COMPUTER APPLICATIONS (86): ICSE Class X

Student Practice Book: Question Bank with Answers

How to use this book

- Try each question on your own first. Look at the answer only after you have tried it.
- Multiple choice: write the letter and one line on why. The reason matters more than the letter.
- Short answers (2 marks): one or two sentences, with the key term in it.
- Programs (15 marks): write the code in BlueJ or any Java editor. Use variable names that describe the data. Test with sample input before you move on.
- Start with Topics 1 to 4, then do the rest. Each topic's program is worth practising in full.

Topic 1: Revision of Class IX syllabus: Java basics, operators, input, Math library, conditional and iterative constructs

Multiple choice (1 mark each)

1.1 The full form of JVM is:

(a) Java Visible Machine
(b) Java Virtual Mode
(c) Java Virtual Machine
(d) Java Visible Mode

Answer: c. JVM stands for Java Virtual Machine.

1.2 What is the output of System.out.println(Math.round(6.6) + Math.ceil(3.4));

(a) 9.0
(b) 11.0
(c) 10.0
(d) 11

Answer: b. Math.round(6.6) = 7 and Math.ceil(3.4) = 4.0, so 7 + 4.0 = 11.0.

1.3 Select the infinite loop:

(a) for(int i=1; i<=10; i++)
(b) for(int i=2; i!=0; i-=3)
(c) for(int i=5; i<=5; i++)
(d) for(int i=1; i>=1; i--)

Answer: b. i starts at 2 and drops by 3 (-1, -4, ...), so it never equals 0 and the loop never ends.

1.4 Which of the following is a valid integer constant? 1. 4 2. 4.0 3. 4.3f 4. "four"

(a) Only 1
(b) 1 and 3
(c) 2 and 4
(d) 1 and 2

Answer: a. 4 is an integer literal. 4.0 and 4.3f are floating-point and "four" is a String.

1.5 Which of the following is an escape sequence character in Java?

(a) /n
(b) \t
(c) /t
(d) //n

Answer: b. \t is the tab escape. Escape sequences begin with a backslash, not a forward slash.

Short answers (2 marks each)

SA 1.1 Name any four tokens of Java.

Answer: Any four of: keywords (e.g. class, int), identifiers (variable/class names), literals (e.g. 25, 'A', "Hi"), operators (e.g. +, *), punctuators (e.g. ;, {}, ()).

SA 1.2 Write an expression in Java for cos x + √(a² + b²).

Answer: Math.cos(x) + Math.sqrt(a*a + b*b)

SA 1.3 What is the result produced by 2 – 10*3 + 100/11? Show the steps.

Answer: 10*3 = 30; 100/11 = 9 (integer division); so 2 - 30 + 9 = -19.

SA 1.4 int x = 20, y = 10, z; Find the value of z in z = ++x * (y--) – y. Show the steps.

Answer: ++x makes x = 21. (y--) gives 10, then y becomes 9. z = 21 × 10 − 9 = 201.

SA 1.5 Give the difference between break and System.exit(0).

Answer: break exits the current switch or loop and continues with the next statement. System.exit(0) ends the whole program.

SA 1.6 Give the difference between the = and == operators.

Answer: = is the assignment operator (stores a value). == is the equality operator (compares two values).

SA 1.7 Predict the output of: (i) Math.pow(25, 0.5) + Math.ceil(4.2) (ii) Math.round(14.7) + Math.floor(7.9)

Answer: (i) 5.0 + 5.0 = 10.0. (ii) 15 + 7.0 = 22.0.

SA 1.8 Write a Java expression to find the sum of the cube root of x and the absolute value of y.

Answer: Math.cbrt(x) + Math.abs(y)

Programs (15 marks each)

P 1.1 [15 marks]

Write a menu-driven program, using switch-case, that lets the user choose one of two series and prints its sum: (1) S = 1/4 + 1/8 + 1/12 + … up to n terms; (2) S = 1/1! − 2/2! + 3/3! − … up to n terms. (! denotes factorial.)

