

**2023**

**COMPUTER SCIENCE AND ENGINEERING**

**Paper : CSCL-1001**

**(Wireless and Mobile Computing)**

**Full Marks : 70**

*The figures in the margin indicate full marks.*

*Candidates are required to give their answers in their own words  
as far as practicable.*

Answer **question nos. 1, 2 and any four** questions from the rest.

1. Answer **any five** questions: 2×5
  - (a) How can you convert a wireless signal from an omnidirectional antenna to a directional one?
  - (b) State the generalized path loss model.
  - (c) “Mobile IPv6 can seamlessly work without the presence of any agent in foreign network.”— Critically comment on the statement.
  - (d) Is a table-driven routing protocol suitable for high-mobility environments? Why, or why not?
  - (e) Is there a chance for having a collision between route request packets in DSR? If yes, how can it be avoided?
  - (f) State with justifications a protocol that can be used in an ad hoc wireless network for search-and-rescue operations.
  - (g) Differentiate broadcasting from border-casting.
  
2. Answer **any five** questions : 4×5
  - (a) How can you improve the tunneling latency by using Minimal Encapsulation protocol instead of IP-in-IP Encapsulation protocol? Justify your answer with corresponding packet formats.
  - (b) Explain how Indirect TCP (I-TCP) solves the problem of packet drop at the last hop. Why does the performance of I-TCP degrade during handoff?
  - (c) With a neat hierarchical diagram, describe the GSM frame structure.
  - (d) Describe the similarity and differences of Wireless LAN and cellular networks.
  - (e) “Route caching can reduce route discovery overhead in DSR.”— Explain.
  - (f) “OLSR is suitable for large and dense network.”— Critically comment on the statement with justification.
  - (g) Consider an application where WSN is used to measure humidity in a field. Low-power sensors report measurements only when certain thresholds are exceeded. What type of routing will be effective for this scenario?

**Please Turn Over**

3. (a) Suppose in a frequency reuse algorithm you start by assigning a set of frequencies to a hexagonal cell, move 'i' number of cells along one of the six directions of the cell, turn  $60^\circ$  anticlockwise, then move 'j' number of cells and assign the same set of frequencies in the cell you reach. Determine the relation among i, j, and N, where N is the cluster size.
- (b) Discuss the working principle of half-wave dipole antenna. Determine the relation between the frequency and length of half-wave dipole antenna. 5+(2+3)
4. (a) Suppose you are calling a GSM mobile, which is currently roaming, from a land phone. Describe the procedure in detail for the connection establishment between your land phone and the mobile.
- (b) Suppose a mobile node with IP 10.10.20.35 / 8 moves to another network and receive and configured IP 192.35.40.23 / 24. Describe how the node discovers the agents, registers and perform tunnelling in Mobile IPv4. 4+6
5. (a) What do you mean by a half rate and a full rate TCH in a GSM cellular network? Determine the capacity of a half rate and full rate TCH channels.
- (b) How does a GSM network authenticate a user? Discuss various dedicated control channels used in GSM. (2+3)+(2+3)
6. (a) What will be the reactions for DSDV and TORA protocols, when topological changes make a route invalid?
- (b) What advantages and disadvantages does multipath routing have?
- (c) Do you suggest a network where this technique performs better than others? Give reasons. 8+1+1
7. (a) State the hidden station and exposed terminal problem through an example.
- (b) Describe the protocols with illustrations that are capable of solving the hidden station (not partially) and exposed station problem. (2+2)+(3+3)
8. (a) "In general, large sensor networks are clustered."— Justify the statement.
- (b) Discuss the cluster head election policy for the LEACH protocol and explain how LEACH can consider the available energy on each node in this election process.
- (c) State your opinion, with necessary justifications, regarding the choice of TDMA within a cluster by LEACH. 2+6+2
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**2022**

**COMPUTER SCIENCE AND ENGINEERING**

**Paper : CSCL-1001**

**(Wireless and Mobile Computing)**

**Full Marks : 70**

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as far as practicable.*

Answer **question nos. 1 and 2, and any four** questions from the rest.

