



**NAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY**

FACULTY OF COMPUTING AND INFORMATICS

DEPARTMENT OF COMPUTER SCIENCE

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| QUALIFICATION: BACHELOR OF COMPUTER SCIENCE | |
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| DURATION: 3 HOURS | MARKS: 80 |

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| SUPPLEMENTARY / SECOND OPPORTUNITY EXAMINATION QUESTION PAPER | |
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| MODERATOR: | MR. ATUMBE BARUANI |

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| INSTRUCTIONS |
| <ol style="list-style-type: none">1. Answer ALL the questions.2. Write clearly and neatly.3. Number the answers clearly. |

THIS QUESTION PAPER CONSISTS OF 7 PAGES (Including this front page)

Part A (10 marks) – Multiple Choice 1 point for each problem

1. 802.11 falls into the category of:

(A) Pedestrian mobility and wireless (B) mobile and wired (C) fixed and wireless (D) vehicular mobile and wireless

2. Which band is used for 802.11 WLAN devices?

(A) VHF (B) UHF (C) SHF (D) none of above

3. The antenna size for a 3G device which uses the 1800 MHz frequency band is

(A) 8.33 cm (B) 2.08 cm (C) 4.16 cm (D) none of above

4. The propagation effect that occurs when a radio wave hits an impenetrable object .

(A) blocking (B) diffraction (C) reflection (D) refraction

5. Which modulation is used in both 802.11b and 802.16?

(A) QPSK (B) QAM-16 (C) QAM-64 (D) none of the above

6. Which is not the advantage of cellular systems?

(A) higher capacity (B) robustness (C) less transmission power (D) none of the above

7. The maximum data rate over a 2 MHz channel whose signal to noise ratio is 10 dB.

(A) 2.16 Mbps (B) 3.33 Mbps (C) 6.66 Mbps (D) none of above

8. Which statement about Bluetooth is correct?

(A) It does not operate in the ISM band. (B) Two kinds of links (ACL and SCO) exist.

(C) Bluetooth 2.0 cannot offer the transfer rate up to 12 Mbps. (D) none of above

9. Which defines an extension of the 802.11 standard for QoS?

(A) 802.11c (B) 802.11d (C) 802.11e (D) 802.11h

10. Which statement is true?

(A) HSCSD is not Packet-switched. (B) GPRS offers data rates up to 171.2 Kbps.

(C) EDGE can achieve a higher transfer rate than GPRS. (D) none of above

Part B(20 marks)- BASICS

QUESTION I [4 marks]

Consider the delay of pure ALOHA versus slotted ALOHA at low load. Which one is less? Explain your answer.

QUESTION II [4 marks]

What is the minimum bandwidth needed to achieve a data rate of 8 bits/sec if the signal is transmitted using NRZ encoding? Explain your answer.

QUESTION III [6marks]

Consider a slotted aloha system with 4 users, A, B, C and D. User A uses a pre-defined backoff sequence (1,2,3,4) when it encounters collision, which means user A will delay 1 slot before its first retry; delay 2 slots before its second retry; delay 3 slots before its third retry; and delay 4 slots before its fourth retry. The backoff sequence of user B is (2,3,2,1). The backoff sequence of user C is (3,1,2,4). The backoff sequence of user D is (1,2,2,3). Here we use a slot as the time unit. Assume a packet is ready for transmission at user A at time 0. User B also has a packet to send at time 0. User C and user D have a packet to send at time 2 and time 3, respectively. Complete the following timing diagram of this scenario, i.e., for each user, specifies in which slot it will transmit, and whether the transmission will be successful (marked with S) or unsuccessful (marked with X).

| | | | | | | | | | | |
|-------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| User A | | | | | | | | | | |
| User B | | | | | | | | | | |
| User C | | | | | | | | | | |
| User D | | | | | | | | | | |
| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| Time slots | | | | | | | | | | |

QUESTION III [2 marks]

In the discussion of the handoff procedure based on relative signal strength with threshold, it was pointed out that if the threshold is set quite low, *the* mobile unit may move far into the new cell. This reduces the quality of the communication link and may result in a dropped call. Can you suggest another drawback to this scheme?

QUESTION IV [4 marks]

Using relevant diagram (s), show the sequence of interactions between the various elements require to setup a voice call from a mobile station in MTC GSM network to another mobile station in LEO GSM network.

Part C (30 marks)-CELLULAR AND MOBILE IP

QUESTION I [16 marks]

Consider two different cellular systems that share the following characteristics. The frequency bands are 825 to 845 MHz for mobile unit transmission and 870 to 890 MHz for base station transmission. A duplex circuit consists of one 30-kHz channel in each direction. The systems are distinguished by the reuse factor, which is 4 and 7 respectively.