How to approach: Use a switch on the choice. Use a loop from 1 to n. Keep a term and a factorial variable. Option 1 adds 1/(4i) style terms; option 2 alternates sign and divides by the factorial.

P 1.2 [15 marks]

Define a class to accept a 3-digit number and check whether it is a Duck number, i.e. a number containing the digit zero. If the number is not a 3-digit number, display "Invalid". (Example: 103 is a Duck number.)

How to approach: Read the number, check it has 3 digits (100–999), then test whether any digit is 0 by taking % 10 and / 10 in a loop.

P 1.3 [15 marks]

Define a class to accept a number and check whether it is an EvenPal number. A number is EvenPal if it is a palindrome (equal to its reverse) and the sum of its digits is even. (Example: 121 is a palindrome and its digit sum 1+2+1 = 4 is even.)

How to approach: Find the reverse with % and /. Compare with the original (palindrome). Sum the digits and check the sum % 2 == 0.

P 1.4 [15 marks]

Write a program to accept a number and check whether it is a Mark number. A number is Mark if the sum of the squares of its digits is even and the last digit of that sum equals the last digit of the number. (Example: n = 246; sum = 4+16+36 = 56; 56 is even and both end in 6.)

How to approach: Split the number into digits with % 10 and / 10. Add the squares. Check the sum is even and compare sum % 10 with n % 10.

Topic 2: Class as the basis of all computation: objects and classes

Multiple choice (1 mark each)

2.1 Consider the statement: Game cricket = new Game(); Which of the following is true?

(a) Game is an object of cricket class
(b) New keyword creates object Game
(c) Game is a class and cricket is an object
(d) Game and cricket are objects

Answer: c. Game is the class and cricket is an object (instance) of it.

2.2 A picture shows the word Polygon at the top, with three children below it: a triangle, a parallelogram and a pentagon. Choose the correct statement:

(a) Polygon is the object and the pictures are classes
(b) Both polygon and the pictures are classes
(c) Polygon is the class and the pictures are objects
(d) Both polygon and the pictures are objects

Answer: c. Polygon is the general class; the triangle, parallelogram and pentagon are its objects.

2.3 Consider the statements: Computer desktop = new Computer( ); Computer Mainframe = new Computer( ); Name the objects of the class given above:

(a) Desktop, Mainframe
(b) desktop, Mainframe
(c) Computer, Mainframe
(d) Computer, desktop

Answer: b. desktop and Mainframe are the object names. Computer is the class.

Short answers (2 marks each)

SA 2.1 What is the purpose of using the 'new' keyword in a Java program?

Answer: new allocates memory for a new object and calls its constructor to set it up.

SA 2.2 Write the Java statement to create an object named sifra of the class Robot, which takes three double parameters.

Answer: Robot sifra = new Robot(10.0, 5.5, 2.0); (any three doubles)

Programs (15 marks each)

P 2.1 [15 marks]

Define a class StepTracker with members: name (user's name), sw (steps walked), cb (calories burned) and km (distance in km). Methods: accept() to input the name and steps using Scanner; calculate() to find calories burned (steps × 0.04) and distance (steps / 1300); display() to show calories, distance and name. Write a main method that creates an object and calls the methods.

How to approach: Create fields name, sw, cb, km. accept() reads with Scanner. calculate() uses cb = sw × 0.04 and km = sw / 1300.0 (use 1300.0 so it is not integer division). display() prints the three values.

P 2.2 [15 marks]

Define a class employee with eno, ename, age and basic. Methods: accept() using Scanner; calculate() for net = basic + hra + da − pf, where hra = 18.5% of basic, da = 17.45% of basic and pf = 8.10% of basic, with an additional allowance of Rs.5000 if age is above 50; print() the details in tabular form; and a main method.

How to approach: Write hra, da and pf as 18.5%, 17.45% and 8.10% of basic. net = basic + hra + da − pf, plus 5000 if age > 50. Print in a table with \t or printf.

