SENIOR DIVISION
PRIME TIME

PROBLEM: Mathematically, the topic of prime numbers is and has been since ancient times a very interesting area of study. In this problem you will investigate prime numbers and the prime-power factorization of numbers.

A **circular prime** is a prime number that will remain a prime on any cyclic rotation of its digits. As an example 1193, 1931, 9311 and 3119 are all primes.

A **deleted prime** is a prime number that will remain a prime if the leftmost digit, or the rightmost digit or one interior digit, if any, is truncated. As examples: 113 becomes 13 if the left most digit is truncated. It is a left deleted prime. Again 113 becomes 11 if the rightmost digit is truncated. It is also a right deleted prime. Further, 113 becomes 13 when the middle 1 is truncated. Primes of this type are called interior deleted primes. For this program, a prime will be classified as interior deleted, if any one of its interior digits is deleted and the resulting integer is a prime.

Smith Numbers – Primes are so interesting that a mathematician while making a telephone call to his brother-in-law noted that the sum of the digits of the phone number equaled the sum of the digits of its prime factors. The mathematician went on to study this phenomenon. The brother-in-law was named Smith and the numbers described above are known as Smith Numbers. As an example the phone number was 493-7775.

4937775= 3*5*5*65837
4+9+3+7+7+7+5 = 3+5+5+6+5+8+3+7

Economical Numbers - Another pair of mathematicians looked at the prime-power factorization of integers and compared the number of digits in the integer with the total number of digits used to write its prime-power factorization (there was nothing on TV that night). Examples: $128 = 2^7$. The integer uses 3 digits. The factorization uses just 2 digits. Numbers of this type where the number of digits in the factorization is less than the number of digits in the integer are classified as **frugal**. 13 =13. The integer and its factorization use the same number of digits. Numbers of this type are called **equidigital.** 30 = 2*3*5. The factorization uses more digits than the integer. Numbers of this type are called **extravagant.**

INPUT: There will be 5 inputs. Each will be a positive integer.

OUTPUT: If the integer is a prime, determine if it is circular, left deleted, interior deleted or right deleted. If the integer is composite, determine if it is a Smith Number, frugal, equidigital or extravagant. In both cases print all that apply. If none of the properties are present in the integer, print NONE.

SAMPLE INPUT	SAMPLE OUTPUT
1. 113	1. Circular, Left, Interior, Right
2. 523	2. Left, Interior
3. 45673	3. Right, Interior
4. 121	4. Smith, equidigital
5. 30	5. Extravagant