Radio Communication Systems II, Examination, 10.12.2013

Problem 1.

a) Why spreading and scrambling codes are used in WCDMA? What are the main differences between spreading and scrambling code usage in WCDMA uplink and downlink?
b) Explain briefly the principle of the RAKE receiver.
c) WCDMA chip rate is 3.84 Mcip/s. Compute the processing gain and the spreading gain for 384kbit/s data service in HSDPA.

Problem 2.

a) Using the Figure 1, explain why the increasing traffic load is decreasing the cell range in WCDMA uplink.
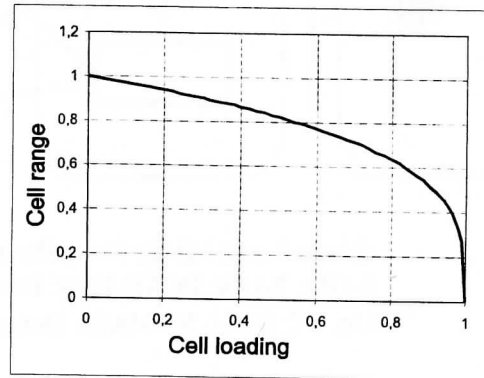b) Name and describe briefly 3 important new features that HSUPA add on top of WCDMA uplink.

Figure 1.

Problem 3. Are the following statements true or false? Answer just T/F (True/False). No justification is required.

1) In LTE uplink transmitter signal is first fed to Inverse Fast Fourier Transform (IFFT) and then Discrete Fourier Transform (DFT) is applied to the outcome from IFFT.
2) In LTE the extended cyclic prefix is used in large cells where the signal delay spread can be large.
3) In LTE downlink cyclic prefix is added after each block of 6-7 symbols.
4) LTE support operations on contiguous 40MHz bandwidth.
5) In LTE uplink, the reference symbols always occupy the same space in the time domain.
6) In WCDMA uplink, the cell capacity is bounded due to limited number of spreading codes.
7) The HSDPA closed-loop transmit diversity method needs two orthogonal Primary Common Pilot Channels (P-CPICHs) for channel estimation.
8) In LTE downlink the Physical Downlink Control Channel (PDCCH) is used to inform the device which time-frequency resource blocks are allocated to it.

(Evaluation: 7 correct answers => 6 points, 6 correct answers => 5 points, 5 correct answers => 4 points, 4 correct answers => 3 points, 3 correct answers => 2 points, 2 correct answers => 1 point, less than 2 correct answers => 0 points)