Mobile Communications
Problem Set 12

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1. What limits the maximum number of simultaneously active users in TDM / FDM systems in comparison to a CDM system?

2. Explain the problems known as "Hidden station" and "Exposed station" using a sketch.

3. Consider the project of covering a large hall (dimensions: 250m x 450m) with Wifi. We use Wifi Hotspots with transmission power of 63 mW and 2 dB antenna gain. The handheld devices using Wifi want to achieve the highest possible data rate, i.e., the highest modulation and coding scheme which is supported at a sensitivity of -65 dbm. Calculate the maximum radius R of one Wifi cell given a path loss coefficient of $\gamma = 2.5$. Hint: Remember that Wifi uses a frequency of 2.4 GHz. Now that we know the radius R of one Wifi cell we can calculate the signal to interference ratio (in dB) assuming that we use 12 Channels (i.e., cluster sizes of $N = 12$).

4. Consider two stations using a slotted reservation ALOHA system. The considered simplified system contains one short reservation slot of length x followed by a corresponding transmission slot of length $10x$. This pattern is repeated continuously. A station makes a reservation in the reservation phase with probability p. Assume statistically independent stations. In case of a successful reservation a station obtains the corresponding timeslot. Use the renewal reward theorem to calculate the long term throughput of the system.

5. An AWGN channel with a bandwidth of 500 kHz should be dimensioned for a data transmission. Is error-free data transmission with 10 Mbps over the AWGN channel possible, if the signal-to-noise ratio is 15 dB? Justify your answer.

6. What function do the beacon frames perform in an IEEE 802.11 network in the infrastructure mode?

7. Can we completely eliminate collisions, if we use the DCF with RTS/CTS?

8. The performance of the wifi network can be influenced by changing the size of the contention window. What influence on the performance has a too large value for CW? Explain your answer briefly.

9. Is it possible that a bluetooth device has the role of a master device in two different piconets? Why?

10. In GSM networks who is responsible for synchronization and why is the synchronization of the utmost importance?

11. What are the advantages and disadvantages of HSCSD?

12. What function do the following system components have in GSM?
    BSC, GMSC, VLR
    Please, write down the full name for each abbreviation.