

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)

ORGANISATION OF ISLAMIC COOPERATION (OIC)

Department of Computer Science and Engineering (CSE)

SEMESTER FINAL EXAMINATION

SUMMER SEMESTER, 2022-2023

DURATION: 3 HOURS

FULL MARKS: 100

CSE 4615: Wireless Networks

Programmable calculators are not allowed. Do not write anything on the question paper.

Answer all 6 (six) questions. Figures in the right margin indicate full marks of questions with corresponding COs and POs in parentheses.

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|----|--|-------------------------|
| 1. | a) Discuss the relationship between different inter-frame spaces used in IEEE 802.11. Describe the use of different inter-frame space. | 4 |
| | b) How does flow control differ from congestion control? What are the changes required for both flow control and congestion control when they are applied in a wireless network? | 4 |
| | c) Skype offers a service that allows you to make a phone call from a PC to an ordinary phone. This means that the voice call must pass through both the Internet and a telephone network. Discuss how this might be done. | 4 |
| | d) Wireless network follows a layered architecture model for data communication. The main difference between wired and wireless technology is how the signal is passed through the transmission medium which is handled by physical layer. For wireless communications, is it mandatory to change other layers to transmit data properly? Briefly discuss on it. | 4 |
| 2. | a) Explain the reason for poor performance of the TCP protocol in wireless networks. How the performance of TCP protocol in wireless network can be improved? | 4 |
| | b) What are the challenges of DTN compared to TCP/IP? Mention some applications of DTN and explain how it is required for those application. | 4 |
| | c) In wireless network, the collision cannot be identified by measuring the signal power at the time of transmission. CSMA/CA avoid collision in wireless network. How can CSMA/CA protocol avoid collision if the collision cannot be detected? | 4 |
| | d) Explain the hidden terminal problem and exposed terminal problem with necessary diagrams. How can you resolve these problems? | 4 |
| 3. | a) What are the metrics to indicate lifetime of WSN? How the LEACH protocol enhance network lifetime? With a labelled diagram explain how LEACH protocol works. | 10
(CO1)
(PO1) |
| | b) Explain the working procedure of S-MAC protocol for WSN. With necessary diagram explain the Synchronized Island problem. | 10
(CO1)
(PO1) |
| 4. | a) Explain the basic operation of the Ad-hoc On-Demand Distance Vector (AODV) routing protocol. Describe the role of sequence numbers in AODV routing. | 7 + 3
(CO1)
(PO1) |
| | b) Explain the basic operation of the Dynamic Source Routing (DSR) protocol in Mobile Ad Hoc Networks (MANETs). How does it differ from AODV protocol? | 6 + 2
(CO1)
(PO1) |

5. a) How Energy Harvesting Wireless Sensor Networks (EH-WSN) is different from the traditional Wireless Sensor Network (WSN)? Are there any changes required in EH-WSN compared to traditional WSN? If so, briefly discuss on it. 5
(CO1)
(PO1)
- b) Figure 1 represents a Energy Harvesting Wireless Sensor Networks (EH-WSN). The network parameters of the nodes and the links are listed in Table 1 and Table 2 respectively. Calculate the route from A to E following the wastage aware routing protocols during morning and noon time. [Hints: You need to show the calculation in each node]. 10
(CO2)
(PO2)

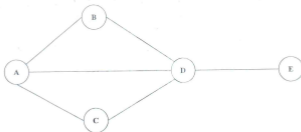


Figure 1: Topology for Energy Harvesting Wireless Sensor Networks for Question 5.b

Table 1: Network Parameters of Nodes for Question 5.b

Node	Current Battery Level	Expected Energy Harvest in ΔT , E_A (Morning Time)	Expected Energy Harvest in ΔT , E_B (Noon Time)
A	0.90 B	0.15 B	0.10 B
B	0.95 B	0.25 B	0.20 B
C	0.80 B	0.20 B	0.30 B
D	0.90 B	0.20 B	0.15 B
E	0.79 B	0.07 B	0.07 B

Table 2: Network Parameters of Nodes for Question 5.b

Link	Expected Energy Consumption in ΔT , E_A (All time)
A-B	0.15 B
A-C	0.20 B
B-D	0.25 B
C-D	0.10 B
D-E	0.15 B

6. a) Ananda is designing a routing protocol for a wireless network. In calculating the best route, he used standard hop count. Is there any problem in the design choice of Ananda? Describe the reasoning behind your answer. What could be other alternatives? Explain why these alternatives are better? 5
(CO3)
(PO2)

- b) Figure 2 represents the topology for a Wireless Metropolitan Area Network (WMAN). The measured forward and reverse delivery ratio is listed in Table 3. Using Expected Transmission Count (ETX) as the routing metric, calculate the route from each nodes to other nodes of the network and mention the route ETX.

Table 3: The measured forward and reverse delivery ratio of each link for Question 6.b

Link	Forward Delivery Ratio R_{fwd}	Reverse Delivery Ratio R_{rev}
A-B	0.85	0.92
A-C	0.70	0.93
A-D	0.92	0.87
B-D	0.76	0.73
C-D	0.88	0.90
C-F	0.77	0.87
D-E	0.88	0.66
E-F	0.79	0.92

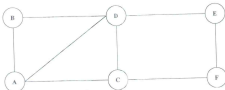


Figure 2: A Topology denoting a Wireless Metropolitan Area Network (WMAN) for Question 6.b