Topic 3: User-defined methods: overloading, call by value / reference, static and pure methods

Multiple choice (1 mark each)

3.1 A method which does not modify the value of variables is termed as:

(a) Impure method
(b) Pure method
(c) Primitive method
(d) User defined method

Answer: b. A pure method does not change the values of its arguments or the object's state.

3.2 Which of the following pairs of methods will cause a compile-time error due to incorrect method overloading?

(a) void test(int a, int b) and void test(double a, double b)
(b) void test(int a, double b) and void test(double a, int b)
(c) void test(int a, double b) and void test(int a)
(d) void test(int a) and int test(int a)

Answer: d. Overloaded methods must differ in their parameter lists. Changing only the return type is not overloading.

3.3 The number of values that a method can return is:

(a) 1
(b) 2
(c) 3
(d) 4

Answer: a. A Java method can return at most one value.

3.4 Invoking a method by passing the objects of a class is termed as:

(a) Call by reference
(b) Call by value
(c) Call by method
(d) Call by constructor

Answer: a. Passing object references to a method is call by reference.

Short answers (2 marks each)

SA 3.1 Give the difference between actual parameter and formal parameter.

Answer: Actual parameters are the values or variables passed in the method call. Formal parameters are the variables in the method header that receive those values.

SA 3.2 Write the prototype of a function search which takes two arguments, a string and a character, and returns an integer value.

Answer: int search(String s, char ch)

SA 3.3 What is the difference between a static member function and a member function which is not static?

Answer: A static method belongs to the class, can be called without an object and can use only static members directly. A non-static method belongs to each object and can use its instance variables.

Programs (15 marks each)

P 3.1 [15 marks]

Define a class to overload the method perform as follows: (i) double perform(double r, double h) returns the curved surface area of a cone, $\pi \times r \times l$, where $l = \sqrt{(r^2 + h^2)}$; (ii) void perform(int r, int c) prints an r × c grid of column numbers using nested for loops; (iii) void perform(int m, int n, char ch) prints the quotient of m ÷ n if ch is 'Q', otherwise prints the remainder if ch is 'R'. Write a main method.

How to approach: Three methods share the name perform: (double, double), (int, int) and (int, int, char). Use nested for loops for the grid. Use / for quotient and % for remainder.

P 3.2 [15 marks]

Define a class to overload the method format as follows: (i) void format() prints the pattern 1 2 3 4 5 / 2 3 4 5 / 3 4 5 / 4 5 / 5 using nested loops only; (ii) int format(String s) returns the sum of the ASCII codes of every character of s (e.g. CAB gives 67 + 65 + 66 = 198); (iii) void format(int n) displays the sum of natural numbers up to n using n(n+1)/2.

How to approach: format() uses nested loops: the outer loop runs rows, the inner loop starts at the row number and runs to 5. format(String) loops over characters with charAt() and adds (int) ch. format(int) returns n*(n+1)/2.

Topic 4: Constructors: default, parameterized and overloaded constructors

Multiple choice (1 mark each)

4.1 A method with the same name as the class, with arguments and no return data type, is termed as:

(a) Parameterized constructor
(b) Default constructor
(c) Non-parameterized constructor
(d) Wrapper class method

Answer: a. A constructor that takes arguments is a parameterized constructor.

4.2 Constructor overloading follows which principle of Object Oriented Programming?

(a) Inheritance
(b) Polymorphism
(c) Abstraction
(d) Encapsulation

Answer: b. Constructor overloading is a form of polymorphism (many forms of one name).

4.3 In constructor overloading, all constructors should have the same name as the class but a different set of _____.

(a) Access specifiers
(b) Classes
(c) Return type
(d) Parameters

Answer: d. Overloaded constructors differ in their parameters, not in name or return type.

4.4 If the name of the class is 'Yellow', which of these can be a possible name for its constructor?

(a) yellow
(b) YELLOW
(c) Yell
(d) Yellow

Answer: d. A constructor must have exactly the same name as the class, including case.

Short answers (2 marks each)

SA 4.1 What is the difference between a constructor function and a member function of a class?

