COMP 445 - Fall 2015
Theory Assignment 1

Due Date & Submission Format: *Please see course outline.*

1) Circuit Switching aims at providing a better service through the reservation of the circuit (i.e. circuit is dedicated). Now, considering only the perspective of the communicating users over a Circuit Switching network (i.e. you should not be concerned with the entire utilization of the network or the advantages to other users), is it possible that Circuit Switching may actually end up harming its users instead of providing a better service to them. If yes, provide a scenario/case that shows that. If no, explain why this service will indeed provide the best service to its users at all times.

2) With DSL ISPs, dedicated lines usually connect to the local offices to the location where the service is provided (i.e. residential homes). In contrast, with Cable ISPs, the connection is shared between multiple homes in a neighborhood. In spite of this configuration that is clearly to the benefit of DSL users, service provided by Cable ISPs may still be superior to the one provided by DSL providers. Explain the reasons behind this. Further, if you are hired by a DSL provider, and taking into account that changes to the company's infrastructure (i.e. wiring) is quite costly, what would you propose in order to speed up the provided service while balancing the cost.

3) HTP provides two connections methods: persistent and non-persistent. While there are clear advantages of persistent-HTTP, it is rather unclear whether non-persistent can be of any use. Conduct a small research to find out why these two modes of connections are provided. In specific, you should find out some of the advantages and disadvantages of each of them, hence justifying their concurrent existence.

4) A successful attack to the Internet DNS would be devastating. Explain what type of attacks can be made towards DNS. Why, to-date, such attacks in practice have not been successful? In your answer, you should consider caching in particular. Why such technique has not only proven to provide better performance, which is its original goal, but also protection against security attacks.

5) Perform a Traceroute between your machine and any other host/server on the Internet, preferably an overseas server. Provide snapshots of what was returned and analyze the returned information. In specific, you should comment on any behavior that looks either different or unusual. Indicate the number of routers between your machine and the targeted host/server.

6) Suppose two hosts, A and B, are 10,000KM apart and are connected by a direct link of rate R = 5 Mbps. Assume further that the propagation speed over the link is 2.5×10^8, and that the packets to be transferred are of size 2 Mbits.

   a. What is the propagation delay to send one packet from A to B?
   b. What is the transmission delay to send 8 packets from A to B?

7) Now assume some modifications to the network specified in Question 6 above, where 2 routers are installed between A and B at more or less equal distances. Further assume the link from A to the first router has been replaced by another link of rate R=4 Mbps, the link between the two routers was kept as before, and the link between the second router and B was replaced by a link of rate R=6 Mbps. Assume negligible processing and queuing delays in the routers.
   a. What is the propagation delay to send one packet from A to B?
   b. What is the total transmission delay to send 2 packets from A to B?
   c. How much time is needed to send one file of size 20 Mbits from A to B?

8) BitTorrent uses a trading scheme referred to as *tit-for-tat*. While some researchers argued particular deficiencies in that scheme, others argued that if it was not for tit-for-tat, it is likely that BitTorrent would not even exist today. Explain both points of view. In other words, you should indicate the disadvantages of the scheme, as well as why it is still crucial to have such a scheme, or an alternative one, for BitTorrent to exist.

9) (Textbook Question P.22 – Page 177). Consider distributing a file F of size 15 Gbits to N peers. The server has an upload rate of u_s= 30 Mbps, and each peer has a download rate of d_i = 2 Mbps and an upload rate of u. For N = 10, 100, and 1000 and u = 300 Kbps, 700 Kbps, and 2 Mbps, fill the following table by the minimum distribution time for each of the combinations of N and u for both client-server distribution and P2P distribution.

Client Server

		N		
		10	**100**	**1000**
u	**300 Kbps**			
	700 Kbps			
	2 Mbps			

Peer to Peer

		N		
		10	**100**	**1000**
u	**300 Kbps**			
	700 Kbps			
	2 Mbps			