operator. An example of ternary operator is Example- ?, :.

Types of Operators

1. Arithmetic Operators

Operator	Symbol	Expression (x = 13, y = 2)	Result
Addition	+	x + y	15
Subtraction	-	x - y	11
Multiplication	*	x * y	26
Division	/	x / y	6
Remainder (Modulus)	%	x % y	1

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Program : Write a program (WAP) to demonstrate the use of arithmetic operators.

```
Public class Arithmeticoperators
{
    Public Static void main (string args[])
    {
        Int x=5, y=2;
        System.out.println((x+y) " Addition");
        System.out.println((x-y) " Subtraction");
        System.out.println((x*y) " Multiplication");
        System.out.println((x/y) " Division");
        System.out.println((x%y) " Modulus");
    }
}
```

OUTPUT

```
7 Addition
3 Subtraction
10 Multiplication
2.5 Division
0.052 Modulus
```

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Unary + Operator : The unary plus operator (+) is written before the operand. The operator results in the same value as the operand. Example

If x = 15 then +x results in 15
x = -7 then +x results in -7

Unary - Operator: The unary minus operator (-) also precedes an operand. This operator negates the value of an operand, if an operand is a positive value, it converts the value of that operand to its negative value and vice-versa. Example

If x = 15 then -x results in -15
x = -7 then -x results in 7

String operator (+) : String operator + Sign can be used to concatenate strings. Example
"6" + "5" will result in "65"
"Room" + "39" will result in "Room 39"

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Relational Operators: Relational operators determine the relationship between the two operands by comparing them. The outcome of these operations is a boolean value which is either true or false.

Operator	Symbol	Expression (x = 23, y = 14)	Result
Greater than	>	x > y	true
Less than	<	x < y	false
Equal to	==	x == y	false
Greater than or equal to	>=	x >= y	true
Less than or equal to	<=	x <= y	false
Not equal to	!=	x != y	true

WAP to demonstrate Relational operators

```
Public Static void main (String args[])
{
  int x = 23, y = 17;
  System.out.println(x > y);
  System.out.println(x == y);
  System.out.println(x != y);
}
```

Output

```
true
false
true
```

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Logical Operators : Logical operators operate only on boolean operands and are used to construct complex decision-making expressions.

Program shows use of logical operators:

```
Public Static void main(String args[])
{
    System.out.Println((25>33) && (25<27));
    System.out.println((38>33) || (33<33));
    System.out.Println(!(23>43));
}
```

OUTPUT

```
false
True
True
```

Increment and Decrement Operators : The operators ++ and -- are called increment and decrement operators. These are unary operators have two versions each:

Prefix increment : (++) like ++x

Postfix increment : (++) like x++

Prefix decrement : (--) like --x

Postfix decrement : (--) like x--

Pre stands for before and the Post stands for after.

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Program for Postfix Increment

```
Public Static void main(String args[])
{
   Int y = 15;
   Int z = y++;
   System.out.println("y:" +y);
   System.out.println("z:" +z);
}
```

OUTPUT

y:16
z:15

Rule for postfix increment is first use, then increment.

Program for Prefix Increment

```
public Static void main(String args[])
{
  int Y = 15;
  int Z = ++Y;
  System.out.Println("y:" +y);
  System.out.Println("z:" +z);
}
```

OUTPUT

Y:16
Z:16

Rule for Prefix increment is first increment, then use.

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Conditional Operator (?:)

The conditional operator is also called a ternary operator because it has three operands.

boolean-expression ? expression1 : expression2

Precedence and Associativity of operators

precedence : Each operator has a presedence or we can say priority of an operator. This precedence is used to determine the order of evaluation of an expression involving more than one operator. There are different levels of precedence from high to low.

Associativity : If two operators have the same precedence then they are either evaluated from 'Left to Right' or from 'Right to Left'

Precedence	Operator	Description	Associativity
1	[]	Array index	Left to Right
	()	Method call	
	.	Member access	
2	++	Pre or postfix increment	Right to Left
	--	Pre or postfix decrement	
	+, -	Unary plus, minus	
	~	Bitwise complement	
	!	Logical NOT	
3	(type cast)	Type cast	Right to Left
	new	Object creation	
4	*	Multiplication	Left to Right
	/	Division	
	%	Modulus (remainder)	
5	+, -	Addition, subtraction	Left to Right
	+	String concatenation	

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Now before going further

1. If a = 8 and b=4, the value of a%=b is ____
2. The statement (1==1)? 1:0 evaluates to ____
3. Implicit type conversion is also known as ____
4. An operator taking only single operand for its operation is called ____
5. A ternary operator requires ____ operands to operate on.

