

EECS 4215: Homework Assignment 1

February 12, 2015

5 % of the course grade

Due: Saturday, February 21, 2015, 23:59 EST

Q1. Wireless technologies are developing.

- (a) What are the advantages of digital wireless over analog?
- (b) What are the advantages of 3G technologies over 2G?
- (c) - 4G are over 3G?

Cite your sources, motivate their choice. Do not just copy/paste. Instead, summarize the important aspects, arrange them in terms of importance, and, finally, add your own personal thoughts and opinions.

Q2. In North America, the government regulations over spectrum are standard agnostic; on the contrary, the EU often mandates that one standard be used in a given band. What approach do you think is better? Why?

Q3. What limits the number of simultaneous users in a TDM/FDM system compared to a CDM system? What happens to the transmission quality of connections if the load gets higher in a cell, i.e., how does an additional user influence the other users in the cell?

Q3. In a table, list all the wireless technologies popular in modern wireless services (2G, 3G, Wi-Fi, WiMAX, HSPA/HSPA+, LTE). Research and list their main parameters such as: (a) frequency of operation; (b) RF channel bandwidth; (c) peak uplink and downlink data rates; (e) modulation type; (f) multiple access scheme.

Q4. What is the main physical reason for the failure of many MAC schemes known from wired networks? What is done in wired networks to avoid this effect?

Q5. How does the near/far effect influence TDMA systems? What happens in CDMA systems? What are countermeasures in TDMA systems, what about CDMA systems?

Q6. Examine the Shannon capacity equation and comment on what happens to channel capacity in the following different situations.

1. You operate in a fixed bandwidth W_0 , and increase the power (S) in the channel. How does capacity behave?
2. You have a limited power radio (therefore S is fixed); you increase system bandwidth, but as you do that system noise typically increases as well: $N = N_0W$ (where N_0 is a fixed noise density). How does capacity behave as bandwidth increases indefinitely? (calculate limit of C as $W \rightarrow \infty$).
3. You now fix your power spectral density: $S = S_0W$ (S_0 is your fixed transmit power density). How does capacity increase with bandwidth?

If you have any questions, don't hesitate to contact the instructor (andriyp@cse.yorku.ca).

Submission

Submit the answers electronically via `submit` command (or equivalent). Late penalty is 20 % per day. Submission 5 days or more after deadline will be given a mark of zero (0). Contact the instructor *in advance* if you cannot meet the deadline explaining your circumstances.

Academic Honesty

Direct collaboration (e.g., sharing answers) is not allowed (plagiarism detection software may be employed). However, you're allowed to discuss the questions, ideas, approaches you take, etc.

State all sources you use (online sources, books, etc.).