# WOBURN CHALLENGE

## 2018-19 Online Round 1

Friday, November 16th, 2018

*Intermediate Division Problems*

Automated grading is available for these problems at:
***wcipeg.com***

For more problems from past contests, visit:
***woburnchallenge.com***

# Problem I1: Comparing Grades

*14 Points / Time Limit: 2.00s / Memory Limit: 16M* *Submit online: http://wcipeg.com/problem/wc181j3*

As grades from the school year's first science test are being handed back, the students of H.S. High School begin to peer at their marks with dread. With the exception of two particularly competitive friends, that is: Alice and Bob are eager to compare their grades against one another, and see who did better this time around!

Alice received a percentage grade of $A$ ($0 \le A \le 100$) on the test, while Bob received a percentage grade of $B$ ($0 \le B \le 100$). However, they don't like to compare these exact percentage grades against one another—instead, they think it's more fun to compare their more approximate letter grades. Each percentage grade corresponds to a letter grade according to the following table:

```
/------------------------|--------------\
| Percentage Grade Range | Letter Grade |
|------------------------|--------------|
|                90..100 | A            |
|                80.. 89 | B            |
|                70.. 79 | C            |
|                60.. 69 | D            |
|                 0.. 59 | F            |
\------------------------|--------------/
```

According to Alice and Bob's rules, whichever of them receives a worse letter grade than the other will have to do something embarrassing in front of the class. However, if they both receive the same letter grade, then neither of them will be subjected to this punishment.

As one of their fellow classmates, you'd like to find out if anything embarrassing is going to occur, so that you can have your phone at the ready. In other words, you'd like to determine whether or not Alice and Bob received the same letter grade as one another. Output "`Same`" (without quotes) if their letter grades are the same, or "`Different`" if they're different.

### Input Format

The first and only line of input consists of two space-separated integers, $A$ and $B$.

### Output Format

Output a single string, either "`Same`" if Alice and Bob received the same letter grade, or "`Different`" otherwise.

**Sample Input 1**

```
84 89
```

**Sample Output 1**

```
Same
```

**Sample Input 2**

```
60 59
```

**Sample Output 2**

```
Different
```

**Sample Explanation**

In the first case, both Alice and Bob received a letter grade of B.

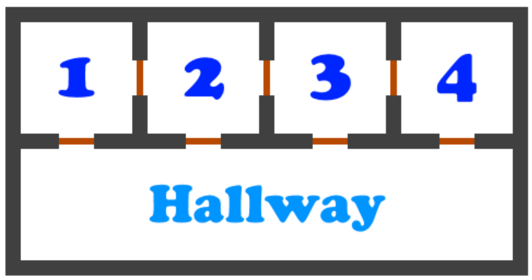
In the second case, Alice received a letter grade of D while Bob received a letter grade of F.

# Problem I2: Germaphobia

*20 Points / Time Limit: 2.00s / Memory Limit: 16M* *Submit online: http://wcipeg.com/problem/wc181j4*

H.S. High School has $N$ ($2 \le N \le 100$) classrooms in a row, numbered from 1 to $N$ in order. There's a common hallway outside the classrooms with a door to each one, meaning that it's possible to move from the hallway to any classroom (or vice versa) by passing through a door. There's also a door between each pair of adjacent classrooms $i$ and $i + 1$ (for each $1 \le i \le N - 1$), meaning that it's possible to move between them in either direction by passing through that door.

For example, if $N = 4$, the school layout looks as follows (with the 4 numbered classrooms at the top, the hallway at the bottom, and doors indicated in brown):




Today, Bob has $M$ ($1 \le M \le 100$) classes to attend, one after another, with the $i$-th one held in classroom $C_i$ ($1 \le C_i \le N$). Multiple classes throughout the day may be held in the same classroom, but no pair of consecutive classes are held in the same classroom as one another (in other words, $C_i \ne C_{i+1}$ for each $1 \le i \le M - 1$).

Upon entering the school in the morning, Bob finds himself in the hallway, and will then need to move into his $M$ classes' classrooms in order (in other words, he'll need to visit classroom $C_1$, then classroom $C_2$, and so on). He may freely visit other classrooms or the hallway in between the classes he needs to attend. After attending the $M$-th class, Bob will need to move back into the hallway before heading home.

Bob is well aware of the alarming volume of germs present on school doorknobs, so he'd like to pass through as few doors as possible throughout the day. Help Bob determine the minimum number of doors he must pass through in total.

### Input Format

The first line of input consists of two space-separated integers, $N$ and $M$.
$M$ lines follow, the $i$-th of which consists of a single integer, $C_i$, for $i = 1..M$.

### Output Format

Output a single integer, the minimum number of doors which Bob must pass through in total.

