

Round 2 2013

[A. Ticket Swapping](#)[B. Many Prizes](#)**C. Erdős-Szekeres**[D. Multiplayer Pong](#)[Contest Analysis](#)[Questions asked](#) **2**

Submissions

Ticket Swapping

8pt	Not attempted 1580/2016 users correct (78%)
11pt	Not attempted 821/1451 users correct (57%)

Many Prizes

7pt	Not attempted 1150/1389 users correct (83%)
13pt	Not attempted 939/1094 users correct (86%)

Erdős-Szekeres

9pt	Not attempted 365/791 users correct (46%)
15pt	Not attempted 182/271 users correct (67%)

Multiplayer Pong

12pt	Not attempted 1/14 users correct (7%)
25pt	Not attempted 1/1 users correct (100%)

Top Scores

bmerry	89
hos.lyric	63
Gennady.Korotkevich	63
fanhqme	63
dzhulgakov	63
komaki	63
EgorKulikov	63
vepifanov	63
Myth5	63
iwi	63

Problem C. Erdős-Szekeres

This contest is open for practice. You can try every problem as many times as you like, though we won't keep track of which problems you solve. Read the [Quick-Start Guide](#) to get started.

Small input
9 points

Solve C-small

Large input
15 points

Solve C-large

Problem

Given a list \mathbf{X} , consisting of the numbers $(1, 2, \dots, \mathbf{N})$, an *increasing subsequence* is a subset of these numbers which appears in increasing order, and a *decreasing subsequence* is a subset of those numbers which appears in decreasing order. For example, $(5, 7, 8)$ is an increasing subsequence of $(4, 5, 3, 7, 6, 2, 8, 1)$.

Nearly 80 years ago, two mathematicians, Paul Erdős and George Szekeres proved a famous result: \mathbf{X} is guaranteed to have either an increasing subsequence of length at least $\sqrt{\mathbf{N}}$ or a decreasing subsequence of length at least $\sqrt{\mathbf{N}}$. For example, $(4, 5, 3, 7, 6, 2, 8, 1)$ has a decreasing subsequence of length 4: $(5, 3, 2, 1)$.

I am teaching a combinatorics class, and I want to "prove" this theorem to my class by example. For every number $\mathbf{X}[i]$ in the sequence, I will calculate two values:

- $\mathbf{A}[i]$: The length of the longest increasing subsequence of \mathbf{X} that includes $\mathbf{X}[i]$ as its largest number.
- $\mathbf{B}[i]$: The length of the longest decreasing subsequence of \mathbf{X} that includes $\mathbf{X}[i]$ as its largest number.

The key part of my proof will be that the pair $(\mathbf{A}[i], \mathbf{B}[i])$ is different for every i , and this implies that either $\mathbf{A}[i]$ or $\mathbf{B}[i]$ must be at least $\sqrt{\mathbf{N}}$ for some i . For the sequence listed above, here are all the values of $\mathbf{A}[i]$ and $\mathbf{B}[i]$:

i	X[i]	A[i]	B[i]
0	4	1	4
1	5	2	4
2	3	1	3
3	7	3	4
4	6	3	3
5	2	1	2
6	8	4	2
7	1	1	1

I came up with a really interesting sequence to demonstrate this fact with, and I calculated $\mathbf{A}[i]$ and $\mathbf{B}[i]$ for every i , but then I forgot what my original sequence was. Given $\mathbf{A}[i]$ and $\mathbf{B}[i]$, can you help me reconstruct \mathbf{X} ?

\mathbf{X} should consist of the numbers $(1, 2, \dots, \mathbf{N})$ in some order, and if there are multiple sequences possible, you should choose the one that is lexicographically smallest. This means that $\mathbf{X}[0]$ should be as small as possible, and if there are still multiple solutions, then $\mathbf{X}[1]$ should be as small as possible, and so on.

Input

The first line of the input gives the number of test cases, \mathbf{T} . \mathbf{T} test cases follow, each consisting of three lines.

The first line of each test case contains a single integer \mathbf{N} . The second line contains \mathbf{N} positive integers separated by spaces, representing $\mathbf{A}[0], \mathbf{A}[1], \dots, \mathbf{A}[\mathbf{N}-1]$. The third line also contains \mathbf{N} positive integers separated by spaces, representing $\mathbf{B}[0], \mathbf{B}[1], \dots, \mathbf{B}[\mathbf{N}-1]$.

Output

For each test case, output one line containing "Case #x: ", followed by $\mathbf{X}[0], \mathbf{X}[1], \dots, \mathbf{X}[\mathbf{N}-1]$ in order, and separated by spaces.

Limits

$1 \leq \mathbf{T} \leq 30$.

It is guaranteed that there is at least one possible solution for \mathbf{X} .

Small dataset

$1 \leq \mathbf{N} \leq 20$.

Large dataset

$1 \leq N \leq 2000$.

Sample

Input	Output
2	Case #1: 1
1	Case #2: 4 5 3 7 6 2 8 1
1	
1	
8	
1 2 1 3 3 1 4 1	
4 4 3 4 3 2 2 1	

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