Instructions:

I. You must submit your homework electronically only in .pdf format. All word processed, no handwriting.
II. Submit your homework via Blackboard no later than **11:59 pm Oct 5, 2022**.
III. Late homework is subject to 10% penalty for each day past the due date, and before the solutions are posted. No homework will be accepted after the solutions are posted.
IV. Students can discuss problems and share their ideas among themselves but MUST work out the homework problems individually. Any deviation from this policy may result in an" F" grade for the course.
V. You must start working on these problems immediately. Otherwise, you may not have enough time to submit them on time.

1. If a binary signal is sent over a 3-kHz channel whose signal-to-noise ratio is 20 dB, what is the maximum achievable data rate? How about when the channel is noise free.

2. Calculate the end-to-end transit time for a packet for both GEO (altitude: 35,800 km), MEO (altitude: 18,000 km) and LEO (altitude: 750 km) satellites. Speed of light = 300,000 km/s.

3. Ten signals, each requiring 4000 Hz, are multiplexed onto a single channel using FDM. What is the minimum bandwidth required for the multiplexed channel? Assume that the guard bands are 400 Hz wide. What is maximum achievable data rate per channel with 8-level signals?

4. What is the percent overhead on a T1 carrier? That is, what percent of the 1.544 Mbps are not delivered to the end user?

5. In a typical mobile phone system with hexagonal cells, it is forbidden to reuse a frequency band an adjacent cell. However, non-adjacent cells can use the same frequency. If 840 frequencies are available, what is the maximum number of frequencies a given cell can use in a 7-cell cluster?