S-72.3260 Radio Resource Management Methods 3cr

Exam 14.12.2010

The exam consists of two parts. Part A contains two problems that need to be answered without using any background material. Part B contains four problems out of which three best will be graded. You are allowed to use any written background material in part B that you consider useful. You can decide how much time you allocate for each part within the three hour exam time. You need to first complete part A after which part B will be handed to you.

Please, provide course feedback through feedback-OODI system.

Part A: Closed book

Have you returned homework problems? If so, which year?

Problem A1

Answer shortly the two following questions:

a) How does the channel characteristics - coherence time and bandwidth – impact the design of radio resource allocations schemes? (5 p)
b) Describe the different interference situations that arise in cellular systems and how they should be taken into account in the design of radio resource control schemes. (5 p)

Problem A2

Consider the WCDMA system.

a) What are the main radio resource control loops? (5 p)
b) What factors are limiting the system capacity in uplink and downlink? (5 p)

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Part B: Open book

You can you any written material that you consider useful. Best tree problems are graded. Pay attention on the time it takes to solve the problem. You may not have enough time for solving all the four problems.

Problem B1

Consider the joint admission control and handover priorization problem. Calls arrival according to Poisson process. New calls arrival with rate λ and handoff calls arrive with the rate $\alpha\lambda$. The cell camping time (sojourn time) is exponentially distributed with parameter μ. During a call a phone on average visits N cells. The total number of channels in the system is C. If there is no free channel for a handover call it is dropped. An arrival call is accepted in the system with state dependent probability p_i where the index i refers to the number of occupied channels.

a) Determine the steady state probabilities of finding the system in a state i where i channels are occupied (2 p)
b) Determine the blocking probability (2 p)
c) Determine the dropping probability in a single cell (2 p)
d) Approximate the dropping probability when taking into account the fact that a mobile visits multiple cells during a call (2 p)
e) How could the same admission control procedure be applied in WCDMA system where admission control decision is made based on the total received power at the cell? (2 p)

Problem B2

Consider a cell serving two users. The user close to the edge has peak spectral efficiency of 0.14 bit/s/Hz and the user close to the base station has peak spectral efficiency of 3 bit/s/Hz.

a) Determine the α-Proportional Fair resource split among the users. (6 p)
b) Discuss the relation of α and max-min fairness, proportional fairness, minimum transmission time solution, and Nash bargaining solution. (4 p)

Problem B3

Consider a single radio link with complex channel response $h(t)$ and perfect channel side information. The system imposes mean power constraint

$$\frac{1}{T}\int_0^T P(t)dt \leq \overline{P}$$