1. **Reading Week.** Catch up on your studying for the course and bring your unresolved questions to the next tutorial, which is on Mon., Feb 26.

2. **Teaching Assignments.** You are chair of the Department of Computer Science, and are given the following information. There is a set of profs \( P = \{p_n\}_{n=1}^N \), a set of courses \( C = \{c_k\}_{k=1}^K \), and the number of course sections \( S = \{s_k\}_{k=1}^K \) being offered next term. Here \( s_k \) is a positive integer equal to the number of different sections of course \( c_k \) that need to be taught next term. In addition, for each prof \( p_n \), you are given the set of courses that he/she likes to teach, say \( T_n \subset C \), along with her teaching load \( L_n \). This teaching load \( L_n \) is the number of courses that prof \( p_n \) is assigned to teach next term (here \( L_n \geq 0 \) is an integer). Finally, suppose the sum of teaching loads, \( L = \sum_{n=1}^N L_n \), is equal to the number of course sections that need to be taught, \( S = \sum_{k=1}^K s_k \).

The prof-to-course assignment problem is then to assign each prof \( p_n \) to exactly \( L_n \) course sections, with the courses themselves chosen from \( T_n \), and ensure that each section of each course gets assigned a professor.

(a) Represent the prof-to-course assignment problem as a \( s-t \) network flow problem. Describe exactly the relationship between flows in your graph and prof-to-course assignments. That is, on one hand, given any flow (or perhaps a restricted family of flows) explain what assignment it represents. And, on the other hand, given an assignment explain how this assignment can be represented as a valid flow in your graph.

(b) One question we might ask is whether an assignment is even possible? Can the professors cover all the sections of all the courses? Describe in detail how you can answer that question using your network flow. (You can use algorithms described in the course notes or text without writing them out again.)

(c) In situations where a prof-to-course assignment is possible, explain how your network flow provides a suitable assignment. In particular, explain why this assignment must satisfy the constraints of the prof-to-course assignment problem.

(d) In situations where it is not possible to cover all the courses, how can you clearly convince the faculty that no such assignment is possible? Your argument must be worded in terms of the sets of courses professors like to teach, their teaching loads, and the sections that need to be taught, and not in terms for your network flow problem. It must be verifiable from these given quantities using only simple arithmetic.