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DEPARTMENT OF ELECTRONIC AND ELECTRICAL ENGINEERING

Spring Semester 2013-14 (2.0 hours)

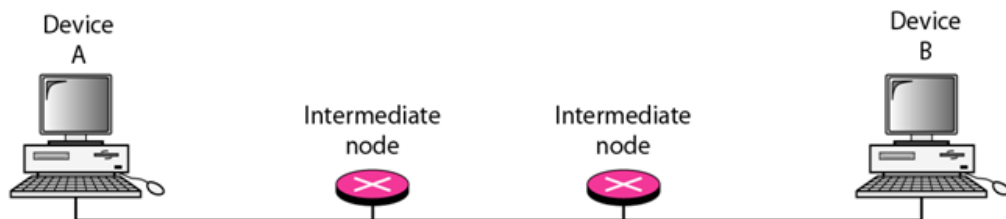
EEE6432 Wireless Packet Data Networks and Protocols

Answer **THREE** questions. **No marks will be awarded for solutions to a fourth question.** Solutions will be considered in the order that they are presented in the answer book. Trial answers will be ignored if they are clearly crossed out. **The numbers given after each section of a question indicate the relative weighting of that section.**

1. a. i) What are the three general properties that define circuit switching? (6)
 ii) What are the three general properties that define packet switching?

 b. What is statistical multiplexing in packet switching networks? What is statistical multiplexing gain? (6)

 c. Using the following figure, show the layers of OSI seven layer protocol stacks and the flow of data when two hosts exchange messages. (8)



2. a. i) Why do we need coding? (6)
 ii) What are the key differences between block codes and convolution codes?

 b. What are the redundancy bits in block codes? How do the redundancy bits help to detect/correct errors? (6)

- c. i) Use Hamming code $C(7, 4)$ as an example to show how the codewords are generated at the sender side and how the parity bits are checked at the receiver side.
- ii) Assume the received codeword is: 0011001. What is the syndrome? What is the dataword? (8)
3. a. Assume that, in a Stop-and-Wait ARQ system, the bandwidth of the line is 10 Mbps and 1 bit takes 20 ms to make a round trip. What is the bandwidth-delay product? If the system data frames are 1000 bits in length, what is the utilization percentage of the link? (6)
- b. A system uses the Stop-and-Wait ARQ protocol. If each packet carries 1000 bits of data, how long does it take to send 1 million bits of data if the distance between the sender and receiver is 5000km and the propagation speed is 2×10^8 m/s? Ignore transmission, waiting, and processing delays. We assume no data or control frame is lost or damaged. (6)
- c. Repeat the above question (3.b) using the Go-Back-N ARQ protocol with a window size of 7. Ignore the overhead due to the header and trailer. (8)
4. a. Explain what random-access, controlled-access and channelization multiple access are. (6)
- b. List three strategies in CSMA/CA that are used to avoid collisions. (6)
- c. When the number of stations is very large, the Poisson distribution can be used to analyse the performance of a multiple access network. Using the Poisson distribution:
- i) Find the probability that a pure Aloha network generates x number of frames during the vulnerable time. Note the vulnerable time for this network is two times the frame transmission time (T_{fr}).
- ii) Find the probability that a slotted Aloha network generates x number of frames during the vulnerable time. Note the vulnerable time for this network is equal to the frame transmission time (T_{fr}). (8)