Assignment 4 is due May 23, 23:30.

Suppose that a travel agent asks you to design and develop an algorithm that computes a shortest itinerary I_c from *Istanbul* to every city/town c in a given set C of cities/towns in Turkey. For instance, if $C = \{Ankara, Izmir\}$, then the goal is to compute a shortest itinerary from *Istanbul* to *Ankara*, and a shortest itinerary from *Istanbul* to *Izmir*.

The travel agent has an additional request. For every city/town c in C, there is a set S_c of cities/towns that the tourists are usually interested in visiting on their way to c. The travel agent desires all the cities/towns in S_c to be included exactly once in the itinerary I_c computed by your algorithm. For instance, for $c=Ankara$ and $S_{Ankara}=\emptyset$, according to the travel distances between cities/towns provided to you by the travel agent, a shortest itinerary from *Istanbul* to *Ankara* may be

$$I_{Ankara}=\langle Istanbul, Izmit, Bolu, Ankara\rangle.$$

If $S_{Ankara}=\{Bolu, Duzce, Zonguldak\}$ then,

$$I_{Ankara}=\langle Istanbul, Izmit, Duzce, Zonguldak, Bolu, Ankara\rangle.$$

If $S_{Ankara}=\{Kirikkale\}$ then

$$I_{Ankara}=\langle Istanbul, Izmit, Bolu, Kirikkale, Ankara\rangle.$$

(a) Define the problem described above, precisely as a computational problem: Input? Output?

(b) Prove that this problem is NP-complete: Membership? Hardness?

A pdf copy of your own solution should be submitted at SUCourse+.