Exercise No. 6
Communication Networks I
Summer Term 2015

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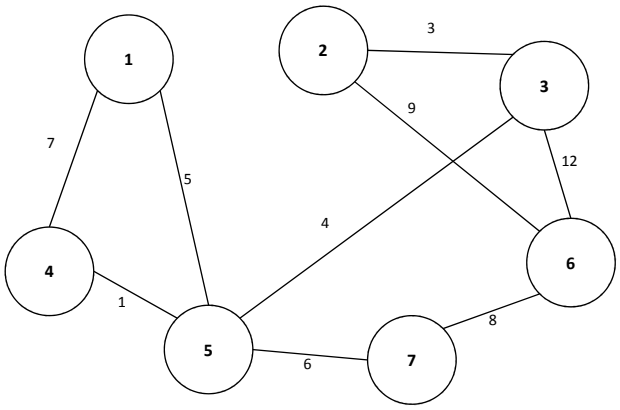
General Remarks

Welcome to the exercise for Communication Networks I. Please adhere to the following general remarks regarding the organization of the exercise during this summer term.

- One week before the tutorial, a new exercise will be published at the Exercise area of the KN1 Moodle (`https://moodle.tu-darmstadt.de/course/view.php?id=5268`)
- The exercise serves as your hands-on experience in addition to the lecture and as a preparation for the exam
- The questions in the exercise can be discussed at the tutorial date
- The sample solution for the exercise is available at the Exercise area of KN1 Moodle in addition to the corresponding tutorial. Nevertheless, we encourage students to try to solve the exercise themselves before the tutorial date without looking into the solution as a good practice to understand the subject of the lecture

Problem 1 - Kruskal's Algorithm

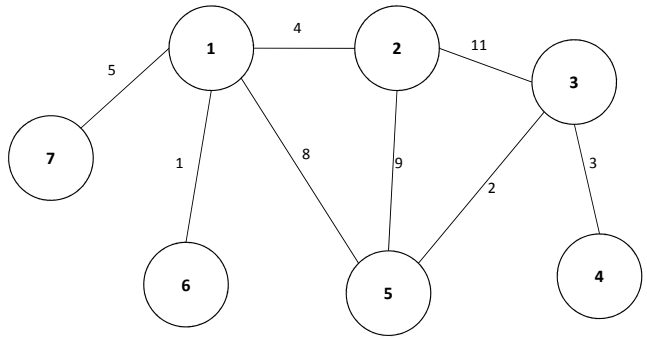
a) Calculate the length of the shortest spanning tree using Kruskal's Algorithm. Draw the final graph and show your results in the table.



Edge	Length	Choice
(4,5)	1	1
(2,3)		

Problem 2 - Prim's Algorithm

a) Calculate the length of the shortest spanning tree using Prim's Algorithm. Draw the final graph and show your results in the table. Complete *U* and *S*.



k	i(k)	λ_k
1	1	-
2		
3		
4		
5		
6	1	1
7		

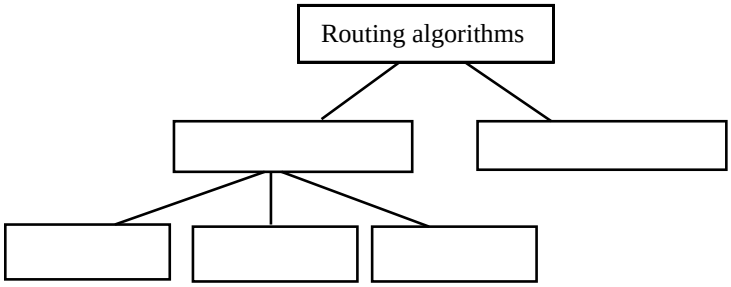
U={1,6}
S={(1,6)}

Notation:
k - node
i(k) - preceding node
λ_k - distance between k and i(k)
U={} - ordered set of nodes
S={} - ordered set of edges

b) Compare Prim's Algorithm with Kruskal's Algorithm: What is the main difference between these two algorithms? How are cycles avoided in Prim's Algorithm?