Check the answers quickly:

1. 0
2. false
3. Automatic, widening, Type promotion Conversion
4. Unary
5. three

The new Operator: The class may be considered as a data type, and an object as a variable of that data type. Creating the object of the class type involves two steps:

1 Declaring a variable of the class type

```
classname objectname;
Car myCar;
```

2 Object name = new classname();

```
myCar = new Car();
```

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The dot (.) operator

Once the objets have been declared and the memory has been allocated, member variables and member methods can be accessed using the dot(.) operator. Syntax

```
objname.memberVariable;
objname.memberMethod();

Car volkswagen = new Car()
Car lamborghini = new Car()

Car volkswagen.colour = "white";
Car lamborghini.Price = "3.10 crore";
```

Expressions: An expression is a combination of constants, variables, operators and method calls. The value of one expression can be combined with other expressions to form a complex expression.

1. Arithmetic Expression: An Arithmetic represents a numeric value. Further categorised into three subtypes - integer, real and mixed expressions.
2. String Expression: A String expression represents a string value. You cannot add and subtract strings, like numbers, but Java does

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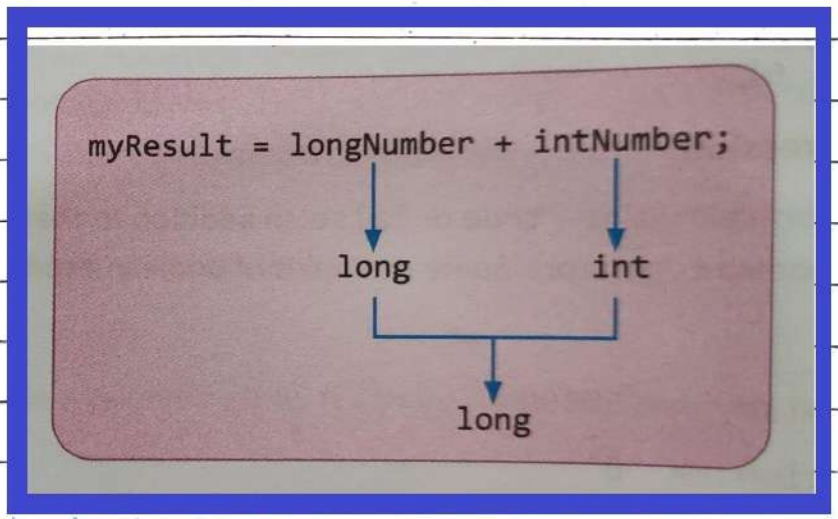
Provide a+ operator for concatenation of strings

3 Boolean (or logical) expression: A boolean expression represents a boolean value - true or false. In addition to arithmetic and relational operators, a boolean expression can contain boolean operators.

Type Conversions: A type conversion is a process that converts a value of one data type to another data type. There are two forms of type conversions: Implicit and Explicit Conversions

Implicit Type Conversions: The type conversion which are automatically performed by the Java compiler are known as implicit type conversions. Implicit type conversion is also known as automatic type conversion, type promotion, widening and coercion conversion.

Example



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Explicit Type Conversions: Where you need to assign an int value to a byte variable. This time, the conversion will not be performed automatically because the byte datatype is smaller in size than int. In this a programmer has to force the conversion and is referred to as explicit or type casting conversion

Example: //Program that shows float value is typecast in int// void main (string args[])

```
{
    float a = 76.89F;
    int b;
    b = (int)a;
    System.out.println(b= "+b);
    System.out.println("a="+a);
    }
}
```

OUTPUT

b = 76 [decimal number missing]

a = 76.89 [F is not in output]

C

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Topic : Operators in Java

Subject Teacher : Prabhdeep

Answer the following:

Ques1. Distinguish between the following:

a. Prefix and Postfix Increment

b. Prefix and Postfix Decrement

c. Unary and Binary Operators

d. Increment and Decrement Operator

e. / and % Operator

Ques2. Explain the term 'typecasting'.

Ques3. What is the purpose of the new operator?

Ques4. Write the output of the following

1.

```
{ int a=4, b=2, c=3;
  System.out.println("output 1:
  "+(a=b*c));
  System.out.println("output 2:
  "+(a=(b*c)));
}
```

2.

```
{int a=2, b=2, c=2;
 System.out.println("output 1:"
 +(a+2<b*c));
 System.out.println("output 2:"
 +(a+2<(b*c)));
}
```

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Topic:-Operators in Java(Ch-4) **AnswerKey**

Multiple Choice Questions

1. n=n+4 2. 11,10 3. 0 4. 0 5. 64 6. 55.0 7. 8 8. -15

Write the Java expressions for the following:

1. p = a * a + b * c
2. m = (a * a - b * b) / (a * b)
3. s = u * t + (1.0 / 2) * a * t * t
4. f = u * v / (u + v)
5. (a + b) * (a + b) + b
6. y = 2 * (l * b + b * h + l * h)
7. a * a + b * b
8. z = x * x * x + y * y * y - x * y / 3

Answer the following questions

1

An operator is a symbol or sign used to specify an operation to be performed in Java programming.

