TEAM _____ SET 1

1. Multiples of 3 and 5

If we list all the natural numbers below 10 that are multiples of 3 or 5, we get 3, 5, 6 and 9. The sum of these multiples is 23.

Find the sum of all the multiples of 3 or 5 below **70000000**.

Answers: (Hint: Use long datatype)

2. Even Fibonacci numbers

Each new term in the Fibonacci sequence is generated by adding the previous two terms. By starting with 1 and 2, the first 10 terms will be:

1, 2, 3, 5, 8, 13, 21, 34, 55, 89, ...

By considering the terms in the Fibonacci sequence whose values do not exceed **40000000**, find the sum of the even-valued terms.

Answers: (Hint: Use long datatype)

3. Largest prime factor

The prime factors of 13195 are 5, 7, 13 and 29.

What is the largest prime factor of the number **600851475143**?

Answers: (Hint: Use long datatype)

4. Largest palindrome product

A palindromic number reads the same both ways. The largest palindrome made from the product of two 2-digit numbers is 9009 = 91 × 99.

Find the largest palindrome made from the product of two **4**-digit numbers, and write their factors. For example, the answer for largest palindrome made from a product of two 2-digit number, will be written as follows,

9009 = 91 x 99 (Write your answer accordingly)

Answers: (Hint: Use long datatype)

5. Smallest Multiple

2520 is the smallest number that can be divided by each of the numbers from 1 to 10 without any remainder.

What is the smallest positive number that is evenly divisible by all of the numbers from **1** to **30**?

Answers: (Hint: Use long datatype)

6. Nth Prime Number

By listing the first six prime numbers: 2, 3, 5, 7, 11, and 13, we can see that the 6th prime is 13.

What is the **11001**th prime number?

Answers:

7. Large Sum

Work out the first ten digits of the sum of the one-hundred 50-digit numbers present in the file **Q7.c** or **Q7.cpp** or **Q7.java** in the form of a String array. **Q7.txt** has also been provided which contains the one-hundred 50-digit numbers in plain text as well.

Answers: (Hint: The sum contains 52 digits)

8. Largest Product in a Series

The four adjacent digits in the 1000-digit number (present in file **Q8.txt**) that have the greatest product are **9 × 9 × 8 × 9 = 5832**. Find the **14** adjacent digits in the 1000-digit number that have the greatest product. What is the value of this product?

The number is present in file **Q8.c** or **Q8.cpp** or **Q8.java** in the form of a String. **Q8.txt** has also been provided which contains the 1000-digit number in plain text as well.

Answers: (Hint: Use long datatype)

9. Largest product in a grid

In the 20×20 grid below, four numbers along a diagonal line have been made **bold**.

08 02 22 97 38 15 00 40 00 75 04 05 07 78 52 12 50 77 91 08
49 49 99 40 17 81 18 57 60 87 17 40 98 43 69 48 04 56 62 00
81 49 31 73 55 79 14 29 93 71 40 67 53 88 30 03 49 13 36 65
52 70 95 23 04 60 11 42 69 24 68 56 01 32 56 71 37 02 36 91
22 31 16 71 51 67 63 89 41 92 36 54 22 40 40 28 66 33 13 80
24 47 32 60 99 03 45 02 44 75 33 53 78 36 84 20 35 17 12 50
32 98 81 28 64 23 67 10 **26** 38 40 67 59 54 70 66 18 38 64 70
67 26 20 68 02 62 12 20 95 **63** 94 39 63 08 40 91 66 49 94 21
24 55 58 05 66 73 99 26 97 17 **78** 78 96 83 14 88 34 89 63 72
21 36 23 09 75 00 76 44 20 45 35 **14** 00 61 33 97 34 31 33 95
78 17 53 28 22 75 31 67 15 94 03 80 04 62 16 14 09 53 56 92
16 39 05 42 96 35 31 47 55 58 88 24 00 17 54 24 36 29 85 57
86 56 00 48 35 71 89 07 05 44 44 37 44 60 21 58 51 54 17 58
19 80 81 68 05 94 47 69 28 73 92 13 86 52 17 77 04 89 55 40
04 52 08 83 97 35 99 16 07 97 57 32 16 26 26 79 33 27 98 66
88 36 68 87 57 62 20 72 03 46 33 67 46 55 12 32 63 93 53 69
04 42 16 73 38 25 39 11 24 94 72 18 08 46 29 32 40 62 76 36
20 69 36 41 72 30 23 88 34 62 99 69 82 67 59 85 74 04 36 16
20 73 35 29 78 31 90 01 74 31 49 71 48 86 81 16 23 57 05 54
01 70 54 71 83 51 54 69 16 92 33 48 61 43 52 01 89 19 67 48

What is the greatest product of **5** adjacent numbers in the same direction (up, down, left, right, or diagonally) in the 20×20 grid? The number is present in file **Q9.c** or **Q9.cpp** or **Q9.java** in the form of an **integer 2D-array**. **Q9.txt** has also been provided which contains the grid in plain text as well.

Answers: (Hint: Use long datatype)

10. Vigenere Cipher

This scheme of cipher uses a text string (say, a word) as a key, which is then used for doing a number of shifts on the plaintext.

For example, let's assume the key is "**POINT**". Each alphabet of the key is converted to its respective numeric value. In this case,

P -> 16, **O -> 15**, **I -> 9**, **N -> 14**, and **T -> 20**

Thus, the shift values are 16, 15, 9, 14, 20

The sender and the receiver decide on a key. Say "**POINT**" is the key. Numeric representation of the key is "16 15 9 14 20"

The sender wants to encrypt the message, say "**ATTACK FROM SOUTH EAST**". He will arrange the plaintext and numeric key as follows: -

Plaintext Alphabet	A	T	T	A	C	K	F	R	O	M	S	O	U	T	H	E	A	S	T
Numeric Key	16	15	9	14	20	16	15	9	14	20	16	15	9	14	20	16	15	9	14

He now shifts each plaintext alphabet by the number written below it to create ciphertext as shown below –

Plaintext Alphabet	A	T	T	A	C	K	F	R	O	M	S	O	U	T	H	E	A	S	T
Numeric Key	16	15	9	14	20	16	15	9	14	20	16	15	9	14	20	16	15	9	14
Encrypted Alphabets	Q	I	C	O	W	A	U	A	C	G	I	D	D	H	B	U	P	B	H

Here, each plaintext character has been shifted by a different amount – and that amount is determined by the key. The key must be less than or equal to the size of the message. You are to ignore any characters other than letters. All the other special characters such as " " (space), "**.**", etc. do not form a part of the encryption technique and hence should be ignore while decrypting.

Your key is, "**ENIGMA**"

Your encrypted text is,

XCVLGJRSB PG JX HQL CFTDUL AP TBN PZBLWWLF BSMCOVOL CO DUP IC COR UMWWNF UMOC UB PSS LHA JROPPAF.

Write the decrypted text below.