Wireless Networks
Prof. A. Capone

Written exam – July, 13 2011

Surname	
Name	
Student ID	

Time available: 2h 20m

R1	R2	R3	D1	D2	D3	A

Question R1 (4.5 points)

a) Describe the basic procedure for location update in mobile radio systems;
b) Explain why there is a tradeoff for the location area dimensioning;
c) Describe the analytical model for the optimization of location area size;
d) Calculate optimal size for:

$l = 600$ m (cell edge)

$V = 10$ km/h (average user speed)

$\gamma = C_p / C_u = 0.1$ (ration between paging cost and location update cost)

$\lambda = 0.15$ [calls/h/user] (traffic per user)

Quesito R2 (punti 4.5)

Design the multiplexing scheme of a TDMA mobile radio system similar to GSM. The system has radio carriers with a net rate of 420 Kb/s and it requires the following logical channels:

- ✓ Traffic channels TCH (uplink and downlink) with rate 52 Kb/s
- ✓ Associated control channels SACCH (uplink and downlink) with rate 4 Kb/s
- ✓ Broadcast channel BCCH (only downlink) with rate 21 Kb/s
- ✓ Frequency channel FCCH (only downlink) with rate 1.5 Kb/s
- ✓ Synchronization channel SCH (only downlink) with rate 10.5 Kb/s
- ✓ Paging channel PCH (only downlink) with rate 15 Kb/s
- ✓ Access grant channel AGCH (only downlink) with rate 9 Kb/s
- ✓ Random access channel RACH (only uplink) with rate 54 Kb/s

On a carrier you have to multiplex 7 TCHs and their 6 SACCHs and one signaling channel for each of the types indicated above. Design the multiplexing scheme indicating the frame and multiframe structure for both uplink and downlink (solutions similar to GSM will get a higher score).

Question R3 (5 points)

a) Describe into detail the signaling procedure for inter-MSC handover indicating for each phase the signaling protocol used.
b) Present how the number portability is handled in mobile radio systems.

Continues on the back …

Question D1 (4.5 points)

a) Describe into detail the collision resolution algorithm based on binary trees..
b) Describe the evolution of the algorithm step-by-step in the case of 7 station that collide together at slot 0, assuming that no new station is added until collision is solved and that the random generator of each station provides the 0/1 sequence reported in the table.

1)	1	0	0	0	1	1	1
2)	1	1	1	1	1	0	0
3)	1	1	1	0	1	1	0
4)	1	0	0	1	0	1	0
5)	0	0	1	0	0	1	1
6)	0	0	1	1	0	0	1
7)	0	1	0	1	0	1	0

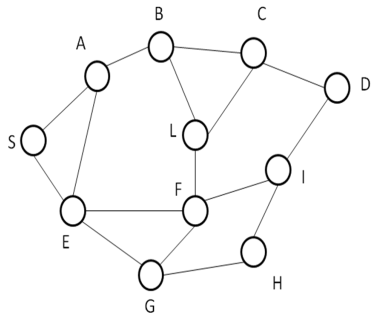
Note that: stations that get a 0 transmit immediately. A new random number is requested to the generator only when needed by stations involved in a collision.

Question D2 (5 points)

a) Describe the model for the computation of the queuing time in polling systems with round-robin service policy (present the formula derivation step by step).
b) Show how it is possible to modify the model for taking into account the specific characteristics of Bluetooth in the case (1) of 1-slot packets only and in the case (2) of packets of 1, 3 and 5-slots.
c) For case (1) calculate the average waiting time assuming: a piconet with 4 slaves, arrival frequency per queue equal to 400 packets per second.

Question D3 (4.5 points)

a) Describe the main characteristics of reactive and proactive routing in ad hoc networks
b) Describe the basic operation of DSR and AODV protocols.
c) Considering the figure, describe for the two cases (DSR and AODV) an example of route discovery procedure for source S and destination D and indicate which nodes are able to cache routes and for which destinations.



Advanced topics (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.