Mathematics — Ganita Manjari

Chapter 11 Test 5

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. Why may an increasing scan of common divisors replace the stored answer whenever it finds another common divisor?

(A) Each new one is larger

(B) Each new one is prime

(C) The inputs become equal

(D) The earlier values were not divisors

2. A common-divisor scan starts at $min(m, n)$ and moves downward. When can it stop?

(A) At the first failed test

(B) Only after reaching 0

(C) At the first common divisor

(D) Only after testing $m + n$

3. Separate full divisor scans for 24 and 40 visit 64 candidate values in total. One combined scan from 1 through 40 visits how many candidates?

(A) 24

(B) 40

(C) 64

(D) 960

4. Why can a list-free GCD scan start with the stored answer equal to 1?

(A) Every GCD equals 1

(B) 1 is the largest input

(C) 1 is prime

(D) 1 divides both inputs

5. Why is candidate 0 excluded from a positive-divisor scan?

(A) Division by 0 is undefined

(B) 0 is greater than every input

(C) 0 has two prime factors

(D) All candidates must be odd

SECTION B

(4 questions × 2 marks = 8 marks)

6. For inputs 18 and 30, initialise $g = 1$ and scan $k = 2,3, \ldots$. Replace g by k only when k divides both inputs. Give g after $k = 2,3,4,5,6$.

7. A scan through 1 to 6 replaces g by k whenever k divides 6 OR 10. Find its final output and explain why this does not compute the GCD.

8. A list-free GCD routine starts with $g = 1$ and tests every integer from 2 through $min(m, n)$. How many candidates does it test for (120, 35) and for (1, 900)?

9. A programmer scans common divisors upward from 1 but returns immediately at the first success. Give a pair of inputs for which this fails and explain the output.

SECTION C

(3 questions × 3 marks = 9 marks)

10. Prove that scanning only through $min(m, n)$ cannot miss a positive common divisor. Then explain why scanning through $max(m, n)$ is unnecessary for this task.

11. A combined scan visits $j = 1, \ldots, max(m, n)$ and always performs both divisibility tests at each visit. Compare its number of divisibility tests with separate full scans for $m = 12, n = 20$.

12. A routine scans from $min(m, n)$ down to 1 and overwrites g at every common divisor. Determine its final output and give two different repairs.

SECTION D

(1 application question × 3 marks = 3 marks)

13. A device can visit at most 100 candidate values. To find the GCD of 84 and 126, it may use separate full scans, one scan to the larger input, or one scan to the smaller input. Which methods meet the budget, and what is the GCD?