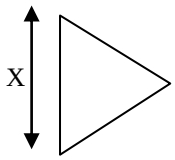
S.A. Computer Olympiad
First Round 2002

Q1. Arrows

Prepared by Donald Cook

Description

You are required to write a program to print out an arrow head using '@' symbols, with the dimensions indicated in the following diagram:



Input

You are given an odd number greater than 3 representing the length *X* in the figure above.

Example

```
Enter X: 7
```

Output

```
@
@@@
@@@@@
@@@@@@@
@@@@@
@@@
@
```

Test your program with

a. 5	b. 13

Q2. Stamps

Prepared By: Donald Cook

Description

Given a set of stamp values (e.g., 1 cent, 2 cents). Calculate the least number of stamps that are required to make up a postage value of M cents (e.g., 5 cents).
In this case we have 2*2cent + 1*1cent stamps required. Clearly 5 * 1 cent stamps uses more stamps.

Task

You are required to write a program that accepts an integer N, the number of stamps in the set, an integer list of the stamps up to N items, (smallest to largest) and M, the postage value required.

Contraints

1 < N < 50, 1< M < 200 and maximum value of a stamp is 100. The stamp values are always multiples of the first number after 1.

Example:

Enter number of stamps in set: 3
Enter value: 1
Enter value: 3
Enter value: 6
Enter postage value required: 11

Output

2 1
1 3
1 6

Test your program with:

a. 4; 1, 2, 4, 8 ; 17	b. 4; 1,3,6,9 ; 25

Q3. Fractions

Prepared By: Bruce Merry (Gold medallist)

Description

Given a numerator N and a denominator D. We can express the fraction N/D as a sum of fractions with a numerator of 1.
For example if N = 3 and D = 4 then we have, 3/4=1/2+1/4.

Task

You are required to write a program that reads in a numerator N, a denominator D and expresses the fraction N/D as a sum of fractions with a numerator of 1. Your program must output the sum. There may be more than one possible answer. You must output the one that maximises the first fraction output. Ties are broken by maximising the second fraction, then the third etc. For example, 2/7 can be represented as 1/7+1/7, 1/4+1/28 or as 1/4+1/56+1/56. The correct output is 1/4+1/28, because the maximum value for the first fraction is 1/4 and once this is chosen the maximum for the second fraction is 1/28.

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Contraints

0<D<N<50

Examples

```
Enter N: 2
Enter D: 7
```

Output

1/4+1/28

```
Enter N: 7
Enter D: 8
```

Output

```
1/2+1/3+1/24
```

Test your program with

a. N=12 D=32	b. N=31 D=47

Q4. Chinese Tea

Prepared by: Cobus Combrink

Description

A Chinese tea-grower arranged a set of mugs in a circle. Each mug was filled to the rim with a different kind of tea.
He then took a set of small cups and filled each cup from a mug, starting with mug 1 and cup 1.
He then moved each cup a certain number of mugs clockwise, from the mug from which it was originally filled, around the circle. After doing this he pours the contents of each cup into the mug next to which it now stands. If a mug overflows, an equal proportion is spilled from the mug and the cup.

Task

You are given the number of mugs (M) and the number of smaller cups (C) used. The cups are placed beside the mugs, starting from mug no. 1. Mug no. 1 and M are adjacent (all the mugs are clockwise in a circle). You are also given the number of positions (P) that the cups have to be moved every time.
The cups are moved clockwise. (The cups next to mug 1 will end up next to mug 3 if it is moved 2 positions.)
The content of the cup is a given fraction (F) of the content of a mug. You have to repeat the process of filling the cups and moving them (P) positions and emptying them into the mugs (N) times. At the end you have to output the fraction of the tea from a specific mug (A) that is in a given mug (B).

Input

The values matching $M\ C\ P\ F\ N\ A\ B$ as explained above.

Output

You are required to print out only the fraction of tea from mug *A*, that is in mug *B* after completion of the process. Round your answer to the 5^{th} decimal.

Constraints

$M \leq 50$
$C \leq M$
$N \leq 2M$
$1 \leq A \leq M$
$1 \leq B \leq M$

Example

Input
2 1 1 0.1 1 1 2
Output
0.09091

Test Data

Test your program with the following data

a. 10 1 3 0.4 20 8 4	b. 50 40 31 0.1 100 1 49

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Q5. Australian Voting

Prepared by: Carl Hultquist (Medallist)

Description

In Australia, voting occurs as follows:

1) Each voter ranks **all** the politicians available in order of preference (i.e. their best candidate gets a 1, 2nd best gets a 2, etc.)
2) All the 1st-choice votes are tallied. If some politician has strictly greater than 50% of the votes, then he wins the election.
3) If no such politician has strictly greater than 50% of the votes, then the politician(s) who have the fewest votes are eliminated (NB: in the case of a tie for the lowest number, all politicians with the same lowest number are eliminated). Their votes are then reassigned to the remaining politicians.For example, if there are 4 candidates (A-D)and 5 voters (v1-v5), then the voting could go like this:

```
   A B C D
voter 1: 1 2 3 4
voter 2: 4 1 2 3
voter 3: 2 3 1 4
voter 4: 1 3 4 2
voter 5: 3 1 4 2
```

No single politician has more than 50% of the vote. D, however, doesn't have **any** 1st-choice votes, so he is eliminated. This results in the new set of stats:

```
   A B C
v1: 1 2 3
v2: 3 1 2
v3: 2 3 1
v4: 1 2 3
v5: 2 1 3
```

There's still no clear winner, but now C is the losing politician. Reassigning his votes gives:

```
   A B
v1: 1 2
v2: 2 1
v3: 1 2
v4: 1 2
v5: 2 1
```

Now A has 3 votes which is greater than 50, so A wins!

Task

Your task is to help the Australian Government by writing a program to compute the result of such an election.

Your program should output the winning politician and the number of votes that he won by.

example

Your program should ask the user for the number of politicians and the number of voters. Then the vote of each voter should be read in as a set of integers: one for each politician.

Input

```
Politicians: 4
Voters: 5
Order: A B C D
v1: 1 2 3 4
v2: 4 1 2 3
v3: 2 3 1 4
v4: 1 3 4 2
v5: 3 1 4 2
```

Output

Politician A wins with 3 votes.

Constraints

- The number of politicians and voters are always less than 26.
- To ensure that someone wins, the number of voters must be odd.

Test your program with

a.
```
Politicians: 7
Voters: 13
Order: A B C D E F G
V1:  1 2 3 4 5 7 6
V2:  3 7 2 4 6 1 5
V3:  2 4 6 1 3 5 7
V4:  7 3 1 2 5 6 4
V5:  4 1 5 7 2 6 3
V6:  6 5 4 3 2 7 1
V7:  2 4 5 1 3 7 6
V8:  1 3 5 7 2 4 6
V9:  5 2 6 3 7 4 1
V10: 2 7 5 3 1 6 4
V11: 7 3 6 2 5 1 4
V12: 3 1 7 4 2 6 5
V13: 7 6 5 4 3 2 1
```

b.
```
Politicians:4
Voters: 7
Order: A B C D
V1: 1 2 3 4
V2: 4 3 2 1
V3: 2 1 4 3
V4: 2 4 1 3
V5: 1 3 2 4
V6: 1 4 3 2
V7: 4 2 3 1
```

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