ESC101: Fundamentals of Computing
MidSem Lab Exam (September 24, 2013)

Duration: 3 hours **Total Marks: 25**

IMPORTANT: *For each problem, indentation and comments carry marks.*

1. **Harmonic Mean:** Harmonic mean of n numbers $(x_1, x_2, \ldots, x_n)$ is the number H defined as:

$$\frac{1}{H} = \frac{1}{n} \sum_{i=1}^{n} \frac{1}{x_i}$$

Write a program that reads a stream of positive integers terminated by -1, and computes the harmonic mean of all these positive numbers that appear before -1.

Here is a sample interaction of the program:

```
$./a.out
2 4 7 -1
Harmonic mean is: 3.36
```

Explanation of output: 3.36 is the harmonic mean of 2, 4 and 7. [Total 5 marks]

2. **Right Truncatable Prime:**

Definitions:

- For a number N as $d_1 d_2 d_3 \ldots d_n$, such that each d_i represents a digit in N, $d_1 d_2 d_3 \ldots d_k$ is a *prefix* of N, where $1 \le k \le n$.
- A number N is said to be a *Right Truncatable Prime* number if (and only if) every prefix of N is a prime number.

Problem : Given a positive integer N as input, find if N is a *Right Truncatable Prime* or not.

Here are a few sample interactions of the program:

```
$./a.out
7193
7193 is an RTP
```

```
$./a.out
1061
1061 is NOT an RTP
```

Explanation of outputs: 7193, 719, 71, 7 are all prime numbers. 1061 is a prime but 106 is not a prime number. [Total 10 marks]

3. **Extremely Large Integers:** Given an integer **N**, determine whether the number is divisible by only **3** or only **5** or both or none.

The number of digits in **N** can vary from 1 upto 100.

Note: The predefined numeric data types (including `long long`) are designed to store numbers less than 10^{20}. You will not get any credits if your program cannot handle large numbers of the order of 10^{100}.

Here are a few sample interactions of the program:

```
$./a.out
Enter the number: 1346
The number is NOT divisible by 3 or 5.

$./a.out
Enter the number: 123456789012345678901234567890
The number is divisible by BOTH 3 and 5.

$./a.out
Enter the number: 10000000000000000000
The number is divisible by ONLY 5.

$./a.out
Enter the number: 123321123
The number is divisible by ONLY 3.
```

[Total 10 marks]