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TEST
Programming Aptitude Test

TEST ENDS
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REMAINING
1 day, 23:53:37

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Instructions

Problem C

Error correcting codes are used in a wide variety of applications ranging from satellite communication to music CDs. The idea is to encode a binary string of length k as a binary string of length $n > k$, called a *codeword*, in such a way that even if some bit(s) of the encoding are corrupted (if you scratch on your CD for instance), the original k-bit string can still be recovered. There are three important parameters associated with an error correcting code: the *length* of codewords (n), the *dimension* (k) which is the length of the unencoded strings, and finally the *minimum distance* (d) of the code.

Distance between two codewords is measured as Hamming distance, i.e., the number of positions in which the codewords differ: 0010 and 0100 are at distance 2. The minimum distance of the code is the distance between the two different codewords that are closest to each other.

Linear codes are a simple type of error correcting codes with several nice properties. One of them is that the minimum distance is the smallest distance any non-zero codeword has to the zero codeword (the codeword consisting of n zeros always belongs to a linear code of length n).

Another nice property of linear codes of length n and dimension k is that they can be described by an $n \times k$ generator matrix of zeros and ones. Encoding a k-bit string is done by viewing it as a column vector and multiplying it by the generator matrix. The example below shows a generator matrix and how the string 1001 is encoded.

$$\begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 1 & 1 & 1 \\ 1 & 0 & 1 & 1 \\ 1 & 1 & 0 & 1 \end{pmatrix} \begin{pmatrix} 1 \\ 0 \\ 0 \\ 1 \end{pmatrix} = \begin{pmatrix} 1 \\ 0 \\ 0 \\ 1 \\ 1 \\ 0 \\ 0 \end{pmatrix}$$

Matrix multiplication is done as usual except that addition is done modulo 2 (i.e., $0+1 = 1+0 = 1$ and $0+0 = 1+1 = 0$). The set of codewords of this code is then simply all vectors that can be obtained by encoding all k-bit strings in this way.

Write a program to calculate the minimum distance for several linear error correcting codes of length at most 30 and dimension at most 15. Each code will be given as a generator matrix.

Input

You will be given several generator matrices as input. The first line contains an integer $1 \le T \le 40$ indicating the number of test cases. The first line of each test case gives the parameters n and k where $1 \le n \le 30$, $1 \le k \le 15$ and $n > k$, as two integers separated by a single space. The following n lines describe a generator matrix. Each line is a row of the matrix and has k space separated entries that are 0 or 1. You may assume that for any generator matrix in the input, there will never be two different unencoded strings which give the same codeword.

Output

For each generator matrix output a single line with the minimum distance of the corresponding linear code.

Sample Input 1

```
2
7 4
1 0 0 0
0 1 0 0
0 0 1 0
0 0 0 1
0 1 1 1
1 0 1 1
1 1 0 1
3 2
1 1
0 0
1 0
```

Sample Output 1

```
3
1
```

Submit

Problem ID: d37b59fd9e9096f3

CPU Time limit: 1 second

Memory limit: 1024 MB

Difficulty: hard

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Sample data files