

## 2050. Parallel Courses III

Hard 162 3 Add to List Share

You are given an integer  $n$ , which indicates that there are  $n$  courses labeled from  $1$  to  $n$ . You are also given `relations` where `relations[j] = [prevCoursej, nextCoursej]` denotes that course `prevCoursej` has **before** course `nextCoursej` (prerequisite relationship). Furthermore, you are given a **0-indexed** integer array `time[i]` denotes how many **months** it takes to complete the  $(i+1)^{\text{th}}$  course.

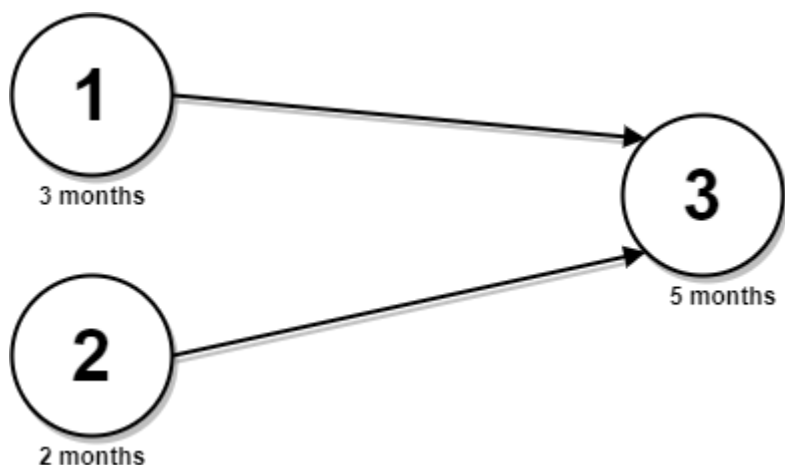
You must find the **minimum** number of months needed to complete all the courses following these rules:

- You may start taking a course at **any time** if the prerequisites are met.
- Any number of courses** can be taken at the **same time**.

Return the **minimum** number of months needed to complete all the courses.

**Note:** The test cases are generated such that it is possible to complete every course (i.e., the graph is a directed acyclic graph).

**Example 1:**



**Input:**  $n = 3$ , `relations = [[1,3],[2,3]]`, `time = [3,2,5]`

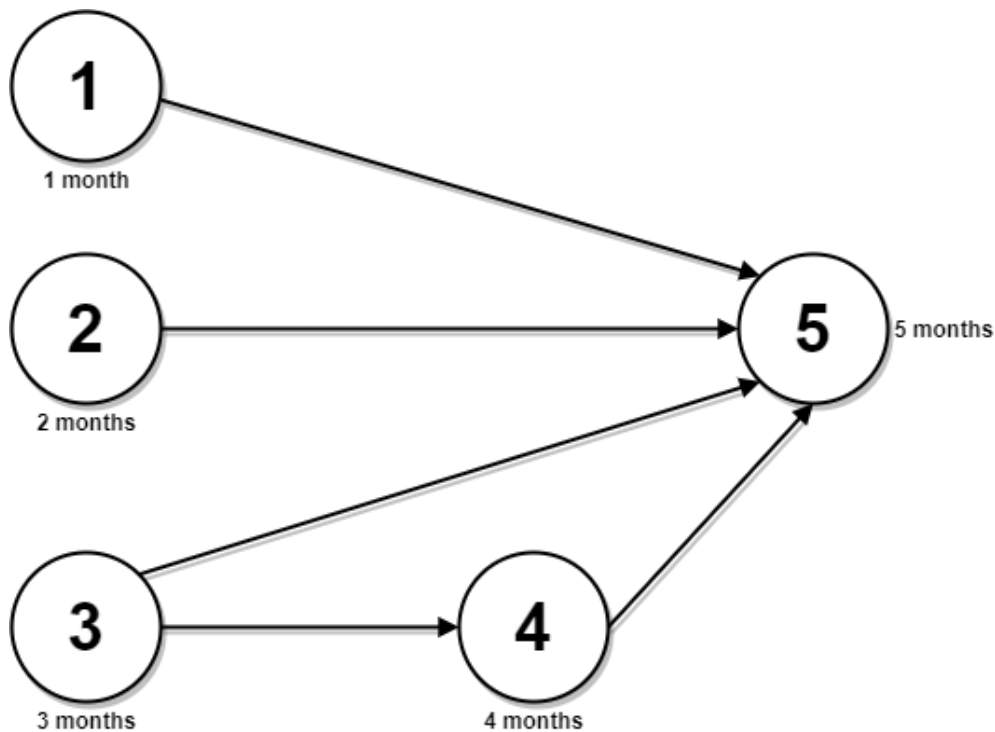
**Output:** 8

**Explanation:** The figure above represents the given graph and the time required to complete each course. We start course 1 and course 2 simultaneously at month 0.

Course 1 takes 3 months and course 2 takes 2 months to complete respectively.

Thus, the earliest time we can start course 3 is at month 3, and the total time required is 8 months.

**Example 2:**



**Input:**  $n = 5$ ,  $\text{relations} = [[1,5],[2,5],[3,5],[3,4],[4,5]]$ ,  $\text{time} = [1,2,3,4,5]$

**Output:** 12

**Explanation:** The figure above represents the given graph and the time required to complete each course. You can start courses 1, 2, and 3 at month 0.

You can complete them after 1, 2, and 3 months respectively.

Course 4 can be taken only after course 3 is completed, i.e., after 3 months. It is completed at month 4 = 7 months.

Course 5 can be taken only after courses 1, 2, 3, and 4 have been completed, i.e., after 7 months.

Thus, the minimum time needed to complete all the courses is  $7 + 5 = 12$  months.

### Constraints:

- $1 \leq n \leq 5 \cdot 10^4$
- $0 \leq \text{relations.length} \leq \min(n \cdot (n - 1) / 2, 5 \cdot 10^4)$
- $\text{relations}[j].\text{length} == 2$
- $1 \leq \text{prevCourse}_j, \text{nextCourse}_j \leq n$
- $\text{prevCourse}_j \neq \text{nextCourse}_j$
- All the pairs  $[\text{prevCourse}_j, \text{nextCourse}_j]$  are **unique**.
- $\text{time.length} == n$
- $1 \leq \text{time}[i] \leq 10^4$
- The given graph is a directed acyclic graph.

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Seen this question in a real interview before?

Yes

No

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