THE NELSON MANDELA AFRICAN INSTITUTION OF SCIENCE AND TECHNOLOGY

SEMESTER EXAMINATIONS

SEMESTER II

SCHOOL OF COMPUTATIONAL AND COMMUNICATION SCIENCE AND ENGINEERING

EMoS 6222: Mobile Telecommunication Technology
Date: 20th October 2021;
Time: 09:00-12:00

- Maximum allowed time is **3** hours
- Mobile phones and any data storage devices are not allowed into the examination room
- Observe all examination regulations
- Answer any 5 questions out of 7 questions
- All answers are to be written in answer book provided

Question One (20 marks)

1. Let's assume that 2 clients want to send data at the same time via CDMA. Client 1 wants to send 1 and client 2 wants to send 0. Client 1 uses code 010011 and client 2 uses code 110101. Show how the receiver will decode Client 1's and client 2's message. [5 marks]
2. Let's assume you are connected NM-AISTs network (172.16.0.0/16). You are connected to the wifi in the library(your IP was 172.16.100.100). You have a TCP transmission. Now you move from library to your hostel and connect to hostels wifi(your new IP 172.16.200.200). If you don't want to terminate the TCP connection what techniques will you use and explain the different steps required? [10 marks]
3. Explain GSM mobility with common Mobile switching centre. [5 marks]

Question Two (20 marks)

a) What is was the goal/objective of wifi6 (802.11ax)? [5 marks].

b) What are the key features of 802.11ax? How do they help achieve the goals? [10 marks]

c) What are the opportunities and challenges from the IoT paradigm? [5 marks]

Question Three (20 marks)

Consider the scenario where you have 10 or more AP's visible when you turn on wifi of you device. Both the AP and client devices use 802.11ac or older as standards.

(a) Will there be any performance degradation? If so, why ?[10 marks]

(b) Last year 802.11ax was released. It comes with a lot of features. Mention and describe the features that will address the issues that you have identified in the previous question. [10 marks]

Question Four (20 marks)

If you use the SampleRate algorithm for rate adaptation. 802.11n
Which of the Bit rates will not be sampled and Why? [20 marks]

Destination	Bit-rate	Tries	Packets Ack'ed	Succ. Fails	Total TX Time	Avg TX Time	Lossless TX Time
00:05:4e:46:97:28	11	16	0	4	250404	∞	1873
00:05:4e:46:97:28	5.5	100	100	0	297600	2976	2976
00:05:4e:46:97:28	2	0	0	0	0	-	6834
00:05:4e:46:97:28	1	0	0	0	0	-	12995
00:0e:84:97:07:50	11	28	14	0	52654	3761	1873
00:0e:84:97:07:50	5.5	50	46	0	148814	3235	2976
00:0e:84:97:07:50	2	0	0	0	0	-	6834
00:0e:84:97:07:50	1	0	0	0	0	-	12995

Question Five (20 marks)

(a) Consider there are 3 nodes in a WLAN: A, B, C. All of them want to send data to an Access Point. They followCSMA/CA protocol. A wants to send 1 data packet, B wants send 2 and C wants to send 1 packet. The minimum and maximum value of contention window is 16 and 1024. Suppose A chooses random backoff number as 4, B chooses 2 for the first packet and 5 for the second one, and C chooses 7. Draw the timing diagram of nodes A, B and C following DIFS and SIFS timing. DIFS=28(us) microsec, SIFS=10us(microsec). Whatever else has not been specified, assume on your own. Don't explain in text, a timing diagram. [10 marks]

(b) Typically in any CSMA/CA network DIFS>SIFS, What will happen if DIFS<SIFS. Write in 2-3 sentences. [5 marks]

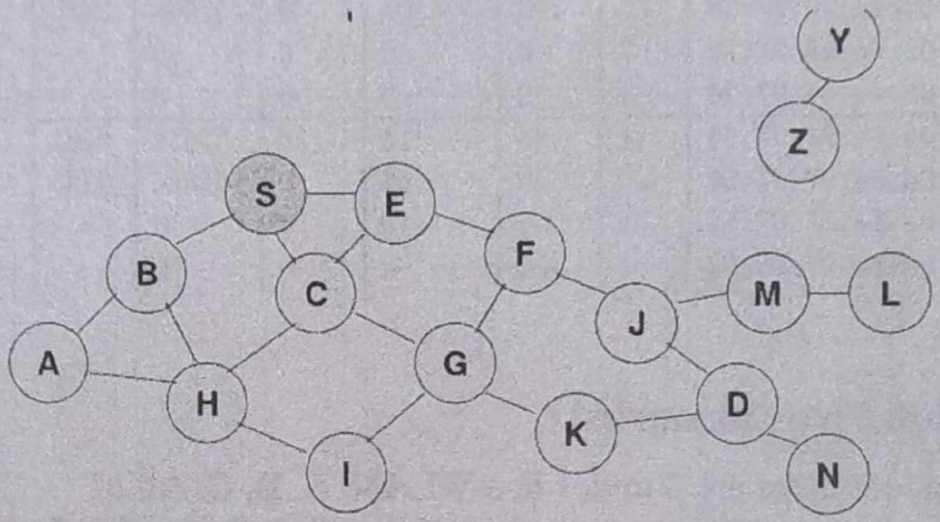
(c) Suppose you are a network administrator. You are asked to design a wireless network that provides quality of service guarantees. Will you use a distributed network like WIFi with CSMA/CA or centralized network like cellular with TDMA/FDMA etc..Explain your answer in 3-4 sentences. [5 marks]

Question Six (20 marks)

(a) Describe the Error control technique used in cellular networks. [15 marks]

(b) When should you used Chase combining? [5 marks]

Question Seven (20 marks)



In the above graph, node S is the source and node D is the destination. Assume now other transmission requests were executed. Create the routing table(forward and reverse) for each node after Route discovery. [20 marks]

**hint : some nodes won't generate routing table