

# Week 3 Challenge Problems

## Problem 1

### Problem Description

Suppose we have a number like 12. Let's define *shifting a number* to mean adding a zero at the end. For example, if we shift that number once, we get the number 120. If we shift the number again we get the number 1200. We can shift the number as many times as we want.

In this problem you will be calculating a *shifty sum*, which is the sum of a number and the numbers we get by shifting. Specifically, you will be given the starting number  $N$  and a non-negative integer  $k$ . You must add together  $N$  and all the numbers you get by shifting a total of  $k$  times.

For example, the shifty sum when  $N$  is 12 and  $k$  is 1 is:  $12 + 120 = 132$ . As another example, the shifty sum when  $N$  is 12 and  $k$  is 3 is  $12 + 120 + 1200 + 12000 = 13332$ .

### Input Specification

The first line of input contains the number  $N$  ( $1 \leq N \leq 10000$ ). The second line of input contains  $k$ , the number of times to shift  $N$  ( $0 \leq k \leq 5$ ).

### Output Specification

Output the integer which is the shifty sum of  $N$  by  $k$ .

### Sample Input

```
12
3
```

### Output for Sample Input

```
13332
```

## **Problem 2**

### **Problem Description**

Canada is cold in winter, but some parts are colder than others. Your task is very simple, you need to find the coldest city in Canada. So, when given a list of cities and their temperatures, you are to determine which city in the list has the lowest temperature and is thus the coldest.

### **Input**

The input is a sequence of city names and temperature values. Temperatures are integer, possibly preceded with a “minus” sign. There is a single space between the city name and the temperature. No city name contains any whitespace and is always less than 256 characters in length. There is at least one city in the list, no more than 10000 cities, and the last city is always Waterloo. You may assume that the temperature is not less than  $-273$  and not more than 200.

### **Output**

You are to output the name of the coldest city on a single line with no whitespace before or after the name. You may assume that there will not be more than one city which is the coldest.

### **Sample Input**

```
Saskatoon -20  
Toronto -2  
Winnipeg -40  
Vancouver 8  
Halifax 0  
Montreal -4  
Waterloo -3
```

### **Output for Sample Input**

```
Winnipeg
```

### Problem 3

Write a robot simulator.

A robot factory's test facility needs a program to verify robot movements.

The robots have three possible movements:

- turn right
- turn left
- advance

Robots are placed on a hypothetical infinite grid, facing a particular direction (north, east, south, or west) at a set of  $\{x,y\}$  coordinates, e.g.,  $\{3,8\}$

The robot then receives a number of instructions, at which point the testing facility verifies the robot's new position, and in which direction it is pointing.

- The letter-string "RAALAL" means:
  - Turn right
  - Advance twice
  - Turn left
  - Advance once
  - Turn left yet again
- In the example above if a robot starts at  $\{7, 3\}$  facing north. Then running this stream of instructions should leave it at  $\{9, 4\}$  facing west.

**Input:** A string that has up to 10 commands

Example: AAARALAA

**Output:** Final positions and direction facing

Example: (20,9) facing east

Your program should start the robot at 0,0 and can go into the negative x and y coordinates

Your program should also allow the controller to "move" again after knowing the robot's new positions and which direction it is facing