SC-551 Practice Problems

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Note: Solve the following problems using C++ programming and, preferably, using OOAD.

1. The user enters a positive integer and a base of number system, both in decimal notation. Your program converts the first number to the notation using second number as the base of the number system. Design & develop such a C-program and test it.

   Test cases:
   Input: **173 2** Output: **10101101**
   Input: **47 16** Output: **2F**
   Input: **2578346 10** Output: **2578346**

2. Design, develop and test a C-program to accept a positive real number in the form **F.I** (float form). Treating **F** as the fractional part and **I** as the integral part, print the number in the form **GH.J** where **H** is the sequence of hashes (character "#") such that the decimal point always occurs at the 6^{th} position from left and **G** is **I** with only the significant digits and **J** is **F** with only the significant digits. Terminate the output with a newline. Assume that the fractional part **F** always has no leading zeroes and both **F** and **I** have at most 5 digits.

   Test cases:
   Input: **10000.6660** Output: **6660#.1**
   Input: **990.0080** Output: **80###.99**
   Input: **101.11111** Output: **11111.101**
   Input: **31657.0** Output: **#####.31657**

3. Design, develop and test CPP code for reading a text file and displaying statistics such as number of lines, number of words, number of characters and number of sentences contained in that file. The number of characters should include characters like white spaces and text control characters.

   Test case:
   Input: The file contains the following text:

```
I am a C programmer. My programs work great and they hardly
have any logical errors. Pointer is my favourite data type.
```

Output:
number of lines : 2
number of words: 22
number of characters: 121
number of sentences: 3

4. Given the coefficients a, b, c, h, g, f in the equation $ax^2 + by^2 + 2hxy + 2gx + 2fy + c = 0$ as input calculate the discriminant $\Delta = \begin{vmatrix} a & h & g \\ h & b & f \\ g & f & c \end{vmatrix}$. and decide what the equation represents. In the cases where Δ is nonzero, $ab - h^2 > 0$ represents an ellipse (its special case is a circle), $= 0$ a parabola and < 0 a hyperbola. In the cases where $\Delta = 0$, $ab - h^2 > 0$ represents two imaginary lines, $= 0$ two real parallel lines and < 0 two real intersecting lines. Design & develop such a CPP-program and test it.

   Test cases:
   Input: **1 1 0 0 0 0** Output: **two imaginary lines**
   Input: **16 9 100 12 -40 -70** Output: **parabola**
   Input: **9 4 0 15 -8 -40** Output: **circle**

5. Design, develop and test a CPP-program to accept a positive real number in the form **I.F** (float form). Convert the fractional part **F** to its reduced ratio form **N/D**, whre N and D are co-prime intergers (*i.e.* they have no common factor other than 1). Test cases:
   Input: **9.25** Output: **9 + 1 / 4**
   Input: **16.375** Output: **16 + 3 / 8**
   Input: **0.7777** Output: **7777 / 10000**