

Feb. 17th, 2021

## Online Exam of Switching technologies for data centers (2020/21)

**Rules for the exam.** It is **forbidden** to use notes, books or calculators. When needed, use approximations. The answers must be provided in correct English. Any notation must be defined.

**Time available: 70 minutes.**

### Problem A

Consider a  $N \times M$  input queued switch with Virtual Output Queueing for data centers. To minimize the flow completion time, the scheduler **transfers at highest priority the packets corresponding to shortest flows**. Let  $F[i][j]$  be the flow length of the head-of-the-line packet of the VOQ from input  $i$  to output  $j$ .

1. Write in pseudocode a greedy algorithm to schedule the transmissions.
2. Define all the required data structures, providing a detailed description of their use and meaning.
3. Can the packets of a specific flow starve forever? Motivate in details your answer.

### Problem B

Design a Banyan network, of size  $8 \times 8$ .

1. From which other network is possible to obtain the required network? How?
2. Draw the whole network, number properly all the inputs, the outputs and the modules.
3. Banyan networks are blocking. Provide an example of blocking configuration with at least 4 connected input-output pairs.
4. How is it possible to design a non-blocking network starting from a Banyan one?

### Problem C

Given the following routing table, represented as (prefix, rule):

$(0000, A), (0001, B), (001, C), (01, D), (010, E), (011, F), (1, G), (1000, H), (1001, I), (1110, L), (1111, M)$

1. Build the corresponding binary trie.
2. Build the corresponding Patricia trie.
3. Evaluate the number of memory accesses when searching for a given address:

Address	Num. memory accesses	
	Binary trie	Patricia trie
0000 0000		
0111 1111		
1011 1111		
1100 1100		
1111 1111		