T1

CME 451 Transport Networks McCrosky 11 Oct. 2006

Midterm

12 October 2006

Instructions:

- This exam is closed book. No materials other than pen/pencil, supplied exam paper, and supplied answer paper may be used.
- You have the entire class period to complete your answers, but exam papers must be handed in to the instructor immediately when the period ends or they will not be marked.
- Feel free to ask questions of the instructor.
- Write each answer starting at the top of the front or back of a sheet of supplied paper.
- Write your name and the number of the question being addressed at the top of each sheet.
- No points will be deducted for poor English, spelling, or grammar. However, it is the responsibility of the student to adequately communicate to the instructor.
- When done, arrange all sheets in order and staple them together. Include any scratch sheets at the end of your stapled collection of pages.

Good luck!

Traffic Models

1) **[5 points, or 5% of the exam which has 100 points; given 80 minutes, it would be wise to budget about 5%*80 = 4 minutes to this question]**

a) What advantages accrue in voice telephony systems as more and more users or calls are aggregated in systems on trunks?

b) Describe the behaviour of data traffic (e.g., ftp or http transfers). What happens as progressively more data streams are aggregated into one flow? Compare this behaviour to voice telephony traffic? What are the consequences on any differences for the Internet?

TCP/IP

2) **[15 points; 12 minutes]** Describe as accurately as you can how the TCP/IP protocol suite accomplishes flow control?

3) **[15 points; 12 minutes]** While TCP/IP is lovely for many applications, it does have shortcomings. Identify and briefly describe any significant problems with TCP/IP, and the effects they cause.

SONET/SDH

4) **[5 points; 4 minutes]** Consider an OC-192 SONET/SDH signal. What sizes (in approximate bits/second) of logical channel pipes can it be sub-divided to provide?

5) **[10 points; 8 minutes]** Briefly explain how SONET/SDH accomplishes the following functions. If you can, describe these mechanisms in terms of specific header bytes.

a) accommodating differences in transmitter and receiver clocks when moving SPEs,

b) checking for transmission errors,

c) framing, and

d) avoidance of excessive consecutive identical digits (CSD) in the receiver.

Multiple Protocol Layers

6) **[6 points; 4.8 minutes]** Consider the following protocols: TCP, UDP, IP, ATM, MPLS, POS, GFP, SONET, G.709, and Ethernet.

a) Which of these protocols are cell-based?,

b) which are packet-based?,

c) which are TDM-based?

d) Which provide an error protection code for their payload?,

e) which provide an error correction code for their payload?.

f) Which protocols are self-routing in the sense that control information in the header helps determine the route the information will follow through a network?

7) **[3 points; 2.4 minutes]** GFP solves two problems inherent in HDLC-derived protocols such as PPP and POS. Identify these problems and describe how GFP avoids the two pitfalls.

8) **[3 points; 2.4 minutes]** What fundamental problems with SONET/SDH does G.709 attempt to solve. Describe how one of these problems is addressed by G.709?

9) **[3 points; 2.4 minutes]** How does ATM use its cell loss priority (CLP) bit to avoid unnecessary loss of performance in TCP/IP traffic when ATM cells carrying that traffic must be dropped.

MPLS

10) **[10 points; 8 minutes]** Describe the operation of an MPLS network in terms of how packets are analyzed and routed.

11) **[5 points; 4 minutes]** Describe MPLS "label stacking", as described in the MPLS summary by Stallings that you read.

Solutions for TCP/IP

12) **[20 points; 16 minutes]** Describe and compare three different protocol stack solutions which have been used or proposed to solve the problems raised by TCP/IP.