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University Examinations 2023/2024

SECOND YEAR SECOND SEMESTER EXAMINATION FOR THE DEGREE OF
BACHELOR OF SCIENCE COMPUTER SCIENCE AND BACHELOR OF COMPUTER
SECURITY AND FORENSICS

CCS 3251: WIRELESS AND MOBILE COMPUTING

DATE: APRIL 2024   **TIME: 2 HOURS**

INSTRUCTIONS: *Answer question **one** and any other **two** questions*

QUESTION ONE (30 MARKS)

a) Write short notes on the following concepts

     i. Cell splitting   (2 Marks)

     ii. Co-channel interference   (2 Marks)

     iii. Cluster size   (2 Marks)

b) Describe the concept of handoff in cellular communication systems and briefly explain why is it necessary for maintaining call quality and continuity as a mobile device moves between cells   (3 Marks)

c) List three Key issues that needs to be addressed during building of a light-weight wireless device   (3 Marks)

d) Elaborate the concept of frequency reuse in cellular systems and further explain how it allows efficient use of available radio spectrum   (4 Marks)

e) Define what a Wireless Sensor Network (WSN) is and explain its significance in commercial and industrial applications   (4 Marks)

f) Provide a step-by-step explanation of the Mobile IP operation and discuss its advantages in resolving address shortage issues and reducing administrative workload

(5 Marks)

g) Explain how the rapid increase of smartphones and the increasing mobility of businesses have contributed to the growing need for mobile databases   (5 Marks)

QUESTION TWO (20 MARKS)

a) Define the term cell shape and provide two advantages of using the hexagonal cell shape over the square and triangle cell shape   (4 Marks)

b) Describe the process of spreading a signal using pseudonoise sequences, and list two benefits derived from spreading a signal over a broader bandwidth   (5 Marks)

c) Using a suitable diagram, explain the process involved in person A communicating with person B over a cellular network, focusing on signal conversions   (5 Marks)

d) Compare and contrast the client-server model and the peer-to-peer model within the realm of mobile databases. Identify two advantages and limitations of each model

(6 marks)

QUESTION THREE (20 MARKS)

a) Briefly define the following terms

      i. Mobile IP   (2 Marks)

      ii. Spread spectrum   (2 Marks)

      iii. ubiquitous computing   (2 Marks)

b) List three benefits brought by the evolution of wireless personal communication from traditional analogue technology such as FDMA to digital technologies such as TDMA and CDMA   (3 Marks)

c) With aid of a diagram, explain the basic structure of a GSM network   (5 Marks)

d) As a network engineer at Meru University of science and Technology, you have been tasked to implement a wireless network controller for the institution. Discuss any three challenges likely to be faced. (6 marks)

QUESTION FOUR (20 MARKS)

a) Explain how triangle routing delays packet delivery to mobile nodes and increases network burden in mobile IP (4 Marks)

b) Using a diagram, discuss the architecture of a Wireless Sensor Network (WSN) according to the OSI model (5 Marks)

c) Compare and contrast fixed channel assignment and dynamic channel assignment strategies in cellular systems. List two advantages of each approach in terms of system performance and complexity (5 Marks)

d) If a cellular system has a total bandwidth allocation of 33 MHz and uses two 25 kHz simplex channels for full-duplex voice and control, calculate the number of channels available per cell for systems with 4-cell reuse, 7-cell reuse, and 12-cell reuse.
(6 Marks)

QUESTION FIVE (20 MARKS)

a) Briefly define the following terms as used in mobile DBMS (4 Marks)
    i. Memory footprint
    ii. Storage optimization
    iii. Data synchronization
    iv. Self-Management

b) Describe the evolution of commercial cellular networking, highlighting the key features, capabilities, and access protocols of each generation (5 Marks)

c) In a cellular system with 1001 radio channels for traffic management, and with each cell covering an area of 6km², and the total area of the system being 2100km², calculate the system capacity for cluster sizes of 4 and 7 (5 Marks)

d) Safaricom, a leading telecommunications company, has observed a significant increase in the number of subscribers around Meru University and its surrounding areas. As a network engineer employed by Safaricom, outline three strategic approaches you would propose to effectively address this surge in demand in the mentioned area   (6 Marks)