The Final Exam Main Topics

1. Internet Architecture and Protocols

The focus should be on understanding the basic functionalities of Internet Protocols (IPv4) and relate these functionalities to the basic fields of the corresponding IP datagram

a. Principles of best-effort service
    i. How do the service semantics relate to E2E argument?
    ii. What are the limitations of such a service?
b. IP Protocol basic features
    i. Fragmentation and reassembly
        1. Pros and Cons
    ii. Stateful vs. Stateless Addressing
c. Subnetting and Supernetting
    i. Subnets and Network Masks
    ii. CIDR and Longest Prefix Matching Rule
d. You should be able to develop an address scheme which meets best the requirements of an organization, in terms of number subnets, number of hosts per subnet, potential for extension in the future, etc.

2. TCP Traffic Control

a. Understanding the sliding window mechanisms TCP used to provide flow control
b. Understand the effect of Window size on the performance of TCP
c. Be prepared to discuss the retransmission strategy TCP uses to deal with errors and absence of positive acks
d. Understand the adaptive retransmission timer TCP uses to estimate the current RTT delay

3. TCP Congestion Control

a. Understanding the mechanisms TCP uses to control congestion
b. Understand RTT variance estimation
c. Understand window management
    i. Slow start, dynamic window sizing on congestion,
    ii. Fast retransmission, Fast recovery, Limited Transmission
d. Be prepared to solve problems similar to those asked in homework assignments.

4. Traffic Engineering Design Issues and Mechanisms for QoS Support

a. QoS Support and SLA
b. Traffic Descriptors
    i. Constant Rate, Average Rate and LBAP
c. Traffic shaping and policing
    i. Leaky Bucket and its variants
    ii. Token Bucket

d. Be prepared to analyze the performance of a token-bucket algorithm for different scenarios, including how to use leaky and token buckets to police and shape traffic

5. Scheduling

a. Be prepared to discuss scheduling disciplines with respect to the basic criteria we discussed in class: Ease of implementation, performance bounds, ease of implementation and fairness and isolation.

b. Understand the concept of min-max fairness, including weighted min-max fairness
    i. Be prepared to apply this concept in a different context and show the resulting min-max allocation.

c. Work conserving scheduling disciplines, non-work conserving, and the main issues related to these disciplines in terms of performance, traffic shaping, etc ...

d. Fair Queueing, GPS and its derivatives
    i. Be prepared to discuss formal definition and prove some basic properties of these disciplines, especially GPS.
    ii. Be prepared to discuss the criteria used to typically to evaluate GPS approximation and compare different approximation of GPS.

e. Packet Dropping
    i. RED Design Principles and algorithms
    ii. Be prepared to answer relevant to the basic idea and mechanisms that drive the design of RED.

6. Homework Practice

Thee test will involve problems very similar to those that have been asked in the homework assignments. You are strongly encouraged to re-work these problems and understand the techniques used for their solutions.