- a. Suppose that in each of the systems, the cluster of cells (4, 7) is duplicated 16 times. Find the number of simultaneous communications that can be supported by each system. [4 marks]
- b. Find the number of simultaneous communications that can be supported by a single cell in each system. [4 marks]
- c. What is the area covered, in cells, by each system? [4 marks]
- d. Suppose the cell size is the same for both systems and a fixed area of 100 cells is covered by each system. Find the number of simultaneous communications that can be supported by each system. [4 marks]

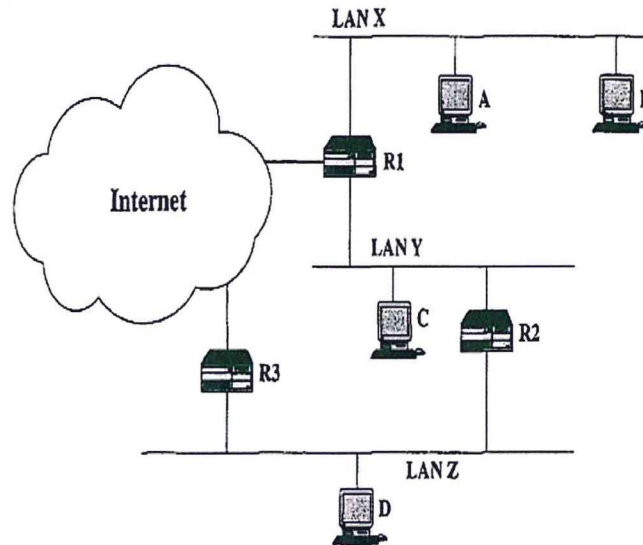
QUESTION II [4 marks]

In mobile IP indirect routing, when a mobile node that is away from its home network communicates with a fixed correspondent node in the Internet, the packets in the two directions traverse different paths – why?

QUESTION III [3 marks]

What are the two different types of destination addresses that can be assigned to a mobile node while it is attached to a foreign network?

QUESTION IV [7 marks]



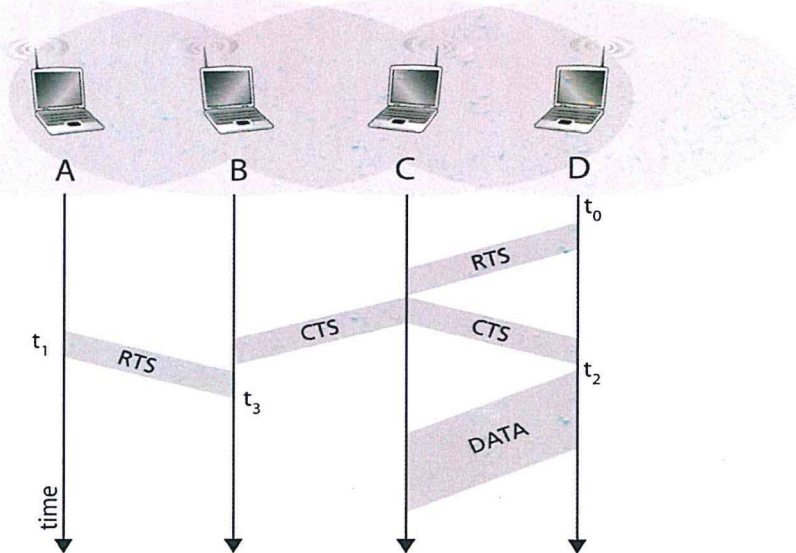
Considering the figure above.. Suppose that LAN Z is the home network for host E and that D sends a block of data to E via IP.

- Show the PDU structure, including the fields of the IP header and the lower-level headers (MAC, LLC) with the contents of address fields indicated for the case in which E is on its home network.[2 marks]
- Repeat part a) for the case in which E is on a foreign network reachable via the Internet through R3. Show formats for the MAC frame leaving D and the IP datagram leaving R3. Assume that IP-to-IP encapsulation is used.[3 marks]
- Repeat part b) for the IP datagram leaving R3, but now assume that minimal encapsulation is used.[2 marks]

PART D (10 marks)- WIRELESS LAN

QUESTION I [6 marks]

Consider the scenario shown below, in which node D sends an RTS to node C at t_0 . Node C responds to the RTS with a CTS (which is heard by nodes B and C) in accordance with 802.11 protocol, and node D begins the transmission of its message at t_2 in the meantime, node A sends an RTS message to B at time t_1 .



- If node A were to begin transmitting to node B at some point after t_3 would A's transmission be successfully received at B? [2 marks]
- If node A were to begin transmitting to node B at some point after t_3 would A's transmission interfere with the ongoing transmission from D to-C?[2 marks]
- At t_3 can B respond to A's RTS message with a CTS message? Why or why not?[2 marks]

QUESTION II [4 marks]

We consider a WLAN in which the maximum propagation delay is 4 sec. The (4) WLAN operates at a data rate of 10 Mbps. The data and ACK packets are of 400 and 20 bits, respectively. The processing time for a data or ACK packet is 1 sec. If the probability p that a data packet or its ACK can be corrupted during transmission is 0.01, find the data link protocol efficiency with the sliding window protocol with window size $W = 8$.

Part E-(10 marks) Bluetooth

QUESTION I [6 marks]

What is the maximum size of the data field for a 3-slot Bluetooth frame at basic rate?
Explain your answer

QUESTION II [4 marks]

List and describe four types of device specified in a piconet.

GOOD LUCK!