Odometer Assignment

Asokan Pichai

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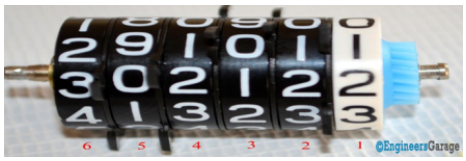
1 What is an odometer?

The classical mechanical odometer is a geared device that displays the distance traveled by vehicles. Typically it is positioned at the centre of the speedometer.

It works by a simple set of wheels. Each digit is handled by a wheel with the numbers on the circumference. When a wheel completes one circle (that is goes from 0 to 9) the notch on that wheel pushes the notch on the next wheel, thus moving the second wheel by one. BY such a cascading set of notches each wheel pushes the next digit by 1 when it completes 10.

When leftmost wheel turns a full-circuit, the reading resets to 000000 – as many as the size.

Of course, the first wheel has to be driven by some arrangement with the vehicle itself to usefully measure the distance correctly.



2 Assignment

We are not interested in the mechanics of the odometer of course. In fact our odometer, which is just code, differs significantly from the one described above.

- The readings of the odometer cannot have the digit 0
  - That is only digits 1-9 are allowed
  - Again just 1-9
- The digits of the reading *must* be in ascending order.

2.1 Examples

- The (numerically) smallest reading for a 3-digit odometer is 123.
- The largest reading for a 3-digit odometer is 789.
- For 4 and 5-digit odometers these are (1234, 6789) and (12345, 56789) respectively.
- For a 4-digit odometer, the six readings after 2467 are: 2468, 2469, 2478, 2479, 2489, 2567.
- For a 3-digit odometer, the ten readings prior to 347 are: 346, 345, 289, 279, 278, 269, 268, 267, 259, 258.
- The smallest reading is the next reading of the largest and the largest is the previous of the smallest.

3 Coding tasks

Write a set of functions so that a programmer who needs an odometer, with the above characteristics, can use those functions to implement the same.

At the minimum, the following functions need to be written:

- `next_reading()` to find the next reading for a given reading. Should return 2468 for 2467 and 2567 for 2489.
- `prev_reading()` to find the previous reading for a given reading. Should return 328 for 329 and 239 for 345.
- `nth_reading_after()` Instead of the next reading, return the reading that occurs after n rotations. The `next_reading` can be thought of as a special case: $n = 1$
- `nth_reading_before()` Similar to above.

- `distance()` Given two readings find the number of readings between them. Note that just subtracting the readings will be wrong often. You also need to handle the fact that the distance from 789 to 123 is 1, while the distance from 123 to 789 is different.