

Written Exam - February 13, 2018

Surname	
Name	
ID	

Time available for the exam: 1:45 hours

1	2	3	4	5	A

Question 1 (6 points)

- a) Describe the difference between Static Frequency Allocation and Dynamic Channel Assignment. What is the approach used by Geometric DCA to ensure interference control?
- b) Consider a mobile radio network with Geometric DCA. The system has 6 channels and the compatibility matrix reported below. To the system, completely empty at the beginning, a sequence of calls arrives according to the arrival order indicated in vector S (indices in S indicate the cell of call arrival). Assuming no call termination in the considered interval, indicate for each call if it is accepted and which channel is assigned (among available channels always select that with minimum index).

$$C = \begin{bmatrix} 2 & 1 & 0 & 1 & 2 \\ 1 & 2 & 1 & 1 & 0 \\ 0 & 1 & 2 & 0 & 0 \\ 1 & 1 & 0 & 2 & 1 \\ 2 & 0 & 0 & 1 & 2 \end{bmatrix}$$

$$S = \{2, 2, 2, 3, 4, 5, 1, 1, 1, 2, 3, 4, 3\}$$

Question 2 (6 points)

- a) Derive a model for calculating the blocking probability of calls of a CDMA mobile radio system with multiple service classes characterized by different information bit rates (and then processing gains). Consider uplink link direction only and perfect power control.
- b) Define the blocking states for the different service classes assuming:
- Negligible thermal noise
 - Eb/No minimum equal to 7
 - Four service classes with processing gains equal to 42, 21, 28.

Question 3 (6 points)

Design the multiplexing scheme of a TDMA mobile radio system similar to GSM. The system has radio carriers with a net rate of 240 Kb/s and it requires the following logical channels:

- ✓ Traffic channels TCH (uplink and downlink) with rate 28 Kb/s
- ✓ Associated control channels SACCH (uplink and downlink) with rate 2 Kb/s
- ✓ Broadcast channel BCCH (only downlink) with rate 30 Kb/s
- ✓ Frequency channel FCCH (only downlink) with rate 5 Kb/s
- ✓ Synchronization channel SCH (only downlink) with rate 15 Kb/s
- ✓ Paging channel PCH (only downlink) with rate 20 Kb/s
- ✓ Access grant channel AGCH (only downlink) with rate 15 Kb/s
- ✓ Random access channel RACH (only uplink) with rate 90 Kb/s

On a carrier you have to multiplex 5 TCHs and their 5 SACCHs and one signaling channel for each of the types indicated above. Design the multiplexing scheme indicating the frame and multi-frame structure for both uplink and downlink (solutions similar to GSM will get a higher score).

Question 4 (5 points)

Describe and compare the different network architectures (radio access network and core network) that have been standardized in the evolution of mobile radio networks from GSM/GPRS to LTE.

Question 5 (5 points)

Describe the number portability mechanism for mobile networks.

Additional topic (2 points)

It is possible to present here topics directly related to those of the course but not discussed during lectures, including those in the suggested readings available on the web page.