Answer: A constructor has the class name, no return type, runs automatically when an object is created and sets up the object. A member function has a return type (or void) and must be called explicitly.

SA 4.2 Explain the concept of constructor overloading with an example.

Answer: Example: class Box has Box() and Box(int side). Both have the name Box but different parameter lists.

Programs (15 marks each)

P 4.1 [15 marks]

Define a class taximeter with data members taxino (taxi number), name (passenger's name) and km (kilometres travelled). A constructor taximeter() initialises taxino to 0, name to an empty string and km to 0. Methods: input() to store taxino, name and km; calculate() to find the bill using the rate per km for the slab in which km falls (≤ 1 km: Rs 25; > 1 to 6: Rs 10; > 6 to 12: Rs 15; > 12 to 18: Rs 20; > 18: Rs 25); display() to print Taxino, Name, Kilometres travelled and Bill amount in tabular form. Create an object in main() and call all the methods.

How to approach: Give the class a constructor that sets taxino = 0, name = "" and km = 0. Use if-else-if slabs for the rate in input(). Bill = km × rate. Print with a header line.

Topic 5: Library classes: wrapper classes, parse and Character methods, autoboxing and unboxing

Multiple choice (1 mark each)

5.1 Which of the following converts "25" to 25.0?

(a) Double.Parsedouble("25")
(b) Double.parse("25")
(c) Double.parseDouble("25")
(d) Double.parseDouble(25)

Answer: c. Double.parseDouble("25") returns 25.0.

5.2 When an object of a wrapper class is converted to its corresponding primitive data type, it is called:

(a) Boxing
(b) Explicit type conversion
(c) Unboxing
(d) Implicit type conversion

Answer: c. Converting a wrapper object back to a primitive is unboxing.

5.3 Predict the output of: System.out.print(Character.toLowerCase('1'));

(a) 0
(b) 1
(c) A
(d) true

Answer: b. Character.toLowerCase('1') returns '1' unchanged, which prints as 1.

5.4 The wrapper class for the data type char is:

(a) String
(b) Char
(c) Character
(d) Float

Answer: c. The wrapper class for char is Character.

5.5 Character class methods are found in the package called:

(a) java.util
(b) java.lang
(c) java.awt
(d) java.io

Answer: b. The Character class is in the java.lang package, which is imported automatically.

Short answers (2 marks each)

SA 5.1 Differentiate between boxing and unboxing.

Answer: Boxing converts a primitive value into a wrapper object (e.g. int to Integer). Unboxing converts the wrapper object back to a primitive (e.g. Integer to int).

SA 5.2 Differentiate between isUpperCase(char) and toUpperCase(char).

Answer: isUpperCase(char) returns true or false. toUpperCase(char) returns the uppercase form of the character.

Programs (15 marks each)

P 5.1 [15 marks]

Define a class to accept a String and print the number of digits, alphabets and special characters in it. (Example: S = "KAPILDEV@83" gives digits = 2, alphabets = 8, special characters = 1.)

How to approach: Read the string. For each char use Character.isDigit, isLetter, else count as special. Keep three counters.

Topic 6: Encapsulation: access specifiers and scope of variables

Multiple choice (1 mark each)

6.1 Wrapping up of data and methods together as one unit is termed as:

(a) Inheritance
(b) Polymorphism
(c) Encapsulation
(d) Abstraction

Answer: c. Binding data and methods into one unit is encapsulation.

6.2 The access specifier that gives the least accessibility is:

(a) package
(b) public
(c) protected
(d) private

Answer: d. private is the most restrictive access specifier.

6.3 Which of the following is NOT an access specifier?

(a) private
(b) protected
(c) package
(d) public

Answer: c. package is the default access level, not a keyword specifier.

Short answers (2 marks each)

SA 6.1 Define encapsulation.

Answer: Encapsulation is binding data and methods together in a class and restricting direct access to the data.

SA 6.2 Mention the types of access specifiers.

Answer: private, protected and public. (Package access is the default when none is written.)

SA 6.3 What is the difference between a local variable and an instance variable?

