BSHS

IEEJA

Number Theory (Quantitative Aptitude)

SET **A**

Questions: **19**
Duration: **120min**

Question Text Array Format

This section demonstrates basic questions on Number Theory using the question_text array for line breaks.

1. *What is a natural number greater than 1 that has no positive divisors other than 1 and itself?*
   - A. Integer
   - B. Perfect number
   - C. Composite number
   - D. Prime number

2. *The Fundamental Theorem of Arithmetic states that every integer greater than 1 can be uniquely represented as a product of prime numbers.*

   Which of the following is the correct prime factorization of 84?
   - A. $2^2 \times 3 \times 7$
   - B. $2 \times 6 \times 7$
   - C. $4 \times 3 \times 7$
   - D. $2 \times 3 \times 14$

3. *A perfect number is a positive integer that is equal to the sum of its proper positive divisors.*

   For example, the proper divisors of 6 are 1, 2, and 3, and their sum is 1 + 2 + 3 = 6.

   Which of the following numbers is the next perfect number after 6?
   - A. 28
   - B. 30
   - C. 12
   - D. 24

LIST Placeholder Format

This section demonstrates questions on Number Theory using the LIST placeholder with a list_items array.

4. *Consider the properties of the number 36:*

   i. It is a perfect square.
   ii. It is a prime number.
   iii. It is an abundant number.
   iv. Its prime factorization is $2^2 \times 3^2$.

   Which of the properties listed above are true for the number 36?
   - A. i and iv only
   - B. ii and iii only
   - C. All of the above
   - D. i, iii, and iv only

5. *The Euclidean algorithm is a method for finding the greatest common divisor (GCD) of two integers.*

   The steps for finding the GCD of 48 and 18 are shown below:

   Step 1: $48 = 2 \times 18 + 12$
   Step 2: $18 = 1 \times 12 + 6$
   Step 3: $12 = 2 \times 6 + 0$

   What is the GCD of 48 and 18?
   - A. 12
   - B. 48
   - C. 18
   - D. 6

6. *Consider the set of integers below:*

   2, 9, 15, 23, 51

   Which of the numbers in the list are prime?
   - A. 9 and 15
   - B. 2 and 23
   - C. 2, 23, and 51
   - D. All are prime

STATEMENT/STATEMENTS Placeholder Format

This section demonstrates questions on Number Theory using STATEMENT and STATEMENTS placeholders.

7. *Consider the following statement from number theory:*

   Statement:

   The Twin Prime Conjecture states that there are infinitely many pairs of prime numbers that differ by 2.

   Is this statement a proven theorem or an unproven conjecture?
   - A. It is not a valid mathematical statement.
   - B. It has been disproven.
   - C. It is an unproven conjecture.
   - D. It is a proven theorem.

8. *Review the following statements about divisibility rules:*

   Statement I:

   A number is divisible by 3 if the sum of its digits is divisible by 3.

   Statement II:

   A number is divisible by 9 if the sum of its digits is divisible by 9.

   Which of these statements are correct?
   - A. Neither statement is correct
   - B. Both Statement I and Statement II
   - C. Statement I only
   - D. Statement II only

9. *Consider the following assertion and reasoning:*

   Assertion (A):

   The numbers 15 and 28 are coprime.

   Reasoning (R):

   Two integers are coprime (or relatively prime) if their greatest common divisor (GCD) is 1.

   Evaluate the correctness of the assertion and reasoning.
   - A. A is correct, but R is incorrect.
   - B. R is correct, but A is incorrect.
   - C. Both A and R are incorrect.
   - D. Both A and R are correct, and R is the correct explanation for A.

PARAGRAPH Placeholder Format

This section demonstrates questions on Number Theory using the PARAGRAPH placeholder.

10. *Read the following description of a famous problem in number theory:*

Goldbach's Conjecture is one of the oldest and best-known unsolved problems in number theory. It states that every even integer greater than 2 is the sum of two prime numbers.

Which of the following expresses the number 20 as a sum of two prime numbers, consistent with the conjecture?

A. 7 + 13 **B.** 1 + 19
C. 10 + 10 **D.** 5 + 15

11. *Read the passage about the Fibonacci sequence:*

The Fibonacci sequence is a series of numbers where each number is the sum of the two preceding ones, usually starting with 0 and 1. The sequence begins: 0, 1, 1, 2, 3, 5, 8, 13, ...

