Exercises on Flows over Time

Exercise 1

Determine maximum flows over time for the time for the time horizons $T_1 = 3$ and $T_2 = 12$ in the following graphs. All arcs have unit capacity and the numbers indicate the travel time.

Exercise 2

Show that the value of a dynamic cut equals the value of a certain cut in the time expanded network.

Exercise 3

Show that an earliest arrival flow is also a latest departure flow!

Exercise 4

Show that an earliest arrival flow need not exist in the case of more than one source and more than one sink!

Exercise 5

Find an earliest arrival flow for an interesting time horizon in the the graph depicted in the second figure above. Make a rough drawing of the situation in the corresponding time expanded graph.

Exercise 6

Show that the min-cost-flow problem for flows over time with time horizon is NP-hard. Can you solve it in pseudopolynomial time?

Exercise 7

Given an example that the earliest arrival flow problem can not be solved by a single temporally repeated flow.