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

Describe in pseudo-code a scheduling algorithm for an $A \times B$ input queued switch, designed to reduce the flow completion time in data centers. Such algorithm is maximal and gives higher priority to the head-of-the-line (HoL) packets with less residual packets in the corresponding flow. Let $P[i][j]$ be the residual number of packets for the flow of the HoL packet at VOQ at input i and destined to output j. Define all the required data structures.
Could be there any starvation problem for the flows? Why?

Problem B

Consider a hash table with 4 buckets storing IP addresses and the corresponding number of packets.

1. What is the difference between a hash function and a hash table?

2. Define a proper hash function.

3. According to the above hash function, describe the state of the hash table after each operation:

Operation	Bucket 1	Bucket 2	Bucket 3	Bucket 4
Insert (10.0.0.1,10)				
Insert (10.0.1.1,15)				
Insert (10.0.2.1,20)				
Insert (10.0.3.1,25)				
Insert (10.0.2.1,30)				
Insert (10.0.4.1,40)				
Delete (10.0.0.1)				

Problem C

Consider the network shown in figure, connecting host H1 to host H2 through 2 Openflow switches (A and B).
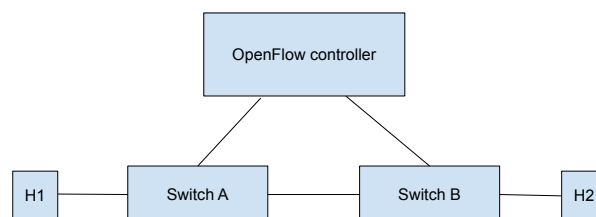
Assume now that 3 Ethernet packets are sent from H1 to H2 and that all the flow tables in the switches are initially empty.

1. Show the sequence of packets observed in all the links (both data plane and control plane), highlighting the role of pkt-in, pkt-out and flow-mod messages.

2. Show the final flow tables in both switches.