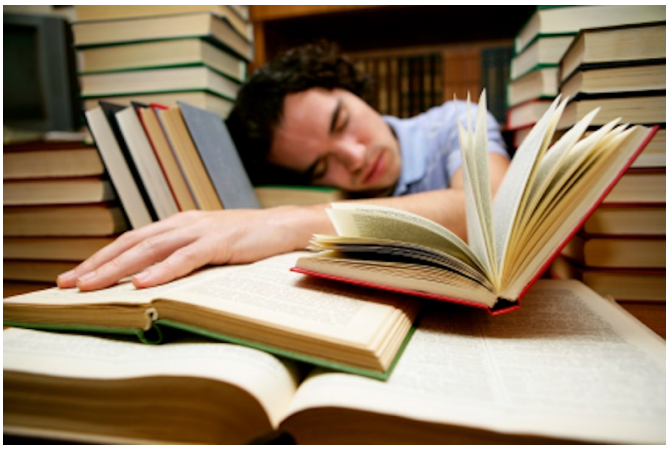
Exam Session (studyplan)

Marco has been studying at *Politecnico di Milano* for many years, he already tackled many exam sessions, but this year he has lots of hard exams so he decided to organize his study plan a bit better.



He wants to prepare all the N exams he has, but noticed that not all of them are equally hard, so he estimated the number of hours H_i needed for each exam. Having followed all the lessons he also noticed that it's possible that, knowing the topics of an exam, some other exams become much easier; because of that he wants to study the subjects according to some partial ordering[1]. For example studying *Calculus I* should be studied before *Calculus II* and *Geometry*, but those two can be studied in any order.

Marco is very multitask, so much that if he completed all the prerequisites of a subject he *can* start right away studying that subject, even if he's already studying something else! Furthermore, studying more than a subject in parallel doesn't increase the time required to complete them: if the i-th subject starts at time t, it will end at time $t + H_i$ regardless of how many other subjects Marco is studying in parallel.

After a quick calculation, Marco already knows the minimum time required to complete all the subjects... but he also wants to know when he can take a break! He allows himself to delay the start of only one subject, but he doesn't want to delay the total time required to study all the subjects.

Help Marco finding, for each subject, which is the latest time he can start studying that subject without extending the total required time.

> ☞ Among the attachments of this task you may find a template file `studyplan.*` with a sample incomplete implementation.

Input

The first line contains the only integer N. The next line contains N integers separated by space: the values of H_i.

The following N lines describe a subject each, they are in the following format:

- First an integer k_i: the number of prerequisites of the i-th subject.
- Then k_i integers: the index of the prerequisites of the i-th subject.

[1] A partial order defines the ordering between *some* pair of items, while a *total* order is defined between all pairs.

Output

You need to write a single line with N integers: the latest time the i-th subject can start without delaying the completion of the study plan.

Constraints

- $1 \leq N \leq 100\,000$.
- $\sum_{i=0}^{N-1} k_i \leq 500\,000$.
- $1 \leq H_i \leq 10\,000$ for each $i = 0 \ldots N-1$.
- It's always possible to devise a study plan.

Scoring

Your program will be tested against several test cases grouped in subtasks. In order to obtain the score of a subtask, your program needs to correctly solve all of its test cases.

– **Subtask 1** (0 points) Examples.

– **Subtask 2** (10 points) $\sum_{i=0}^{N-1} k_i = N-1$, $k_i \leq 1$ for each $i = 0 \ldots N-1$ and every subject is a direct prerequisite of at most one other subject.

– **Subtask 3** (10 points) There are no prerequisites between the subjects.

– **Subtask 4** (20 points) $N \leq 10$ and $H_i \leq 10$.

– **Subtask 5** (35 points) $N \leq 1000$ and $\sum_{i=0}^{N-1} k_i \leq 5000$.

– **Subtask 6** (25 points) No additional limitations.

Examples

input	output
5 10 5 30 15 10 0 1 0 1 0 1 1 2 2 3	0 20 10 25 40
4 15 7 3 10 0 1 2 1 0 0	0 18 15 15

Explanation

In the **first sample case** there are 5 subjects, the subject 0 has no prerequisites, so it can start at time $t = 0$. When it ends at time $t = 10$ subjects 1 and 2 can start, the first ends at at $t = 15$ so subject 3 can start. Subject 4 has to wait for subjects 2 and 3: it can start at $t = 40$, and after it ends all the subjects have been completed at $t = 50$.

Marco can delay some subjects without exceeding the total time of 50, for example if subject 1 starts at $t = 20$ instead of $t = 10$, subject 3 starts at $t = 25$ but subject 4 is not delayed, so the total time is still 50. On the other hand it's not possible to delay subjects 0, 2 and 4 without exceeding the minimum required time of 50.

In the **second sample case** subjects 0 and 4 can start right away, after $t = 15$ subject 2 can start and at $t = 18$ subject 1 starts. When subjects 1 and 4 end the plan is completed, at $t = 25$.

The only subject that can be delayed is 4, and it can start at $t = 15$ without delaying the study plan.