Homework 1 (100pt)

Rule: Finish all on your own.
Submit your solution in PDF format to eCourseware.

1. Explain ASK, FSK, PSK, and QAM.
2. If a wireless communication system supports BPSK, QPSK, 8PSK, 16QAM, 64QAM and 256QAM, what is the best strategy to choose a modulation scheme for wireless transmissions in the system?
3. Suppose that you need to design a cellular-like network, in which there is one base station serving as the centralized controller. Each wireless node is equipped with one single antenna and can use only one fixed frequency at 2.5GHz to transmit/receive wireless signals to/from the base station. Choose the most appropriate setups for the network.
   - Duplexing: full or half? Justify your choice.
   - Multi-access: SDMA, FDMA, TDMA, or CDMA? Justify your choice.
4. Why slotted ALOHA is better than pure ALOHA in terms of communication efficiency. What is the additional cost in slotted ALOHA?
5. If a wireless communication system uses $p$-persistent CSMA, should we choose a large or small value of $p$?
6. Explain the hidden terminal and exposed terminal problems.
7. Describe how ACK is transmitted in 802.11 DCF.
8. In binary exponential backoff in 802.11 DCF, the backoff time is a random number uniformly distributed in $[0, cw-1]$, where $cw$ is called the contention window. If two nodes both enter the backoff stage, one node’s $cw$ is 16 and the other’s $cw$ is 32, what is the probability that the two nodes end up with the same backoff time (this indicates that a collision will happen).
9. What is the beacon signal used for in 802.11?