Answer: A local variable is declared inside a method or block and exists only there. An instance variable belongs to an object and exists as long as the object does.

Programs (15 marks each)

P 6.1 [15 marks]

Define a class Bank with double variables p (principal), n (time in years), r (rate of interest) and a (amount). Methods: accept() to input p and n using Scanner; calculate() to set the rate by time (up to ½ year: 9%; more than ½ to 1 year: 10%; more than 1 to 3 years: 11%; more than 3 years: 12%) and the amount $a = p(1 + r/100)^n$; display() to print Principal, Time, Rate and Amount in tabular form; and a main method.

How to approach: Use if-else-if for the rate slab by n. Compute a = p × Math.pow(1 + r/100, n). Print headings then values.

P 6.2 [15 marks]

Define a class Eshop with name (item purchased) and price. Methods: accept() using Scanner; calculate() to find the net amount after discount: price 1000–25000 → 5.0%; 25001–57000 → 7.5%; 57001–100000 → 10.0%; more than 100000 → 15.0%; display() to print the item name and net amount; and a main method.

How to approach: Use if-else-if on price for the discount rate. net = price − price × discount / 100. Print name and net.

Topic 7: Arrays: single and double dimensional arrays, sorting (selection and bubble) and searching (linear and binary)

Multiple choice (1 mark each)

7.1 Java statement to access the 5th element of an array X is:

(a) X[4]
(b) X[5]
(c) X[3]
(d) X[0]

Answer: a. Array indexing starts at 0, so the 5th element is X[4].

7.2 The index (subscript) of the last element of an array ar[ ] is:

(a) ar.length( )
(b) ar[ ].length
(c) ar.length()-1
(d) ar.length-1

Answer: d. The last index is ar.length - 1.

7.3 A two-dimensional array P[2][3] holds the peripherals shown: row 1 has Mouse, Keyboard, Printer; row 2 has Scanner, Barcode Scanner, Microphone. The index of Barcode Scanner is:

(a) P[1][1]
(b) P[0][1]
(c) P[1][2]
(d) P[0][0]

Answer: a. Barcode Scanner is in row 1 (second row) and column 1 (middle column), so P[1][1].

7.4 The number of bytes occupied by a character array of 10 elements is:

(a) 20 bytes
(b) 60 bytes
(c) 40 bytes
(d) 120 bytes

Answer: a. 10 elements × 2 bytes per char = 20 bytes.

Short answers (2 marks each)

SA 7.1 Differentiate between linear search and binary search.

Answer: Linear search checks elements one by one and works on unsorted arrays. Binary search repeatedly halves a sorted array and is faster.

SA 7.2 State the number of bytes and bits occupied by a character array of 10 elements.

Answer: 10 elements × 2 bytes = 20 bytes = 160 bits.

Programs (15 marks each)

P 7.1 [15 marks]

Define a class to accept 10 integers in an array and arrange them in ascending order using the selection sort technique. Display the sorted array.

How to approach: Outer loop runs i from 0 to 8. Inner loop finds the smallest element from index i onward and swaps it into position i.

P 7.2 [15 marks]

Define a class that stores the characters 'A','H','N','P','S','U','W','Y','Z','b','d' in an array. Accept a character from the user and search for it using the binary search technique. Print "Search Successful" if found, otherwise "Search is not Successful".

How to approach: Store the 11 characters. Binary search needs sorted order, and the characters are in ASCII order (uppercase before lowercase). Use low, high and mid.

P 7.3 [15 marks]

Write a program to accept the designations of 100 employees in a single dimensional array. Accept a designation from the user and print the number of employees holding that designation.

How to approach: Accept 100 strings, then count matches with equals() (use equalsIgnoreCase if case should not matter).

P 7.4 [15 marks]

Define a class to accept values into a 4 × 4 integer array, and find and display the sum of each row.

How to approach: Use nested loops. For each row, add the four values and print the row sum.

P 7.5 [15 marks]

Define a class to accept values into a 4 × 4 integer array and check whether it is a DIAGONAL array, i.e. the sum of the left diagonal elements equals the sum of the right diagonal elements. Print an appropriate message.