2

The different types of operators are Arithmetical, Logical and Relational.

3

(a) Arithmetical operator

Arithmetic operators are used to perform mathematical operations on its operands. Operands of arithmetic operators must be of numeric type. A few arithmetic operators operate upon one operand. They are called Unary Arithmetic operators. Other arithmetic operators operate upon two operands. They are called Binary Arithmetic operators. As an example consider the below statement:

int a = 10 + 20;

Here, the addition arithmetic operator, represented by the symbol + will add 10 and 20. So variable a will be 30.

(b) Relational operator

Relational operators are used to determine the relationship between the operands. Relational operators compare their operands to check if the operands are equal to (==), not equal to (!=), less than (<), less than equal to (<=), greater than (>), greater than equal to (>=) each other. The result of an operation involving relation operators is a boolean value — true or false.

Example:

```
int a = 8;
int b = 10;
boolean c = a < b;
```

Here, as a is less than b so the result of a < b is true. Hence, boolean variable c becomes true.

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Topic:-Operators in Java(Ch-4) **AnswerKey**

(c) Logical operator

Logical operators operate on boolean expressions to combine the results of these boolean expression into a single boolean value.

Example:

```
int a = 7;
int b = 10;
boolean c = a < b && a % 2 == 0;
```

Here, the result of first boolean expression a < b is true and the result of second boolean expression a % 2 is false. The logical AND operator (&&) combines these true and false boolean values and gives a resultant boolean value as false. So, boolean variable c becomes false.

(d) Unary operator

Operators that act on one operand are called as Unary operators. Unary +, unary -, ++, --, etc. are some unary operators in Java.

(e) New operator

new operator is used to instantiate an object by dynamically allocating memory for it.

(f) Binary operator

Operators that act on two operands are called as Binary operators.

4

condition ? expression 1 : expression 2

Ternary operator evaluates the condition. If the condition is true then result of ternary operator is the value of expression 1. Otherwise the result is the value of expression 2.

Example:

```
boolean isLeapYear = true;
int febDays = isLeapYear ? 29 : 28;
```

Here, the ternary operator checks if the value of boolean variable isLeapYear is true or false. As it is true, expression 1, which in this example is the value 29, is the result of the ternary operator. So, int variable febDays becomes 29.

5

Differentiate between the following:

(a) Arithmetical operator and Logical operator

Arithmetical Operator

Arithmetic operators are used to perform mathematical operations.

+, -, *, /, etc. are a few examples of Arithmetic operators.

Logical Operator

Logical operators operate on boolean expressions to combine the results of these boolean expression into a single boolean value.

&&, ||, ! are a few examples of Logical Operators

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Topic:-Operators in Java(Ch-4) **AnswerKey**

(b) Binary operator and Ternary operator

Binary operator

Binary operators work on two operands.

+, -, *, /, etc. are a few examples of Binary operators.

(c) Logical AND (&&) and Logical OR(||)

Ternary operator

Ternary operator work on three operands.

The conditional operator ? : is a Ternary operator.

Logical AND (&&)

It evaluates to true only if both of its operands are true.

Example:

```
int a = 8, b = 13, c = 0;
if (a > 10 && b > 10)
   c = 10;
else
   c = 5;
```

Here, value of c will be 5 as one of the operands is false.

Logical OR(||)

It evaluates to true if one or both of its operands are true.

Example:

```
int a = 8, b = 13, c = 0;
if (a > 10 || b > 10)
   c = 10;
else
   c = 5;
```

Here, value of c will be 10 as at least one of the operands is true.

(d) Prefix operator and Postfix operator

Prefix Operator

It works on the principle of CHANGE-THEN-USE.

It is written before the operand.

Example:

```
int a = 99;
int b = ++a;
```

After the execution of these two statements, both a and b will have the value of 100.

Postfix Operator

It works on the principle of USE-THEN-CHANGE.

It is written after the operand.

Example:

```
int a = 99;
int b = a++;
```

After the execution of these two statements, a will have the value of 100 and b will have the value of 99.

(e) System.out.print( ) and System.out.println( )

System.out.print( )
It prints data to the console but the cursor remains at the end of the data in the same line.
Next printing takes place from the same line.
System.out.println( )
It prints data to the console and places the cursor in the next line.
Next printing takes place from next line.

6 An operator is a symbol or sign used to specify an operation to be performed whereas an expression is a set of variables, constants and operators i.e. an expression is a combination of operators and operands.

