Mathematics — Ganita Manjari

Chapter 11 Test 3

The World of Algorithms

Class IX | 2026–27

Time Allowed: 45 Minutes | Maximum Marks: 25

General Instructions

1. All 13 questions are compulsory. Choose one option in A; show working in B–D.
2. No calculators. Give exact answers unless an approximation is requested.
3. Unless stated otherwise, inputs are positive integers. Give precise algorithm steps.

SECTION A

(5 questions × 1 mark = 5 marks)

1. Before scanning candidates for divisors of n, the output list should be:

(A) [0]
(B) [n, n]
(C) [1, 2, 3]
(D) [ ]

2. A divisor scan tests only $1,2, \ldots, n-1$. Which divisor is always omitted?

(A) 0
(B) n
(C) $n+1$
(D) No divisor

3. Using divisor pairs, how many candidates from 1 upward need testing for all divisors of 80?

(A) 8
(B) 9
(C) 40
(D) 80

4. When divisor pairs of 49 are listed without repeated entries, which pair contributes only one entry?

(A) (1, 49)
(B) (2, 24.5)
(C) (7, 7)
(D) (0, 49)

5. Which entry belongs in the list of prime divisors of 90?

(A) 1
(B) 9
(C) 15
(D) 5

SECTION B

(4 questions × 2 marks = 8 marks)

6. Find all divisor pairs of 72, then write its divisors once each in increasing order.

7. Execute the basic divisor-list algorithm for $n = 1$. Explain why the result does not make 1 prime.

8. A pair-based routine outputs the divisors of 20 as [1, 20, 2, 10, 4, 5]. It reports the last entry as the largest divisor. Diagnose and fix the error.

9. While finding divisors of 21, a program stops at the first candidate that does not divide 21. Show what it misses and repair the stopping rule.

SECTION C

(3 questions × 3 marks = 9 marks)

10. Justify why testing positive integers j with $j^2 \leq n$ is enough to find every divisor of n by pairing j with $n \div j$.

11. Show that the square of a prime p has exactly three distinct positive divisors. Use this to identify all numbers from 1 to 30 with exactly three divisors.

12. Write an algorithm that takes $n \geq 2$ and returns its distinct prime divisors in increasing order. Explain why repeated prime factors appear only once.

SECTION D

(1 application question × 3 marks = 3 marks)

13. Thirty-six identical square tiles are arranged into rectangles. Rotated versions count as the same layout. List every possible side-length pair and identify the square layout.