How to approach: Sum the main diagonal (a[i][i]) and the other diagonal (a[i][3-i]). Compare and print the message.

P 7.6 [15 marks]

Define a class to accept values into a 4 × 4 integer array. Calculate and print the NORM of the array, which is the square root of the sum of squares of all its elements.

How to approach: Sum the squares of all 16 elements inside nested loops, then print Math.sqrt(sum).

P 7.7 [15 marks]

Write a program to accept a two-dimensional integer array of order 4 × 5. Check whether it is a Sparse Matrix, i.e. the number of zero elements is greater than the number of non-zero elements. Print appropriate messages.

How to approach: Count zeros and non-zeros in nested loops over a 4 × 5 array. Compare the counts and print the message.

Topic 8: String handling: String class methods and their use in programs

Multiple choice (1 mark each)

8.1 What is the output of "Remarkable".substring(6)?

(a) mark
(b) emark
(c) marka
(d) able

Answer: d. "Remarkable" has indexes 0 to 9; substring(6) starts at index 6, giving "able".

8.2 The output of "COMPOSITION".substring(3, 6) is:

(a) POSI
(b) POS
(c) MPO
(d) MPOST

Answer: b. substring(3, 6) takes indexes 3, 4 and 5, which are P, O and S, giving "POS".

8.3 What is the output of "ANGER".compareTo("ANGEL")?

(a) 3
(b) -6
(c) 6
(d) 0

Answer: c. 'R' (82) − 'L' (76) = 6, the difference at the first mismatch.

8.4 The output of "CONCENTRATION".indexOf('T') is:

(a) 9
(b) 7
(c) 6
(d) (-1)

Answer: c. The letter T is at index 6 in CONCENTRATION.

8.5 Which of the following returns a String?

(a) length()
(b) charAt(int)
(c) replace(char, char)
(d) indexOf(String)

Answer: c. replace() returns a String. length() returns int, charAt() returns char and indexOf() returns int.

Short answers (2 marks each)

SA 8.1 Give the output of: "TRANSPARENT".toLowerCase(); and "TRANSPARENT".compareTo("TRANSITION")

Answer: toLowerCase() gives "transparent". compareTo gives 7, since 'P' (80) − 'I' (73) = 7.

SA 8.2 Write a Java statement to find and display the position of the last space in a string str, and another statement to extract the second character of str.

Answer: int pos = str.lastIndexOf(' '); and char c = str.charAt(1);

SA 8.3 String s = "application"; int p = s.indexOf('a'); System.out.println(p); System.out.println(p + s); Predict the output.

Answer: Output: 0 then 0application (indexOf('a') is 0, and p + s is 0 followed by the string).

Programs (15 marks each)

P 8.1 [15 marks]

Define a class to accept a String and print whether it is a Super String. A String is Super if the number of uppercase letters equals the number of lowercase letters. Use Character and String methods only. (Example: "COmmITmeNt" has 5 uppercase and 5 lowercase letters.)

How to approach: Loop with charAt(i). Use Character.isUpperCase and Character.isLowerCase to count each. Compare the counts.

P 8.2 [15 marks]

Define a class to accept a String, convert it to uppercase, and create and display a new string by replacing each vowel with the immediately next character and each consonant with the previous character. Other characters remain the same. (Example: #IMAGINATION@2024 gives #JLBFJMBSJPM@2024.)

How to approach: Convert to uppercase. For each letter: if vowel, add the next letter (char + 1); if consonant, add the previous letter (char − 1). Other characters are copied as they are.

P 8.3 [15 marks]

Write a program to input a string, convert it to uppercase, and print the pairs of vowels occurring in it together with the number of such pairs. (Example: "BEAUTIFUL BEAUTIES" gives pairs EA, AU, EA, AU, IE and count 5.)

How to approach: Convert to uppercase. Scan the string and, whenever two vowels appear next to each other, print the pair and count it. (Check your count against the example.)