

## Pointing the Way

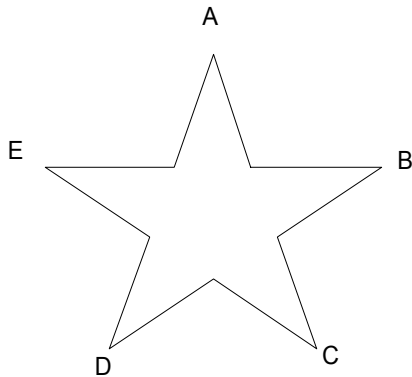
input file: point.in

output file: point.out

A compass is usually thought of as having 4 primary points at North, East, South, and West. These directions correspond to points on a circle, with North at 0 degrees, East at 90 degrees, South at 180 degrees, and West at 270 degrees. There can be many points between the primary points. For example, the point North-East is halfway between North and East, at 45 degrees and East-North-East is halfway between East and North-East at 67.5 degrees.

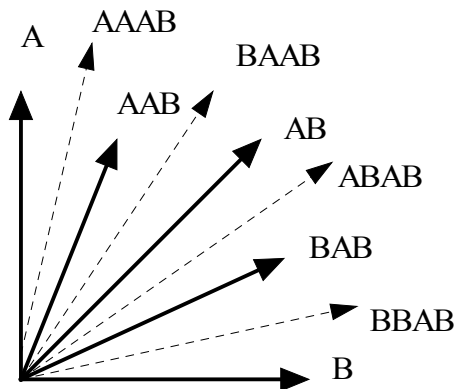
This plan has been determined to be too restrictive for space travel, so you have been asked to create a more general compass, with anywhere from 3 to 26 primary points.

For example, if a compass were to have 5 points, for simplicity sake, name them with the first five letters of the alphabet as below:



The point A is oriented with 0 degrees. This means B is at 72 degrees, C is at 144 degrees, D is at 216 degrees, and E is at 288 degrees. At 36 degrees, halfway between A and B, is the compass point AB. At 18 degrees, halfway between A and AB is the compass point AAB. At 54 degrees, halfway between AB and B is the point BAB.

To name compass points, follow the example in the chart below for a compass with 4 points and the rules below:



- The major compass points are called *1-points*. The name of a 1-point is a single alphabetic character, where the first 1-point is 'A' (at 0 degrees) and others are B, C, ... in clockwise order.
- 2-points are halfway between two one points. The name of the 2-point between two contiguous 1-points, P and Q (specified in clockwise order,) is PQ.
- A *k*-point (where  $k \geq 3$ ) bisects an angle determined by a  $(k-1)$ -point and an  $n$ -point (where  $n < k-1$ ). For instance, ABAB is a 4-point which bisects the angle of

the 3-point BAB and the 2-point AB. The name of a *k*-point between  $\alpha$  and  $\beta$  is  $\alpha\beta$ , where  $\beta$  is the name of the nearest  $(k-1)$ -point and  $\alpha$  is the name of the 1-point nearest to  $\alpha\beta$  in the direction opposite of  $\beta$ .

Your program must take a number of compass points and a group of compass points for each and return the degree measure of the compass point. For example, for the example above, a 5 pointed compass would place BAB at 54 degrees and CD at 180 degrees.

## Input

The input will have information about a number of different input sets. The first line of each set will be a number of compass points,  $n$ , where  $3 \leq n \leq 26$ . The second line of the data set will have a number of compass points to be analyzed,  $k$ . The next  $k$  lines will each have compass point, where each point is a list of between 1 and 8 upper case letters. You may assume each string represents a valid compass point for the given compass. There will be no leading or trailing blanks on a line.

The end of input will be indicated by a compass with 0 points. This data should not be processed.

## Output

Output the number of points of the compass at the beginning of the output for each set. For each of the  $k$  compass points, echo the compass point and give the degree measurement it represents to 2 decimal places of precision.

Have a blank line after each data set.

### Sample Input

```
5
3
B
BBC
AAEA
26
1
W
4
1
BBAB
0
```

### Sample Output

```
Compass with 5 points:
B: 72.00 degrees
BBC: 90.00 degrees
AAEA: 351.00 degrees

Compass with 26 points:
W: 304.62 degrees

Compass with 4 points:
BBAB: 78.75 degrees
```