HW13.1. Vacation Schedule

Doctor's Vacation Schedule

You are helping the medical consulting firm Doctors Without Weekends set up their work schedules of doctors in a large hospital. They've got the regular daily schedules mainly worked out. Now, however, they need to deal with all the special cases and, in particular, make sure they have at least one doctor covering each vacation day.

Here's how this works. There ar k vacation periods (e.g. the week of Christmas, the July 4th weekend, the Thanksgiving weekend, ...), each spanning several continuguous days. Let D_j be the set of days including in the j-th vacation period; we will refer to the union of all these days, $\cup_j D_j$, as the set of all vaction days.

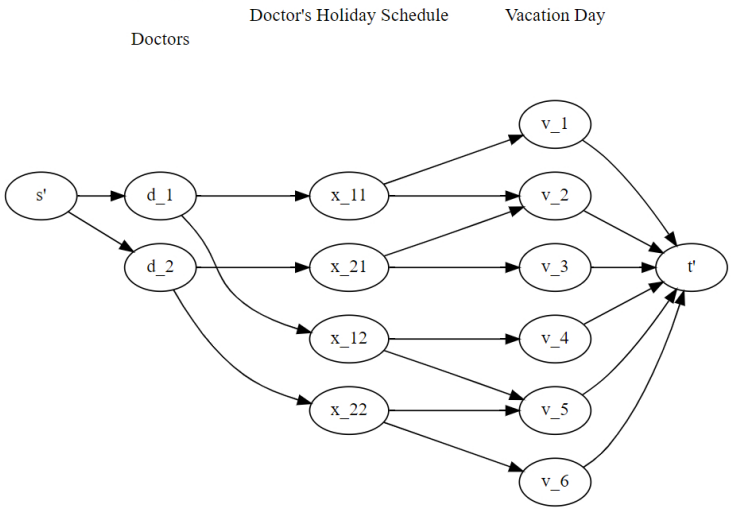
There are n doctors at the hospital, and doctor i has a set of vacation days S_i where he or she is available to work. (This may include certain days from a given vacation period but not others; so, for example, a doctr may be able to work the Friday, Saturday or Sunday of Thanksgiving weekend, but not the Thursday.

Use network flows to determine whether it is possible to select dcotrs to work on each vacation day subject to the constraints.

- For a given parameter, c, each doctor should be assigned to work at most c vacation days total, and only days when he or she is available.
- For each vaction period j, each doctor should be assigned to work at most one of the days in the set D_j. (In other works, although a particular doctor may work on several vacation days over the course of the year, he or she should not be assigned to work two or days of the Thanksgiving weekned, or two or more days of the July 4th weekend, etc.)

Network flow formulation

Consider the following flow graph:



Note that holidays are groups as being part of the same vacation period. Also, it was not possible to draw subscripts on the vertex labels, so underscores (_) are used to indicate subscripts.

Select all that are needed to define the graph

- [x] There vertex x_ij for every doctor i and vacation period j.
- [ ] There is an edge with capacity 1 from x_ij to v_k if $k \in D_j$.
- [ ] There is an edge with capacity 1 from each doctor to each "Doctor's holiday schedule" involving that doctor.
- [x] There is an edge with capacity 1 from d_i to x_ij for every doctor i and vacation period j.
- [x] There is a vertex v_k for each vacation day k.
- [ ] There is an edge from s to each doctor with capacity 1.
- [x] There is an edge with capacity 1 from x_ij to v_k if $k \in D_j$ and doctor i is available to work on vacation day k.
- [x] There is an edge from s to each doctor d_i with capacity c.
- [x] There is an edge from each vacation day v_k to t with capacity 1.
- [ ] There is an edge with capacity 1 from x_ij to v_k if doctor i is available to work on vacation day k.
- [ ] There is an edge from each vacation day v_k to t with capacity 1.
- [x] There is a vertex d_i for each doctor i.

Select all possible options that apply.

✓ 100%

If there are m total vacation days, then there is a schedule meeting the constraints if the max flow of the graph is

Homework 13

Assessment overview

Total points: 2/2

Score: 100%

Question

Submission status: complete

Best submission: 100%

History: 1

Total points: 1 /1

Auto-graded question

Report an error in this question

Previous question

Next question

Personal Notes

No attached notes

Attach a file

Add text note

m 100%

Try a new variant

Correct answer

Submitted answer

ashwin.pawar@slu.edu submitted at 2024-05-06 07:25:14 (CDT) 100%

hide