Wireless Networks
Mid Semester Examination, Full Marks-28

1. Consider a wireless channel of 80MHz bandwidth and 1024 sub-carriers out of which there are 996 data subcarriers. Consider a Modulation scheme of 256 QAM and coding rate of 5/6, guard band=400ns [2.5+2]
   a) Compute the physical layer bitrate and symbol duration
   b) Suppose, the channel is divided into 4* 242 tones, and it is assigned to 4 users. Assume the same modulation and coding scheme, and compute the physical layer bitrate for each user.

2. Continuing from 2, suppose the AP has data for these 4 users, for all of them the AP uses an aggregation level of 10 and the packet size is 1500B. Suppose, it takes 8 symbols to send a 1500B packet and 4 symbols to send block-ACK and 1 symbol to send normal ACK. CWmin=15, DIFS=28us, SIFS=10us, slot-time=9us. Ignore any other overheads (such as preamble, header, trailer etc). Assume there are no failures/losses. [3 +3 +3]
   a) Compute the efficiency of transmission if we use OFDMA for both data and ACK. Here the ACK type is normal ACK. Efficiency is defined as data transmission duration/total duration, it measures how much of airtime is used for effective data.
   b) Compute the efficiency of transmission if we use OFDMA for both data and ACK, the ACKs types are block ACK
   c) Compute the efficiency of transmission if we use OFDMA for data only but ACKs are sent in OFDM fashion and ACK types are block ACK.

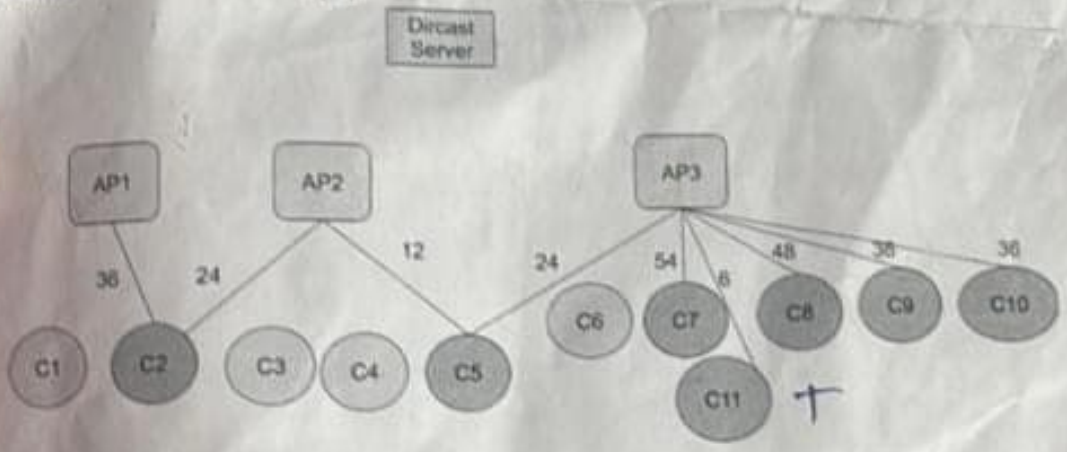
3. Suppose, in a CDMA system user A's code is 11101000 and user B's is 10111011 suppose 0 is encoded as -1. Suppose, user A wants to transmit 1 and user B wants to transmit 0. [2+ 2]
   a. Show how and whether the receiver will be able to decode both the user's data.
   b. Now suppose, user B uses 5 times more power than user A, show how and whether the receiver will be able to decode each user's data.

4. Consider the following variation of the SampleRate algorithm, called SampleRateDiff. SampleRateDiff is similar to SampleRate in all aspects except one: while SampleRate sends every 10th packet at a rate that provides lower loss transmission time, SampleRateDiff has an additional constraint that it sends at that rate if a) provides lower loss transmission time b) the sampled rate needs to be higher than the current one. Consider a 802.11g wireless link running SampleRate and SampleRateDiff, that can operate at 54, 48, 36, 24, 12, 6 Mbps. [2.5+ 2.5]
   a. For destination A, the table shows the transmission time of each rate. Determine what will SampleRate and SampleRateDiff will choose.
   b. For destination B, determine what SampleRate and SampleRateDiff will choose.

Destination		Avg Tx. Time	Lossless Tx. Time
A	54	3761	1873
	48	3000	2500

	36	3200	3200
	24	-	5000
	12	-	8000
	6	-	10000
B	54	2000	1873
	48	3000	2500
	36	2900	2900
	24	-	5000
	12	-	8000
	6	-	10000

4. Suppose, you employ Dircast solution for multicasting. Note that Dircast assumes that no changes would be made at the AP. Now, consider the following network. The nodes in orange color are the multicast clients. Each node's capability is shown with the link from AP to client, a node having two links can associate with either one. For example, C2 if it associates with AP1 can operate at 36 Mbps and with AP2 can operate at 24Mbps. C11 is the target client in AP3's network, it operates at 6Mbps.



a. What associations will Dircast choose as part of its association control mechanism? [1]
b. Now, suppose C11 turns off its WiFi interface, tell how Dircast will handle this i.e., how will other multicast client receive their multicast frames? Who will be the target client? Will the changes in association remain the same or change and how? [3]
c. Suppose, C11 goes into power save mode, how will Dircast handle this i.e, whether and how will other multicast clients receive their multicast frames? [1.5]