10753 Exponential Function

In the course of Linear Algebra, the following theorem is proved:

> **Theorem.** *Let A be a square matrix of size n with entries in $\boldsymbol{C}$. There are square matrices T and J of size n such that*
>
> $$A = T^{-1}JT, \quad J = \begin{pmatrix} J_1 & \mathbb{0} & \mathbb{0} & \mathbb{0} \\ \mathbb{0} & J_2 & \mathbb{0} & \mathbb{0} \\ \mathbb{0} & \mathbb{0} & \ddots & \mathbb{0} \\ \mathbb{0} & \mathbb{0} & \mathbb{0} & J_k \end{pmatrix}$$
>
> *where J_i are Jordan cells:*
>
> $$J_i = \begin{pmatrix} \lambda_i & 1 & 0 & 0 & \dots & 0 \\ 0 & \lambda_i & 1 & 0 & \dots & 0 \\ \ddots & \ddots & \ddots & \ddots & \ddots & \ddots \\ \ddots & \ddots & \ddots & \ddots & \ddots & \ddots \\ 0 & \dots & \dots & \dots & \lambda_i & 1 \\ 0 & \dots & \dots & \dots & \dots & \lambda_i \end{pmatrix}$$
>
> *Here λ_i is an eigenvalue of A.*

The decomposition $A = T^{-1}JT$, where J is of the form described above, is called a *Jordan decomposition* of A. The Jordan decomposition of a matrix may fail to be unique.

Given a matrix A, we can define the matrix **exp** A in the following way: if $A = T^{-1}JT$ is a Jordan decomposition of A, then $\exp A = T^{-1}J'T$

$$J' = \begin{pmatrix} J'_1 & \mathbb{0} & \mathbb{0} \\ \mathbb{0} & \ddots & \mathbb{0} \\ \mathbb{0} & \mathbb{0} & J'_k \end{pmatrix}, \quad J'_i = \begin{pmatrix} \frac{e^{\lambda_i}}{0!} & \dots & \dots & \frac{e^{\lambda_i}}{m_i!} \\ 0 & \frac{e^{y_i}}{0!} & \dots & \frac{e^{\lambda_i}}{(m_i-1)!} \\ \ddots & \ddots & \ddots & \ddots \\ 0 & \dots & 0 & \frac{e^{\lambda_i}}{0!} \end{pmatrix}$$

Here m_i is the size of J_i. If $k \le l$, then the number in the k-th row and l-th column of J'_i is

$$j_{kl} = \frac{e^{\lambda_i}}{(l-k)!},$$

otherwise it is 0.

It can be proved that $\exp A$ is independent of the Jordan decomposition of A used. It can also be proved that if A is real-valued, then $\exp A$ is also real-valued. Your task is: given a matrix A, compute $\exp A$.

For example, if

$$A = \begin{pmatrix} 3 & 0 \\ 1 & 3 \end{pmatrix},$$

then

$$J = \begin{pmatrix} 3 & 1 \\ 0 & 3 \end{pmatrix}, T = \begin{pmatrix} 1 & 1 \\ 1 & 0 \end{pmatrix}, J' = \begin{pmatrix} e^3 & e^3 \\ 0 & e^3 \end{pmatrix}$$

and

$$\exp A = \begin{pmatrix} e^3 & 0 \\ e^3 & e^3 \end{pmatrix} \approx \begin{pmatrix} 20.086 & 0 \\ 20086 & 20086 \end{pmatrix}$$

Input

The first line of the input contains the number of the test cases, which is at most 15. The descriptions of the test cases follow. The first line of a test case description contains one integer N ($1 \leq N \leq 8$), denoting the size of the matrix A. Each of the next N lines contains N integers separated by spaces, describing the matrix A. It is guaranteed that the entries of A are between 0 and 5. The test cases are separated by blank lines.

Output

For each test case in the input, output N lines, each containing N integers separated by spaces, describing the matrix $\exp A$. The numbers must have at least three digits after the decimal point. Print a blank line between test cases.

Sample Input

```
2

2
3 0
1 3

1 5
0 1
```

Sample Output

```
20.086 0.000
20.086 20.086

2.718 13.591
0.000 2.718
```