CS3201 Algorithm Design

Semester 1/2018

Term Project Report

Problem: 1280

Timus Online Judge

Topological Sorting

Submitted to
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CONTENT

1. Introduction

1.1) Problem Details

Problem: 1280, Topological Sorting

Author: Vladimir N. Pinaev

Time limit: 1.0 second

Memory limit: 64MB

Difficulty level: 153

Problem source: 2003-2004 ACM Central Region of Russia Quarterfinal Programming Contest, Rybinsk

1.2) Problem Description

Michael wants to win the world championship in programming and decided to study N subjects (for convenience we will number these subjects from 1 to N). Michael has worked out a study plan for this purpose. But it turned out that certain subjects may be studied only after others. So, Michael's coach analyzed all subjects and prepared a list of M limitations in the form "s_i u_i" ($1 \le s_i, u_i \le N$; $i = 1, 2, \ldots, M$), which means that subject s_i must be studied before subject u_i.

Your task is to verify if the order of subjects being studied is correct.

Remark. It may appear that it's impossible to find the correct order of subjects within the given limitations. In this case any subject order worked out by Michael is incorrect.

Limitations

$1 \le N \le 1000$; $0 \le M \le 100000$.

1.3) Input and Output

Input

The first line contains two integers N and M (N is the number of the subjects, M is the number of the limitations). The next M lines contain pairs s_i, u_i, which describe the order of subjects: subject s_i must be studied before u_i. Further there is a sequence of N unique numbers ranging from 1 to N — the proposed study plan.

Output

Output a single word “YES” or “NO”. “YES” means that the proposed order is correct and has no contradictions with the given limitations. “NO” means that the order is incorrect.

Sample

input	output
5 6 1 3 1 4 3 5 5 2 4 2 1 2 1 3 4 5 2	YES
5 6 1 3 1 4 3 5 5 2 4 2 1 2 1 2 4 5 3	NO

2. Code Overview

2.1) Coding

```python
import sys
sys.setrecursionlimit(1000)

n,m = list(map(int,input().split()))
a = [0 for i in range(n+1)]
graph = [[] for i in range(n+1)]

for i in range(m):
    s,u = list(map(int,input().split()))
    graph[s].append(u)
    a[u] = a[u] + 1


v = list(map(int,input().split()))
f = False
for i in range(n):

    if a[v[i]] == 0:
        a[v[i]] = -1
        for j in range(len(graph[v[i]])):
            a[graph[v[i]][j]] = a[graph[v[i]][j]] - 1
    elif a[v[i]] > 0:
        print('NO')
        f = True
        break
if not f:
    print('YES')


```

2.2) Code explanation

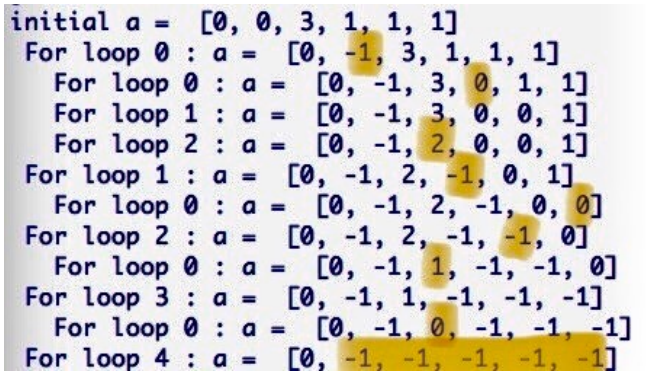
For the test case sample 1

5 6
1 3
1 4
3 5
5 2
4 2
1 2
1 3 4 5 2

```
a [0, 0, 3, 1, 1, 1]
YES
graph [[], [3, 4, 2], [], [5], [2], [2]]
v [1, 3, 4, 5, 2]
a [0, -1, -1, -1, -1, -1]
```

Line 4: We declare ‘n’ and ‘m’ to accept the input of N subjects and M limitations respectively.
Line 5: Initialize ‘a’ list with value 0 of size n+1.
Line 6-10: Create ‘graph’ list that stores the values of u at index s.
Line 11: Adds value of 1 in a at index u.

Line 14: ‘v’ list stores N sequence of numbers from the input(proposed study plan).



Line 16-21: For loop that checks if value of a at index v[i] is equal to zero. If yes, value is changed to -1 to indicate value at that index in a is in the proposed study plan(v).
Then outer for loop of range n has if else statement that checks if the value at a[v[i]] == 0, if so it enters the inner for loop.
The inner for loop with range of length of graph at index v[i](value of v for outer loop i).
The value of graph at v[i][j] (graph[v[i]][j]) will be the index of ‘a’ list from which 1 is subtracted.
The above picture illustrates the working code and the highlights show the values being subtracted by 1.
Else, if the value at a[v[i]] > 0, print NO and turn the Boolean marker f = true and break.

2.3) Output

input	output
5 6 1 3 1 4 3 5 5 2 4 2 1 2 1 3 4 5 2	YES
5 6 1 3 1 4 3 5	NO

5 2 4 2 1 2 1 2 4 5 3	
5 6 1 3 1 4 3 5 5 2 4 2 1 2 1 4 3 5 2	YES

3. Submission Result

3.1) Timus status

Recent submissions

Author: Min Aung Dain • Problem: Topological Sorting

ID	Date	Author	Problem	Language	Judgement result	Test #	Execution time	Memory used
8153065	16:58:14 28 Nov 2018	Min Aung Dain	1280. Topological Sorting	Python 3.6	Accepted		0.592	2 568 KB

ID	Date	Author	Problem	Language	Judgement result	Test #	Execution time	Memory used
8153491	20:38:10 28 Nov 2018	SonamCT	1280. Topological Sorting	Python 3.6	Accepted		0.592	2 572 KB

3.2) Submission Detail

Language: Python 3.6

Execution time: 0.592

Memory used: 2 568 KB