

# Problem E

## Eg[yp]tian Fractions (HARD version)

Given a fraction  $a/b$ , write it as a sum of different Egyptian fraction. For example,  $2/3=1/2+1/6$ .

There is one restriction though: there are  $k$  restricted integers that should not be used as a denominator. For example, if we can't use  $2^6$ , the best solution is:

$$2/3=1/7+1/8+1/9+1/12+1/14+1/18+1/24+1/28$$

The number of terms should be minimized, and then the large denominator should be minimized. If there are several solutions, the second largest denominator should be minimized etc.

### Input

The first line contains the number of test cases  $T$  ( $T \leq 100$ ). Each test case begins with three integers  $a$ ,  $b$ ,  $k$  ( $2 \leq a < b \leq 876$ ,  $0 \leq k \leq 5$ ,  $\gcd(a, b) = 1$ ). The next line contains  $k$  different positive integers not greater than 1000.

### Output

For each test case, print the optimal solution, formatted as below.

### Sample Input

```
5
2 3 0
19 45 0
2 3 1 2
5 121 0
5 121 1 33
```

### Output for the Sample Input

```
Case 1: 2/3=1/2+1/6
Case 2: 19/45=1/5+1/6+1/18
Case 3: 2/3=1/3+1/4+1/12
Case 4: 5/121=1/33+1/121+1/363
Case 5: 5/121=1/45+1/55+1/1089
```

### Extremely Important Notes

It's not difficult to see some inputs are harder than others. For example, these inputs are very hard input for every program I have:

```
596/829=1/2+1/5+1/54+1/4145+1/7461+1/22383
265/743=1/3+1/44+1/2972+1/4458+1/24519
181/797=1/7+1/12+1/2391+1/3188+1/5579
```

$$616/863=1/2+1/5+1/80+1/863+1/13808+1/17260$$

$$22/811=1/60+1/100+1/2433+1/20275$$

$$732/733=1/2+1/3+1/7+1/45+1/7330+1/20524+1/26388$$

However, I don't want to give up this problem due to those hard inputs, so I'd like to restrict the input to "easier" inputs only. I know that it's not a perfect problem, but it's true that you can still have fun and learn something, isn't it?

Some tips:

- Watch out for floating-point errors if you use double to store intermediate result. We didn't use double.
- Watch out for arithmetic overflows if you use integers to store intermediate result. We carefully checked our programs for that.

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Rujia Liu's Present 6: Happy 30th Birthday to Myself

Special thanks: Yubin Wang