Multi-touch gesture classification

Problem ID: multitouch

With the advent of touch-screen based interfaces, software designers have had to reinvent computer control for finger-based gestures. The most basic task in interpreting a gesture is classifying the touches into one of several possible gestures. This can be difficult because the touches are really blobs of pixels on the screen (not unique points), and gestures involve movement.

We define a *touch* as a connected set of pixels. A pair of pixels is part of the same touch if they are horizontally or vertically adjacent. The *touch point* is the position of a touch. It's defined as the average location of all pixels that are in the set.

A *grip* is the set of all touch points for an image. The *grip point* is the average location of all touch points in the grip. For each touch point we define its *touch vector* as the vector from the grip point to the touch point. A *gesture* is a pair of grips (initial and final), and both grips have the same number of touches. There is a one-to-one correspondence between touches in the initial and final grip. The correspondence is chosen such that the sum of squared distances between corresponding touch points is minimized.

There are three kinds of gestures: pan, zoom, and rotation. There is a distance associated with each kind. The *pan distance* is measured between the two grip points. The *grip spread* is the average distance between each touch point and the grip point. The *zoom distance* is the difference between the two grip spreads. The *touch rotation* is the signed angle (in $(-\pi, \pi)$ radians) between the two touch vectors for corresponding touch points (which is zero if either touch vector has length zero). The *grip rotation* is the average touch rotation. The *rotation distance* is the arc length of the grip rotation along a circle with radius equal the grip spread of the initial grip.

You need to classify the gestures based whether it is a pan, zoom, or rotation. Pick the one which has the greatest associated distance.

Input

Input is one pair of images, given side-by-side. Both images are 15×30 pixels, and there will be a single space on each line separating the two images. Each image uses `X` to represent pixels of a touch, and a period (`.`) to represent no touch. Both images have the same number of touches, between 1 and 5.

Output

Print the number of touches and the type of gesture (pan, zoom, or rotate) as well as the direction of the gesture for zoom or rotate. The direction for a zoom is `in` if the grip spread of the final grip is smaller than that of the initial grip, otherwise it is `out`. The direction of a rotate is either `clockwise` or `counter-clockwise`. All distance comparisons that affect the output will be robust against numerical error of 10^{-5}.

Sample Input 1

```
.............................. ..............................
.............................. ..............................
....XXXX....................... ..............................
....XXXX....................... ............XXXX..............
....XXXX....................... ............XXX...............
.............................. ..............................
.............................. ..............................
.............................. ..............................
.............................. ..............................
.............................. ..............................
.............................. ..............................
.............................. ..............................
.............................. ..............................
.............................. ..............................
.............................. ..............................
```

Sample Output 1

```
1 pan
```

Sample Input 2

```
.............................. ..............................
.............................. ..............................
.............................. ..................XX..........
.............................. .......XXX......XXXX..........
.............................. ......XXXX........X...........
........XXX....XXX............ ........X.....................
.........XXX...XX............. ..............................
.............................. ..............................
............XX................ ..............................
...........XXX................ ..............................
.............................. ..............................
.............................. ..............XX..............
.............................. ..............XXXX............
.............................. ..............XX............
.............................. ..............................
```

Sample Output 2

```
3 zoom out
```

Sample Input 3

```
.............................. ..............................
.............................. ..............................
........XX..................... ..............................
........XX..................... ..................XXXXX........
.............................. ...................XXX..........
.............................. ..............................
..XXX................XXX...... .....XX.......................
...XX................XXX..... .....XXX.......................
.............................. ..............................
.............................. ..............................
.............................. .....XXX.......................
.........XXX................... ......XX......XXXX............
..........X.................... ..............XXXX............
.............................. ..............................
.............................. ..............................
```

Sample Output 3

```
4 rotate counter-clockwise
```