Qualifying Exam: Network Architecture
Jan. 2017

Instruction:
- Put your name and student number on all your answer sheets.
- You have 60 minutes to complete the exam.
- **Show all your work. Partial credit will be considered, if you show intermediate steps in obtaining the answer.**

Question #1 (30pt):

a) "Virtual circuit switch" which is stateful network switch should maintain state about the communication. Stateless networks such as IP network don't need to maintain it. Explain why stateless networks are good for network survivability. (10pt)

b) Stateless IP network has problems shown below. Suggest your solutions(20pt)
- Difficulties to implement some functions which need network level control information such as congestion control, multicast, QoS guarantee,… etc.,
- Greedy sources aren't handled well

Question #2 (20pt):
a) What is the main reason for mobility problem of IP network which has hierarchical addressing scheme? (10 points)

b) How does the "HIP' protocol solve this problem? (10 points)

Question #3 (30pt):   TCP
a) TCP uses AIMD to reach equilibrium when there exist multiple flows over the links. Explain how AIMD achieve this goal.

b) Why does TCPW show better performance than TCP-RENO when burst packet losses occur due to bit corruption over wireless link?

c) A sender needs to avoid injecting a new packet before an old packet has exited from the TCP path to minimize packet drops from the buffers. How does TCP-RENO achieve this?

Question #4 (20pt): Active queue management
a) TCP does the "congestion control" for IP networks. It is supposed to be done at network layer since that is network layer problem. What is the basic reason why TCP does it?

b) "Random Early Detection(RED)" and "Explicit Congestion Notification (ECN)" are often used as leverage to enhance efficiency of congestion control. Show the case where RED may help TCP congestion window control for better congestion control. Show also the case where ECN with RED can be used as leverage in TCP congestion control.