ASCII Addition

An ASCII art is a matrix of characters, exactly 7 rows high, with each individual character either a dot or the lowercase letter x. An expression a + b, where a and b are positive integers, is written in ASCII art by writing all expression characters (a, b, and +) as 7x5 matrices. Given this representation of the expression, find the result of the addition and output it in the ASCII art form.

Big Truck

A truck is tasked with driving from one location to another by taking the shortest route possible. Along the way, it aims to pick up as many items as possible from the locations it passes through, without making its route any longer than necessary. There is no limit to the number of items the truck can carry.

The destination will be given as an integer n (2 <= n <= 100), and the starting location will always be 1. There are n locations in the city, each of which has 0-100 items that can be picked up at that location. Next, roads between locations will be given in terms of length and what two locations they connect. No two roads connect the same two locations, and no road connects one location to itself.

Given this “map” of the city, compute and output the shortest path from location 1 to location n, followed by the maximum number of items the truck can pick up along the way. If there is no route from location 1 to location n, output “impossible”.

Canonical Coins

A coin system is a finite set of distinct positive integers corresponding to coin values, or denominations. For any coin system S, we assume that there’s an unlimited supply of coins of each denomination, and we also assume that S contains 1, since this guarantees that any positive integer can be written as a sum of values in S.

For a given coin system and a positive integer amount, the “greedy algorithm” may be used to determine the smallest number of coins required to dispense that amount. This algorithm involves repeatedly choosing a coin of the largest denomination that’s <= the amount still owed, until the amount reaches zero. A coin system for which the greedy algorithm always produces the optimal (fewest) number of coins is called canonical.

Given a coin system with S with n coins (S = {c1, c2,...cn}) determine whether S is “canonical” or “non-canonical”, and output the appropriate word as a string. Note that if S is non-canonical, then there exists at least one counterexample in which the minimum number of coins needed to produce an integer x is less than the number of coins used by the greedy algorithm.

Counting Stars

Given a matrix of m*n pixels (1 <= m,n <= 100; m and n are given), write an analysis program that counts the number of stars visible in this bitmap image. Each pixel is either black or white (represented by characters * and -, respectfully). Black pixels are part of the sky, while white pixels are part of a star. White pixels that are adjacent vertically or horizontally are part of the same star.

Input contains 1-50 test cases. For each, output the case number and the number of stars visible in the corresponding image.

Vacuumba

A robotic floor vacuum navigates rooms by turning some angle left or right before moving forward in a straight line in that direction. A plan for the robot consists of a sequence of these straight-line segments. The robot starts at the origin, facing the positive Y direction. Given one of these plans, predict where the robot will be after following it.

Input contains several test cases. Each case will consist of m (1 <= m <=10) segments in the robot's plan. Each segment will consist of one rotation angle in range [-360, 360] and a distance in range [-100, 100].

For each test case, output the expected location of the robot after following the plan.