15-441
Question Set #1

1) What is preferable, a 10KHz media with a SNR of 20, or a 20KHz media with 3dB of noise (N:S, not S:N)? Why? Please show any work.

2) The typical analog voice line has a limited bandwidth, approximate 4KHz. Assuming that the codec produces 8-bit binary samples, how many concurrent calls can be supported by a 1MHz media? Why? Please show any work.

3) Assume that a mobile phone provider wants to improve the service quality on their "all digital mobile-to-mobile network" by offering CD-quality, mono channel, sound with a bandwidth of up to 44.1KHz at 16 bits per sample. Given that the existing system supports a bandwidth of up to 3.6KHz at 1-byte per sample, how much will they need to expand their network capacity to handle the sample call volume?

4) Under what circumstances would Pure Aloha be preferable to Slotted Aloha.

5) What would be the likely impact on a typical network of changing the IEEE 802.3 or Ethernet standard to use no delay instead of an exponential backoff? What about a simple linear backoff? Why?

6) Consider the design of a 1Gbps CSMA/CD protocol for use over a copper-cable run with a maximum length of 1km. Assume that signals propagate through the cable at a rate of 0.7c, a.k.a. 210,000km/s. What is the minimum frame size? How do you know?

7) Now, repeat question #6, but assume the protocol is CSMA, but does **not** involve *collision detection*.

8) In class, one detail of link layer protocols, including Ethernet, that we never mentioned is the *inter-frame gap*. Senders are required to pause between sending frames. This pause results in this gap between frames – they are not back-to-back. In some sense, this wastes valuable network time. What is the purpose of this gap?

9) The Ethernet standard dates back to the early 1970s. The specification is for an inter-frame gap of 96 bit-time, which is the amount of time it takes to send 96 bits. Several things have evolved in computers and networks since then. If the standard were developed from a “blank slate” today, do you think this delay would be the same or larger or smaller? Why? In answering, we are most concerned with the factors that you are considering and how they fit into your model – not you ultimate assessment.

10) Neither Ethernet, nor similar CSMA/CD protocols, are commonplace on fiber optic media. Why?