

**I. PART 1. MULTIPLE CHOICE QUESTIONS (7.0 points)**

Write the correct answer (A, B, C, or D) for each of the following questions in the correspondingly numbered space on your answer sheet.

**Question 1:** When a certain number is divided by 9, the quotient is 6 and the remainder is 6. The number is \_\_\_\_.

- A. 60                      B. 42                      C. 33                      D. 67

**Question 2:** The sum of nine consecutive positive integers is 99. The smallest of these integers is \_\_\_\_.

- A. 15                      B. 11                      C. 6                      D. 7

**Question 3:** The digits 1, 2, 3, 4 can be arranged to form twenty-four different four-digit numbers. If these twenty-four numbers are then listed from the smallest to largest, in which position is 3214?

- A. 13th                      B. 14th                      C. 15th                      D. 16th

**Question 4:** The sum of the digits of a five-digit positive integer is 2. (A five-digit integer cannot start with zero.) The number of such integers is \_\_\_\_.

- A. 1                      B. 2                      C. 3                      D. 5

**Question 5:** Use only digits 1, 2, 3, 4, and 5, a sequence is created as follows: one 1, two 2, three 3, four 4, five 5, six 1, seven 2, and so on. The sequence appears as: 1, 2, 2, 3, 3, 3, 4, 4, 4, 4, 5, 5, 5, 5, 5, 1, 1, 1, 1, 1, 2, 2, .... The 100th digit in the sequence is \_\_\_\_.

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

**Question 6:** How many different values of  $k$  is the 4-digit number  $\overline{7k52}$  divisible by 12?

- A. 0                      B. 1                      C. 2                      D. 3

**Question 7:** The numbers 49, 29, 9, 40, 22, 15, 53, 33, 13, 47 are grouped in pairs so that the sum of each pair is the same. Which number is paired with 22?

- A. 33                      B. 40                      C. 49                      D. 53

**Question 8:** A number is called *Beprisque* if it is the only natural number between a prime number and a perfect square (e.g. 10 is Beprisque but 12 is not). The number of *two-digit* Beprisque numbers (including 10) is \_\_\_\_.

- A. 4                      B. 2                      C. 3                      D. 5

**Question 9:** A number is formed using the digits 1, 2, ..., 9. Any digit can be used more than once, but adjacent digits cannot be the same. Once a pair of adjacent digits has occurred, that pair, in that order, cannot be used again. How many digits are there in the largest number?

- A. 72                      B. 73                      C. 144                      D. 145

**Question 10:** Today is Wednesday. What day of the week will it be 100 days from now?

- A. Monday                      B. Tuesday                      C. Thursday                      D. Friday

**Question 11:** The 50th term in the sequence  $5, 6x, 7x^2, 8x^3, 9x^4, \dots$  is \_\_\_\_.

- A.  $54x^{49}$                       B.  $54x^{50}$                       C.  $45x^{50}$                       D.  $55x^{49}$

**Question 12:** When 12345678 is divided by 10, the remainder is \_\_\_\_.

- A. 8                      B. 2                      C. 4                      D. 6

**Question 13:** Which of the following language that computer can understand and execute?

- A. Machine language                      B. C programming language  
C. Pascal programming language                      D. None of above

**Question 14:** Which type of language is C++ or Pascal?

- A. High-level language                      B. Low-level language  
C. Middle-level language                      D. None of the above

**Question 15:** Which of the following is a correct identifier in C++ or Pascal programming language?

- A. 7var\_name                      B. 7VARNAME                      C. VAR\_1234                      D. \$var\_name

**Question 16:** Which of the following is **NOT** a correct identifier in C++ or Pascal programming language?

- A. 2\_ABC13                      B. A\_BC\_321                      C. \_ABC123                      D. A\_2BC13

**Question 17:** How many bits are there in a byte?

- A. 16                      B. 8                      C. 6                      D. 4

**Question 18:** Which of the following is used for comment in C++ (or Pascal) ?

- A. // comment                      B. /\* comment \*/                      C. ((\* comment \*)                      D. \*/ comment \*/

**Question 19:** Which of the following is called division operator?

- A. +                      B. -                      C. \*                      D. /

**Question 20:** How many relational operators are there in C++ (or Pascal)?

- A. 3                      B. 4                      C. 5                      D. 6

**Question 21:** How many arithmetic operators are there in C++ (or Pascal)?

- A. 3                      B. 4                      C. 5                      D. 6

**Question 22:** The “*longint*” integer type in C++ (or “*longint*” integer type in Pascal) is\_\_\_\_\_.

- A. unsigned integer of at least 64 bits  
B. signed integer of at least 32 bits  
C. unsigned integer of at least 32 bits  
D. signed integer of at least 64 bits

**Question 23:** What is the condition in *if* <condition> statement?

- A. Constant                      B. Variable                      C. Boolean expression                      D. Statements

**Question 24:** What is the *i:=i+I;* statement in Pascal (or the *i=i+I;* statement in C++) called?

- A. Assignment statement  
B. Looping statement  
C. Conditional statement  
D. Compound statement

**Question 25:** Which of the following is **false**?

- A. Variable values can change while a program runs  
B. Variables can be processed by most of data  
C. All variables use the same amount of memory  
D. Variables must be stored in a database or file if they are to be retained when the program ends

**Question 26:** Which type does integers numbers with 2 bytes of allocated memory belong to?

- A. Integer type in Pascal (or short type in C++)  
B. Longint type in Pascal (or int type in C++)  
C. Char type in Pascal (or char type in C++)  
D. Boolean type in Pascal (or bool type in C++)

**Question 27:** What is the range of 16 bit signed integer?

- A. From 0 to 255                      B. From  $-2^{15}$  to  $2^{15}-1$                       C. From 0 to  $2^{16}-1$                       D. From  $-2^{31}$  to  $2^{31}-1$

**Question 28:** What is the range of 32 bit unsigned integer?

- A. From 0 to 255                      B. From  $-2^{15}$  to  $2^{15}-1$                       C. From 0 to  $2^{32}-1$                       D. From  $-2^{31}$  to  $2^{31}-1$

**Question 29:** To calculate the memory you will use when programming a problem, you need to know\_\_\_\_\_.

- A. the physical address location in memory  
B. variable's name  
C. the size of the memory used by the data type of the variables  
D. the size of the computer's external memory

**Question 30:** How many bytes are allocated when you use two 16-bit signed integer variables and three 32-bit unsigned integer variables?