What is the next number in this sequence?

A. 18 **B.** 21
C. 20 **D.** 23

12. *The following paragraph describes modular arithmetic:*

In modular arithmetic, we are concerned with the remainder when an integer is divided by another integer, called the modulus. The expression 'a ≡ b (mod n)' means that a and b have the same remainder when divided by n. The value of 'a mod n' is the remainder of the division a ÷ n.

Based on this definition, what is the value of 17 mod 5?

A. 3 **B.** 1
C. 4 **D.** 2

MTF (Match The Following) Placeholder Format

This section demonstrates match-the-following questions on Number Theory using the MTF_DATA placeholder.

13. *Match the number theory terms with their correct definitions:*

Term	-	Definition
i. Prime	-	a. Two integers with a GCD of 1.
ii. Coprime	-	b. An integer equal to the sum of its proper divisors.
iii. Perfect	-	c. A natural number > 1 with only two divisors: 1 and itself.

Which option shows the correct matching?

A. i-b, ii-c, iii-a **B.** i-a, ii-b, iii-c
C. i-c, ii-a, iii-b **D.** i-c, ii-b, iii-a

14. *Match the mathematical notation with its meaning in number theory:*

Notation	-	Meaning
1. a | b	-	a. The greatest common divisor of a and b.
2. gcd(a, b)	-	b. a and b have the same remainder when divided by n.
3. a ≡ b (mod n)	-	c. a divides b (b is a multiple of a).

Which option correctly matches the notations to their meanings?

A. 1-b, 2-c, 3-a **B.** 1-c, 2-a, 3-b
C. 1-a, 2-b, 3-c **D.** 1-c, 2-b, 3-a

15. *Match each number with its unique prime factorization:*

Number	-	Prime Factorization
A. 56	-	1. $3^2 \times 11$
B. 99	-	2. $2^3 \times 3 \times 5$
C. 120	-	3. $2^3 \times 7$

Which pairing is correct?

A. A-3, B-2, C-1 **B.** A-1, B-2, C-3
C. A-2, B-3, C-1 **D.** A-3, B-1, C-2

Mixed Placeholder Combinations

This section demonstrates complex questions on Number Theory by combining multiple placeholders.

16. *Read the definition of amicable numbers:*

Amicable numbers are two different positive integers such that the sum of the proper divisors of each is equal to the other number. A proper divisor of a number is a positive divisor other than the number itself.

Consider the following pairs of numbers:

i. (110, 150)
ii. (220, 284)
iii. (300, 310)

Which pair from the list is amicable?

A. Pair ii **B.** Pair iii
C. Pair i **D.** None of the pairs are amicable

17. *The Chinese Remainder Theorem helps solve systems of congruences.*

The Chinese Remainder Theorem can find an integer x that satisfies multiple remainder conditions simultaneously. For example, finding an integer x that leaves a remainder of 2 when divided by 3, and a remainder of 3 when divided by 5.

Consider the following system of congruences:

Condition I:
x ≡ 2 (mod 3)

Condition II:
x ≡ 3 (mod 5)

Which number from the list below is the smallest positive integer solution?

A. 11 **B.** 8
C. 5 **D.** 13

18. *Consider the numbers in the list below:*

12, 17, 25, 30

Review the following properties:

Statement I:
The number is a composite number.

Statement II:
The number is a deficient number (the sum of its proper divisors is less than the number).

Which number from the list satisfies both Statement I and Statement II?

A. 17 **B.** 12
C. 30 **D.** 25

19. *Read the definition of a Mersenne Prime:*

A Mersenne prime is a prime number that can be written in the form 2^p − 1, where p must also be a prime number. Not all numbers of this form with a prime p are themselves prime.

Now evaluate the following statements:

Assertion (A):
The number 31 is a Mersenne prime.

Reasoning (R):
31 can be expressed as 2^5 − 1, and 5 is a prime number.

Based on the definition provided, what is the most logical conclusion?

A. Both A and R are incorrect
B. A is correct, but R is incorrect
C. R is correct, but A is incorrect
D. Both A and R are correct, and R explains A

* * * * **END** * * * *