7

If m=5 and n=2 then what will be the output of m and n after execution that will store in (a) & (b)?
(a) m -= n;
m -= n
⇒ m = m - n
⇒ m = 5 - 2
⇒ m = 3
(b) n = m + m/n;
n = m + m/n
⇒ n = 5 + 5 / 2
⇒ n = 5 + 2
⇒ n = 7

8

difference between = and ==.
=
It is the assignment operator used for assigning a value to a variable.
E.g. int a = 10; assigns 10 to variable a.
==
It is the equality operator used to check if a variable is equal to another variable or literal.
E.g. if (a == 10) checks if variable a is equal to 10 or not.

9

a = 58

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Topic:-Operators in Java(Ch-4) **AnswerKey**

10

if x =5

(a) 5* ++x;

5 * ++x

⇒ 5 * 6

⇒ 30

(b) 5* x++;

5 * x++

⇒ 5 * 5

⇒ 25

11

a = 2, b = 3, and c = 9

(a) a - (b++) * (--c);

a - (b++) * (--c)

⇒ 2 - 3 * 8

⇒ 2 - 3 * 8

⇒ 2 - 24

⇒ -22

(b) a * (++b) % c;

a * (++b) % c

⇒ a * (++b) % c

⇒ 2 * (4) % 9

⇒ 8 % 9

⇒ 8

12

If a = 5, b = 9, calculate the value of:

a += a++ - ++b + a;

a += a++ - ++b + a

⇒ a = a + (a++ - ++b + a)

⇒ a = 5 + (5 - 10 + 6)

⇒ a = 5 + 1

⇒ a = 6

13

a = 11 and b = 12

14

tax = income <= 100000 ? 0 : (0.1*income);

15

d = p > 5000 ? p * 5 / 100 : 2 * p / 100;

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Topic:-Operators in Java(Ch-4) **AnswerKey**

Solutions to Unsolved Java Programs

1

(a) (x + 3) / 6 - (2x + 5) / 3; taking the value of x = 5

```
public class Expression
{
   public static void main(String args[]) {
      int x = 5;
      double value = ((x + 3) / 6.0) - ((2 * x + 5) / 3.0);
      System.out.println("Result = " + value);
   }
}
```

(b) $a^2 + b^2 + c^2$ / abc; taking the values a=5,b=4,c=3

```
public class Expression
{
   public static void main(String args[]) {
      int a = 5, b = 4, c = 3;
      double value = (a * a + b * b + c * c) / (double)(a * b * c);
      System.out.println("Result = " + value);
   }
}
```

2

```
public class Salary
{
   public static void main(String args[]) {
      int salary = 25 * 350;
      int fine = 5 * 30;
      int netSalary = salary - fine;
      System.out.println("Monthly Income = " + netSalary);
   }
}
```

3

```
public class CompetitiveExam
{
   public static void main(String args[]) {
      int totalQuestions = 150;
      int c1 = (int)(80 / 100.0 * totalQuestions);
      int c2 = (int)(72 / 100.0 * totalQuestions);
      System.out.println("Correct Answers of Candidate 1 = " + c1);
      System.out.println("Correct Answers of Candidate 2 = " + c2);
   }
}
```

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Topic:-Operators in Java(Ch-4) **AnswerKey**

4

(a) a number is updated from 80 to 90

```
public class PercentIncrease
{
   public static void main(String args[]) {
      int orgNum = 80;
      int newNum = 90;
      int inc = newNum - orgNum;
      double p = inc / (double)orgNum * 100;
      System.out.println("Percentage Difference = " + p + "%");
   }
}
```

(b) a number is updated from 7.5 to 7.2

```
public class PercentIncrease
{
   public static void main(String args[]) {
      double orgNum = 7.5;
      double newNum = 7.2;
      double inc = newNum - orgNum;
      double p = inc / orgNum * 100;
      System.out.println("Percentage Difference = " + p + "%");
   }
}
```

5

```
public class Celsius
{
   public static void main(String args[]) {
      double f = 98.6;
      double c = 5 * (f - 32) / 9.0;
      System.out.println("Temperature in Degree Celsius = " + c);
   }
}
```

6

```
public class QuadRatio
{
   public static void main(String args[]) {
      int r1 = 3, r2 = 4, r3 = 5, r4 = 6;
      double x = 360 / (double)(r1 + r2 + r3 + r4);
      double a = r1 * x;
      double b = r2 * x;
      double c = r3 * x;
      double d = r4 * x;
      System.out.println("Angle A = " + a);
      System.out.println("Angle B = " + b);
```

```
        System.out.println("Angle C = " + c);
        System.out.println("Angle D = " + d);
    }
}
```