- A. 4                      B. 12                      C. 6                      D. 16

**Question 31:** What kind of operator denoted by “NOT” in Pascal (or “!” in C++) ?

- A. Arithmetic operators  
B. Relational and comparison operators  
C. Logical operators  
D. Assignment operator

*You can choose either Pascal programming language or C++ programming language to do the following questions:*

**Question 32:** What is the value of **u** after running the following code:

The code is written by the Pascal Programming Language	The code is written by the C++ Programming Language
<pre> Var x,y,u,i:integer; begin   x:=54; y:=81; u:=0;   for i:=1 to x do     if (x mod i=0) and (y mod i =0) then       u:=i;   write(u);   readln; end.</pre>	<pre> #include &lt;iostream&gt; using namespace std; int main() {   int x=54, y=81,u;   for(int i=1;i&lt;=x;i++)     if (x%i==0 &amp;&amp; y%i==0)       u=i;   cout&lt;&lt;u;   return 0; }</pre>

A. 9                      B. 1                      C. 3                      D. 27

**Question 33:** What is the value of **x** after running the following code:

The code is written by the Pascal Programming Language	The code is written by the C++ Programming Language
<pre> Var   a,b,x:integer; begin   a:=1234; b:=23; x:=0;   while a&gt;=b do     begin       a:=a-b;       x:=x+1;     end;   write(x);   readln; end.</pre>	<pre> #include &lt;iostream&gt; using namespace std; int main() {   int a=1234, b=23, x=0;   while (a&gt;=b)   {     a=a-b;     x=x+1;   }   cout&lt;&lt;x;   return 0; }</pre>

A. 1211                      B. 1                      C. 53                      D. 15

**Question 34:** What is the value of **x** after running the following code:

The code is written by the Pascal Programming Language	The code is written by the C++ Programming Language
<pre> var   x,y:integer; begin   x:=15; y:=8;   x:=x+y;   y:=x-y;   x:=x-y;   write(x);   readln; end.</pre>	<pre> #include &lt;iostream&gt; using namespace std; int main() {   int x=15, y=8;   x=x+y;   y=x-y;   x=x-y;   cout&lt;&lt;x;   return 0; }</pre>

A. 15                      B. 8                      C. 23                      D. 7

**Question 35:** What is the value of **s** after running the following code:

The code is written by the Pascal Programming Language	The code is written by the C++ Programming Language
<pre> var   s,i:integer; begin   s:=0;   for i:=2 to 10 do     if i mod 2=0 then       s:=s+i;   write(s);   readln; end.</pre>	<pre> #include &lt;iostream&gt; using namespace std; int main() {   int s=0;   for(int i=2;i&lt;=10;i=i+2)     s=s+i;   cout&lt;&lt;s;   return 0; }</pre>

A. 30                      B. 54                      C. 25                      D. 55

## II. PART II. PROBLEMS SOLVING (3.0 points)

Write program by Pascal (or C++) programming language to solve the following problems:

### Question 1. (1.0 point)

LCM (Least Common Multiple) of two positive integer numbers is the smallest positive integer number which can be divided by both numbers. For example, LCM of 15 and 20 is 60, and LCM of 5 and 7 is 35. Your task is: "Given positive integers N and M, you must write a program which finds LCM of N and M."

**Input:** It contains two positive integers, N ( $1 \leq N \leq 10^9$ ) and M ( $1 \leq M \leq 10^9$ ).

**Output:** It contains the required value from the task.

**Example:**

Input	Output
15 20	60

### Question 2. (1.0 point)

Your task is: "Given a number N, you must find its total number of divisors, then you check if they are odd or even". For example, the number 10 has four divisors which are 1, 2, 5, 10. So, four is an even number.

**Input:** It contains an positive integer, N ( $1 \leq N \leq 10^{18}$ )

**Output:** It contains "odd" if its total number of divisors is odd, and "even" if its total number of divisors is even.

**Example:**

Input	Output
100	odd

### Question 3. (1.0 point)

In math, a number is said to be divisible by another number if the remainder is 0. For example: 15 is divisible by 3, because  $15 \div 3 = 5$  exactly but 9 is not divisible by 2 because  $9 \div 2$  is 4 with 1 left over. Your task is: "Given positive integers m, n, a, and b, you must find how many integers from range m to n are divisible by a or b"

**Input:** It contains four positive integers, m, n, a, b ( $1 \leq m \leq n \leq 10^{18}, 1 \leq a, b \leq 10^9, a \neq b$ ).

**Output:** It contains the required value from the task.

**Example:**

Input	Output	Explanation
3 11 2 3	6	There are total 6 numbers from 3 to 11 which are divisible by 2 or 3 i.e, 3, 4, 6, 8, 9, 10

**-THE END-**

Student's full name: ..... Student's ID: .....

First observer's name and signature: ..... Second observer's name and signature: .....