For all following problems, unless otherwise noted, file names refer to classical domains from the classical planning domains repository of http://planning.domains available here: https://bitbucket.org/planning-researchers/classical-domains/src/master/classical/

1. **Blocksworld:** Finish the Blocksworld problem started in class (continue from Slide 38).

2. **Elevator Domain:** Open the domain file `elevators-00-strips/domain.pddl`. Then open `elevators-00-strips/s3-4.pddl` and solve the planning problem using Partial-Order Plan-Space Planning.

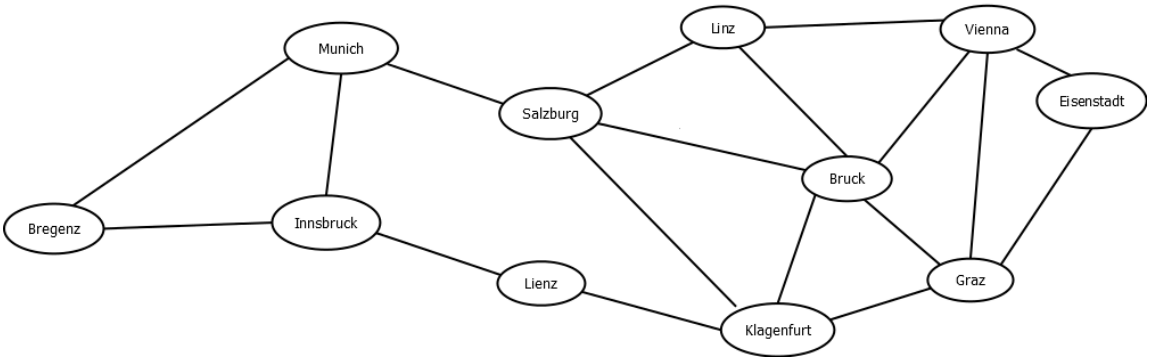
For the following four problems, assume the following domain:

Operator: `load(?t - truck, ?p - package, ?l - location)`
Precondition: `(and (at ?t ?l) (at ?p ?l))`
Effect: `(and (not (at ?p ?l)) (in ?p ?t)))`

Operator: `move(?t - truck, ?fr - location, ?to - location)`
Precondition: `(and (at ?t ?fr) (road ?fr ?to))`
Effect: `(and (not (at ?t ?fr)) (at ?t ?to))`

Operator: `unload(?t - truck, ?p - package, ?l - location)`
Precondition: `(and (at ?t ?l) (in ?p ?t))`
Effect: `(and (at ?p ?l) (not (in ?p ?t)))`

We will also use this map for the locations and roads:



3. **Logistics Domain:** Consider the case where you have 2 trucks and 6 packages all in different cities in Austria. Write down the initial state and a possible (interesting) goal for this problem. What advantage does Partial-Order planning have in this case over State-Space planning?

4. **Logistics Domain:** Consider the case where you have a truck in Vienna, a package p_1 in Graz that needs to be delivered to Linz, and a package p_2 in Bruck that needs to be delivered to Salzburg. Write down the initial state and goal condition for this planning problem and solve it using Partial-Order Planning.

5. **Logistics Domain:** Consider the case where you have a truck in Bregenz, a truck in Linz, a package p_1 in Innsbruck that needs to go to Klagenfurt, a package p_2 in Munich that needs to go to Eisenstadt, and a package p_3 in Bruck that needs to go to Eisenstadt. Find at least two (significantly) different, reasonable plans to solve this problem (you don't have to write down the entire partial-order planning procedure), and explain how Partial-Order Planning may help with finding them (Note: Trucks can carry more than one package at the same time).

6. **Logistics Domain:** One advantage of partial-order planning we discussed in class is the principle of least commitment, which means that variables are bound to values as late as possible. Imagine in addition to trucks we also have airplanes that connect some (but not all) cities, i.e. airplanes can only move to and from cities with airports. Write planning operators that encode this behavior (add reasonable extra predicates as needed), and explain how the principle of least commitment may be useful in this scenario.