

Concordia University
ELEC463/6851 – Telecommunication Networks

Instructor: Dr. D. Qiu

Final Exam

Winter 2006

Notes: This is a closed-book exam. You are allowed to have two-page double-sided crib sheets. Calculators are allowed.

- 1) Explain slow start, congestion avoidance, fast retransmit, and fast recovery of TCP congestion control. **(15 marks)**
- 2) Assume that bit errors occur at random with probability $p = 10^{-6}$. For GFP framing, what is the probability that the PLI and cHEC are not consistent? **(10 marks)**
- 3) Consider the PPP byte stuffing method. What are the contents of the following received sequence of bytes after byte destuffing? **(10 marks)**
0x7D 0x5E 0xFE 0x24 0x7D 0x5D 0x7D 0x5D 0x62 0x7D 0x5E
- 4) Draw the diagram of a multistage switch that consists of three stages of smaller space-division switches. What is the condition that such a switch should satisfy in order to be non-blocking? **(15 marks)**
- 5) SONET allows positive or negative byte stuffing to take place at most once every four frames. Calculate the minimum and maximum rates of the payload that can be carried within an STS-1 SPE. **(15 marks)**
- 6) A wireless LAN uses polling to provide communications between M workstations and a central base station. The system uses a channel operating at 2.5Gbps. All stations are 100 meters from the base station. Polling messages are 64 bytes long and frames are of constant length of 1250 bytes. Assume that stations indicate that they have no frames to transmit with a 64-byte message. Assume that the signal propagates at a speed of 3×10^8 m/sec. What is the maximum possible arrival rate in frames/second that can be supported if stations are allowed to transmit 10 frames per poll? **(15 marks)**

(see next page for question 7)

- 7) A 74,000 byte message is to be transmitted from the source to the destination. The network limits packets to a maximum size of 1500 bytes, and each packet has a 20 byte header. The transmission lines in the network have a bit error rate of 10^{-6} . Assume that the size of ACK/NACK packet is 40 bytes and that the transmission of ACK/NACK packets is error free. There are no queueing delays, the processing times are negligible and the time out duration has been chosen to expire at the arrival time of ACK/NACK. Assume that **end-to-end** Stop-and-Wait ARQ is being used. As soon as the last bit of a packet arrives at the switch, its transmission over the second link begins. ACK/NACK are sent by the destination and the source does not begin the transmission of the next packet until the present packet is received error free by the destination. How long does it take on the average to get the message from the source to the destination? Assume that the signal propagates at a speed of 2×10^8 m/sec. (20 marks)

