SYSC 5306: Mobile Computing Systems
Final Exam, Winter 2005
Duration: 90 minutes
Instructor: T. Kunz

Name: **Student number:**

Answer all questions on this exam paper. Each explanation should be as brief as possible; you may also want to use diagrams where appropriate.

1) Media Access Control (10 marks)

CDPD and GPRS (among others) employ a random access strategy. In essence, a node that wants to transmit data, competing for access to a shared channel with other nodes. As a result, collusions can occur. For a cellular network, could you envision other approaches for packet data transmission over a shared channel that would

- Reduce/minimize/do away with collisions
- Allow an arbitrary (or at least large number) of nodes in a cell to transmit some data
- Does not pre-allocate resources to each node (i.e., nodes will only access the channel if and when they have data to send

Are there any disadvantages to your proposal?

2) CDMA (20 marks)

a) You are to assign 4 DS-CDMA senders a chip sequence. Below, three potential sets of 4 chip sequences are given. Which of these four sets would you choose, and why?

(i)
```
−1 +1 +1 −1 +1 +1 +1 −1 −1 −1 −1 −1 −1 +1 +1 +1
+1 +1 +1 +1 −1 −1 −1 −1 −1 +1 +1 −1 −1 +1 +1 −1
+1 +1 +1 −1 −1 +1 +1 +1 +1 +1 −1 −1 −1 +1 −1 +1
+1 −1 +1 −1 −1 −1 +1 −1 +1 −1 +1 −1 +1 −1 +1 −1
```

(ii)
```
+1 +1 +1 −1 +1 +1 −1 −1 −1 −1 −1 −1 +1 +1 +1
+1 +1 +1 +1 −1 −1 −1 −1 −1 +1 +1 −1 −1 +1 +1 −1
+1 +1 +1 −1 −1 +1 +1 +1 −1 −1 −1 −1 −1 −1
+1 −1 +1 −1 +1 −1 +1 −1 +1 −1 +1 −1 +1 −1 +1 −1
```

(iii)
```
−1 +1 +1 −1 +1 +1 +1 −1 −1 −1 −1 −1 −1 +1 +1 +1
+1 +1 +1 +1 −1 −1 −1 −1 −1 +1 +1 −1 −1 +1 +1 −1
+1 +1 +1 −1 −1 +1 +1 +1 +1 +1 −1 −1 −1 −1 −1 −1
+1 −1 +1 −1 +1 −1 +1 −1 +1 −1 +1 −1 +1 −1 +1 −1
```

b) Assume a receiver receives the signal:
`(+1 −1 +1 −3 +1 +1 +3 +1 +3 −1 −1 −1 +1 −3 −1 −1).`
Which stations send what data bit?

c) Assume a receiver receives the signal
`(+1 +2 +2 0 0 −1 0 −2 −2 0 0 −1 −2 +1 +2 0).`
Which stations did send what data bit?

d) In both frequency and time division multiplexing, there is a need for guard "space" to make sure that "adjacent" users do not interfere with each other. In frequency division multiple access, this is done by not using small guard bands separating the individual channels. In time division multiple access, guard bands exist in the time domain (i.e., between one sender stopping transmission and the next sender starting up, there is a brief pause). Does DS-CDMA require guards? If so, where are they? If not, why not?

3) Mobile IP (10 marks)

CDPD allows an end-user to run TCP/IP applications in a cellular network, roaming between cells and/or service providers. Summarize the main similarities and differences in the mobility management for MobileIP and CDPD. Will the end-user see/experience any difference?

4) Ad-Hoc Networks (10 marks)

Describe the AODV protocol. Your discussion should, among other things, focus on:

- route discovery,
- route maintenance, and
- the role of sequence numbers.

5) TCP over Wireless (10 marks)

a) Describe the principle problem that TCP faces when employed in a cellular architecture, where one of the connection endpoints is connected over a single wireless hop to the fixed network.

b) What are the strengths and weaknesses of split-TCP solutions?

c) Are there additional problems that would occur if TCP was to be deployed in an ad-hoc network?