Problem 3 - Routing in General

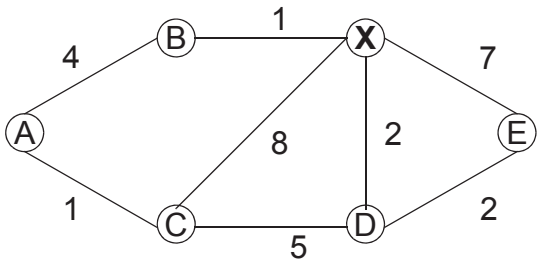
a) We know a lot of routing algorithms. Please give a classification of these algorithms, using the following scheme:



b) Describe shortly some advantages and disadvantages of the different classes of routing algorithms.

c) Name three routing algorithms and the class they belong to!

d) Determine the routing table for node X according to Dijkstra's Shortest- Path-Algorithm for the following network topology:

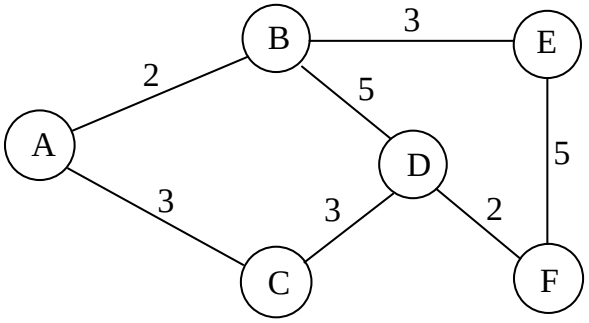


Dest.	Distance	Outgoing Link
A		
B		
C		
D		
E		

Problem 4 - Backward Learning

a) Which class of routing algorithms does the Backward Learning algorithm belong to?

b) Look at the following network (the numbers indicate a metric for the distance of 2 nodes):



In this network, the Backward Learning routing algorithm is used. You can find the routing tables of the nodes in the following table (next page). The intital state of the routing tables was specified by the network administrator. The entries in the routing tables have the following form:

Station	Target	Egress/Costs

A question mark means, that the distance is not yet known.
Now six packets are transmitted over the network (in this order):

Sender		Receiver
F	→	A
D	→	A
B	→	F
C	→	B
E	→	D
A	→	F

Determine after each transmission, how the routing tables of all the stations look like (fill out the table on the next page). You need not to copy the entries, when nothing changes.

			after transmission of packet…					
Node	Target	Initial state	F → A	D → A	B → F	C → B	E → D	A → F
A	A	-						
	B	B/2						
	C	C/3						
	D	B/?						
	E	B/?						
	F	B/?						
B	A	A/2						
	B	-						
	C	D/?						
	D	D/5						
	E	E/3						
	F	D/?						
C	A	A/3						
	B	D/?						
	C	-						
	D	D/3						
	E	D/?						
	F	D/?						
D	A	F/?						
	B	B/5						
	C	C/3						
	D	-						
	E	F/?						
	F	F/2						
E	A	B/?						
	B	B/3						
	C	B/?						
	D	B/?						
	E	-						
	F	F/5						
F	A	E/?						
	B	E/?						
	C	E/?						
	D	D/2						
	E	E/5						
	F	-						

c) Now, the entries of the routing table of station B are not yet optimal. For which targets the optimal path was not found? Can you give some packets, whose transmission improve B's routing table?

d) Assume the network is in the initial state again (like in b). Find a sequence of packets, that will cause the best possible entries in B's routing table (considering the initial state). Fill out the following table with the needed packets and B's routing table after each transmission (you need not write down the routing tables of the other stations):

			after transmission of packet…					
Node	Target	Initial state						
B	A	A/2						
	B	-						
	C	D/?						
	D	D/5						
	E	E/3						
	F	D/?						

e) How can the Backward Learning algorithm be modified, so that the quality of the routing tables improves?