**Sample Input**

```
4 5
2
3
1
4
3
```

**Sample Output**

```
8
```

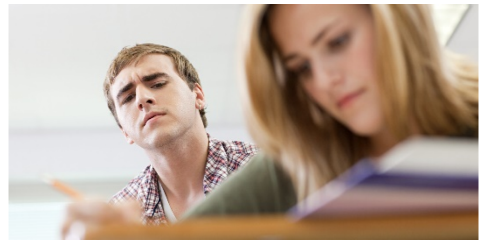
**Sample Explanation**

One optimal route Bob might take is as follows:

Hallway → **Classroom 2** → **Classroom 3** → Classroom 2 → **Classroom 1** → Hallway → **Classroom 4** → **Classroom 3** → Hallway

# Problem I3: Inspiration

*26 Points / Time Limit: 2.00s / Memory Limit: 16M* *Submit online: http://wcipeg.com/problem/wc181s1*



It's time for a history test! Unfortunately, while some students have come well-prepared, others appear to have forgotten about the test entirely. They may need some "inspiration" to get through it with passing grades.

The desks in H.S. High School's history classroom are laid out in a nice, traditional grid. The grid has $R$ ($1 \le R \le 50{,}000$) rows, numbered $1..R$ from front to back, and $C$ ($1 \le C \le 10$) columns, numbered $1..C$ from left to right. The state of each desk in a given row $r$ and column $c$ is described by an integer $D_{r,c}$ ($0 \le D_{r,c} \le 2$), which is one of the following:

- 0: That desk is unoccupied
- 1: That desk is occupied by a "type-1" student — one who has studied for the test
- 2: That desk is occupied by a "type-2" student — one who has *not* studied for the test

Each type-2 student is in trouble… unless they can catch a glimpse of inspiration, in the form of a type-1 student's test paper. Without looking too suspicious, a student can see manage to see the papers on some desks directly in front of them, in the same column. However, they can only clearly see at most the closest $K$ ($1 \le K \le R - 1$) desks in front of them. In other words, the test paper of a type-1 student sitting in row $r_1$ and column $c_1$ can be seen by a type-2 student sitting in row $r_2$ and column $c_2$ if and only if $c_1 = c_2$ and $r_2 - K \le r_1 \le r_2 - 1$. Note that a type-2 student doesn't gain any additional benefit from seeing multiple type-1 students' papers, and that it's possible for a single type-1 student's paper to inspire multiple type-2 students.

How many of the type-2 students can be inspired by looking at at least one type-1 student's test paper?

### Subtasks

In test cases worth 8/26 of the points, $K \le 10$.
In test cases worth another 10/26 of the points, $K = R - 1$.

### Input Format

The first line of input consists of three space-separated integers, $R$, $C$, and $K$.
$R$ lines follow, the $i$-th of which consists of integers, $D_{i,1..C}$, for $i = 1..R$.

### Output Format

Output a single integer, the number of type-2 students who can be inspired.

### Sample Input

```
5 3 2
1 0 1
1 2 2
0 1 2
2 1 2
0 2 2
```

### Sample Output

```
4
```

### Sample Explanation

The type-2 students in the 2nd and 3rd rows of the 3rd column can both be inspired by the type-1 student sitting at the front of that row. The type-2 student in the 4th row of the 1st column can be inspired by the type-1 student sitting 2 desks in front of them. Finally, the type-2 student at the back of the 2nd column can be inspired by either of the type-1 students sitting 1 or 2 desks in front of them.

# Problem I4: Essay Generator

*40 Points / Time Limit: 4.00s / Memory Limit: 64M* *Submit online: http://wcipeg.com/problem/wc181s2*

Alice has a $W$-word essay due tomorrow ($1 \le W \le 10{,}000$), but she's too busy programming to bother with that! However, Alice happens to know that H.S. High School's English teacher is sick of reading and grading long essays, so she figures that if she just submits a "reasonable" essay which fulfills the requirements but is as short as possible, she may get some pity marks!

As such, Alice wants to write a program to generate a sequence of $W$ words to pass off as her essay, where each word is any string consisting of 1 or more lowercase letters ("`a`".."`z`") (not necessarily a real English word). The essay will have no punctuation or formatting, as those seem unnecessary to Alice. In an attempt to disguise the essay's generated nature, Alice will insist that all $W$ words are distinct. Finally, for her plan to come together, she'll make the sum of the $W$ words' lengths as small as possible.

Help Alice generate *any* essay which meets the above requirements.

### Subtasks

In test cases worth 10/40 of the points, $W \le 20$.
In test cases worth another 10/40 of the points, $W \le 100$.

### Input Format

The first and only line of input consists of a single integer, $W$.

### Output Format

Output a single line containing Alice's essay: a sequence of $W$ distinct space-separated words, with the sum of their lengths minimized.

### Sample Input

```
2
```

### Sample Output

```
i a
```

### Sample Explanation

The sum of the lengths of the two words "`i a`" is 1 + 1 = 2, which is the minimum possible total length of a two-word essay. Various other essays (such as "`x y`") would also be accepted. However, the essay "`i i`" would not be accepted due to its words not being distinct, and the essay "`i am`" would not be accepted due to the total length of its words (1 + 2 = 3) not being as small as possible.