IOT ASSORTED QUESTIONS

First midterm

(1) according to the Friis transmission formula, how does the received power depend on transmission power and traversed distance?
(2) how is security enforced (authentication, encryption) in GSM? List network elements, protocols used, and messages exchanged
(3) list the common control channel used in 2G systems, explaining for which reasons they are used
(4) discuss the different techniques that you can exploit to save power when communicating over a low power wireless system
(5) what are the tasks of MSC, VLR, HLR in cellular systems (refer to 2G) and which is the different role of these entities? Write a list of functionalities per each network element
(6) describe the impairments caused by multipath fading on reliability of received signal propagation
(7) what is the tail energy effect? How can it be reduced?
(8) what does cross factor refer to? How does it change the energy model? Comment how introduction of cross factor in the energy model can affect design of wireless system
(9) task of BTS and BSC in cell system (2G) and which is the role of the two entities
(10) with respect to cell system 2G explain RACH and AGCH logic channels
    (a) which information are transmitted?
    (b) which is the type of these logical channels (to which class of logical channels they belong)?
    (c) are these channels shared among users? If yes, how is access by multiple users managed?
    (d) how are these channels mapped to physical channels?
    (e) what is the burst (packet format) used to transmit information over these channels?
(11) explain how network architecture has changed when moving from 2G to GPRS to 3G, 4G and 5G systems
(12) how cellular systems play a role for IoT? Explain NB-IoT standard
(13) what is frequency hopping and why is it used?

Second midterm

(1) what is the architecture of 6LowPan networks? How does 6LowPan compress headers?
(2) describe whats is the virtual carrier sensing scheme in CSMA/CA and explain how it works. Why is it used?
(3) provide examples of technologies we have seen for IoT that use CSMA/CA. Why is it used?
(4) OLSR follows a link state approach where topology updates messages are relayed only by multipoint relay nodes. Explain its algorithm used for multipoint relay selection
(5) decribe how GeRaF works
(6) describe how CTP works
(7) which kind of routing protocol is DSR? Which are the principles for route selection?
(8) which kind of routing protocol is DSDV? Which are the principles for route selection?
(9) explain the difference between synchronous and asynchronous protocols; which kind of protocol X-MAC is? Describe how X-MAC works
(10) what is the MAC protocol used to arbitrate access to the radio channel in LoraWAN? Which aspects can be used to increase capacity?
(11) what is the idea behing IoT network with wake-up radios? What is the problem they address and what are the advantages/disadvantages associated to their use? Describe how FLOOD-WUP and GREEN-WUP exploit this capability and how these two protocols work
(12) discuss the key ideas behind S-MAC, T-MAC, B-MAC and the problems they solve. How does the protocol work? Describe pros and cons of the different approaches
(13) discuss the evolution of IEEE 802.15.4: the basic IEEE 802.15.4 version and at least two variants adopted in IEEE 802.15.4*e*, explaining their motivation, how they work and the reason behind the proposed changes over IEEE 802.15.4

Past exam

(1) discuss what we mean with delay spread and how does it affect wireless communication performance
(2) which are the advantages and drawback of decreasing the cell size in a cellular system?
(3) why cellular systems allocate the lower freqeuncy band for uplink communication?
(4) explain what we mean with timing advance, why it is needed and how it is implemented in GSM network
(5) describe what are the subsystems in the GSM architecture, what is their role, the network elements involved in each of them, and for each of such network elements describe the information they maintain, the task they perform, the other network elements they are interfaced/interconnected to
(6) explain how an authentication is performed in 2G cellular systems. Draw a scheme, labelling network elements and protocols involved, clarifying messages exchanged and steps performed at the involved network elements
(7) what is the physical and MAC layer technology used in 3G/4G systems? What is their key feature?
(8) what is the MAC protocol used in 2G systems?
(9) provide a few example of energy efficient techniques to adopt at the MAC layer
(10) define call blocking probability. What is the formula that allows to express the call blocking probability? Which are the assumptions under such formula?
(11) explain when an handover is triggered, the different types of handover, which elements are involved, and which is the information flow and which are the messages exchanged to implement the handover in 2G (GSM)
(12) Explain the algorithm behind IEEE 802.15.4*e* Trickle