

Exam

Mobile Systems

28 October 2010

Question 1. General

- 1a. Explain why in GSM it is necessary to apply handover
- 1b. Explain the differences (in terms of advantage and disadvantage) between hard handover and soft handover.
- 1c. Explain why the uplink channel uses different frequencies than the downlink channel.
- 1d. Does the MS send and receive at the same time in GSM?
- 1e. When can *cell-breathing* in an UMTS-network occur?
- 1f. How does the system know where the MS is located?

Question 2. Cellular Networks

An operator of a GSM-900 mobile phone system intends to provide service for an area of $10'000\text{km}^2$. There are 50'000 people living in that area, homogeneously distributed. One person calls on average 5 min during busy hour.

- 2a. How many Erlang is produced in total during busy hour?
- 2b. Define a nominal cell plan for this system. Define cluster size, cell size, and number of available communication channels per cell.
- 2c. How many communication channels are needed in total if 2% blocking is allowed?

Question 3. CDMA

- 3a. Why has a well-designed CDMA-based system in principal a higher capacity than a well-designed GSM system?
- 3b. What is meant with scrambling code, spreading code and channelization code in UMTS?
- 3c. When can auto-correlation of a code occur at the receiver side?
- 3d. Show a possible OVVSF code for the sequence 1101 if the spreading factor = 8.
- 3e. Assume an UMTS systems with a fixed transmission bandwidth of 3.84 MHz. What is the capacity (= number of communication channels) for a cell if the Bit Energy-to-Noise Density equals 6 dB and the information data-rate is 30 kbps? Assume these values for the other parameters:
 - Power control correction factor = 0.8
 - Adjacent cell co-channel Interference = 0.9
 - Voice activity factor = 0.5

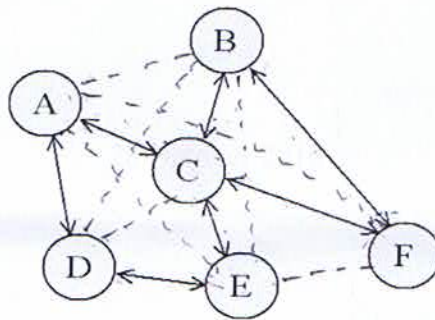
Question 4. Mobile Learning

- 4a. How would you try to increase retention of a school's course material using a mobile learning app?
- 4b. Create an interaction model for the mobile learning app in 4a. including also Richard Mayer's theory.
- 4c. Design an user model using GOMS for your app.

Question 5. Social Networks

- 5a. What is meant with "Homophily" in a social network. Give an example.
- 5b. When is there social balance in a triad? Show an example.

Given is this social network:



- 5c. What is the density of this network?
- 5d. Which node has the most power in this network if "Betweenness" would be the criterium?
- 5e. What is the betweenness of this node (answered in 5d)?
- 5f. How many cliques does this network have?
- 5g. Show at least one n-clan of this network