INSTITUTE OF TECHNOLOGY
LINKÖPINGS UNIVERSITET

Exam in TSKS03 Wireless Systems

Exam code:	TEN1
Date:	2013-01-07 **Time:** 14:00–18:00
Place:	T2
Teacher:	Mikael Olofsson, tel: 281343
Visiting exam:	15 and 17
Administrator:	Carina Lindström, 013-284423, carina.e.lindstrom@liu.se
Department:	ISY
Allowed aids:	None
Number of tasks:	9
Solutions:	Will be published within three days after the exam at http://www.commsys.isy.liu.se/TSKS03
Result:	You get a message about your result via an automatic email from Ladok. Note that we cannot file your result if you are not registered on the course. That also means that you will not get an automated email about your result if you are not registered on the course.
Exam return:	2013-01-28, 12.15–13.00, Mikael Olofssons office, Building B, top floor, corridor A between entrances 27–29. After that in the student office of Dept. of EE. (ISY), Building B, Corridor D, between Entrances 27–29, right next to Café Java.

Important: **Solutions and answers must be given in English.**

Grading: This exam consists of nine questions. Each question can give you 2, 4 or 6 points. Totally, you can get 36 points. Grade limits:

- Grade three: 16 points,
- Grade four: 22 points,
- Grade five: 28 points.

Sloppy solutions and solutions that are hard to read are subject to hard judgement, as are unreasonable answers.

1 LTE uses *Channel-dependent scheduling*. Describe the principles behind this method. (2p)

2 WLAN (802.11) uses fragmentation, where large chunks of data are split up into fragments, and those fragments are sent in separate frames, that are to be acknowledged separately by the receiver. Why is this the case? What is gained by using fragmentation? (2p)

3 HSPA uses Hybrid ARQ with soft combining. Soft combining can be done using *Chase combining* or *Incremental redundancy*. Explain briefly what those methods are, and give one argument that could be a reson why HSPA uses Incremental redundancy. (2p)

4 Explain the terms full duplex and half duplex communication. Also, explain why FDD can provide full duplex and why TDD only can provide half duplex. Still, there are mobile phone systems that give the users the impression of full duplex. Explain how that is possible. (4p)

5 Explain the concept power control in Cellular systems. What problem is that supposed to solve. Also, explain why that problem is around. (4p)

6 At a large enough distance, and propagation through free space, the received power is inversely proportional to the square of the distance between sender and receiver. Explain why. For simplicity, assume an isotropic sender antenna. (4p)

7 Interprete and explain the acronyms *DS-CDMA*, *FDMA* and *TDMA*. Also give an application for each of the three methods. (6p)

8 Name and describe three methods to evaluate the quality of speech coding. (6p)

9 Are the following claims true or false? You do not need to explain your answer. (6p)

a. The average number of bits needed for a lossy representation of symbols from a source is lower bounded by its entropy.

b. Gold sequencies are source codes.

c. BCH codes are error control codes.

d. In hard handover, a mobile always communicates through one base station at a time.

e. Puncturing is a way to assign channel parts dynamically to users.

f. OFDM is based on the Discrete Fourier Transform.

For each of the claims above, a correct answer gives you +1 point, while an incorrect answer gives you −1 point. No answer give you 0 points for that claim. You cannot get less than 0 points totally from this task.