1. Answer **any five** questions : 2×5
  - (a) With suitable example differentiate between single hop and multi hop wireless communication systems.
  - (b) Discuss address auto configuration in IPv6.
  - (c) Why do we need special care for the transport layer protocols for wireless environment?
  - (d) State the utility of the DS frame in MACA-W protocol.
  - (e) State the purpose of Back-Off counter. How is its value adjusted in MACA-W?
  - (f) Asymmetric (or unidirectional) links occur when node A can hear node B, but B cannot hear node A. Explain whether this is a problem for the AODV protocol and if so, how this can be addressed.
  
2. Answer **any five** questions : 4×5
  - (a) Suppose in a Cellular System each hexagonal cell has a radius of 500 m and you use the same set of frequencies (forming 30 channels) in the cells you reach by moving 2 cells in each direction, turning anticlockwise 600 and then moving 2 cells in that direction. Determine the cluster size and capacity of the Cellular System formed with 10 such clusters.
  - (b) Suppose you are calling a GSM mobile, which is currently in roaming, from a land phone. Describe the procedure in detail for the connection establishment between your land phone and the mobile.
  - (c) Discuss the LTE architecture to support voice over IP.
  - (d) State, with justifications, the pros and cons of a routing protocol that uses GPS information in an ad-hoc wireless network for search-and-rescue operations.
  - (e) Compare the routing protocol DSDV with DSR with respect to overheads and route optimality.
  - (f) Is it possible to solve the exposed terminal problem using DBTMA protocol? Comment with justification.

**Please Turn Over**

3. (a) State the general problems of Mobile IP regarding security and quality of service.  
(b) Discuss various techniques to get rid of such problems. 4+6
4. (a) What do you mean by a full rate TCH in a GSM cellular network?  
(b) Determine the capacity of a half rate and full rate TCH channels.  
(c) How is a user authenticated in GSM network?  
(d) Describe the TDMA frame structure of a GSM network. 2+2+3+3
5. (a) How does TCP set-up sender side window size in the presence of congestion control protocols?  
(b) How does it affect the packet drop in the last hop of a Wireless LAN?  
(c) Discuss any mechanism to reduce the packet drop.  
(d) What are the pros and cons of your mechanism? 3+1+4+2
6. (a) "Flooding is a simple strategy for distributing data to one specific node or all remaining nodes in a network." How do sequence numbers contribute to reducing unnecessary transmissions? Are sequence numbers alone sufficient? If not, what other information is needed to use them correctly?  
(b) Is it possible to form a loop (count to infinity problem) while using AODV? Explain your answer through an example.  
(c) How can the packet generation be minimized within route discovery phase in DSR? 4+3+3
7. (a) Among DSDV and TORA, when topological changes make a route invalid, what will be the reaction of each protocol? Discuss, in brief.  
(b) Do you foresee any problem to apply link state routing in an ad-hoc network? Could you suggest any improvement on the link state for applying in ad-hoc network? Discuss the methodology of the improved protocol, in brief. 4+(1+2+3)
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**Mode of Examination: Online  
M.Tech. Semester-II Examination, 2021**

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2021

**Subject: Computer Science & Engineering**

**Paper Code & Name: CSCL1001 & Wireless and Mobile Computing**

**Full Marks: 70**

**Date: 09.08.21**

**Time: 3:00 Hours**

**Duration: 12:00 AM to 3:00 PM**

**Please follow the following instructions carefully.**

- Promise not to commit any academic dishonesty.
- Candidates are required to answer in their own words as far as applicable.
- Each page of answer scripts should have your examination Roll Number on the right side top corner of your answer script
- The name of the scanned copy of the assessment script will be in the following format
  - (Example: CSCL1001-WMC-91-CSM-201001)
- The subject of the mail should be the assessment-script file name.
- The scanned answer script is to be sent to [cucse2020@gmail.com](mailto:cucse2020@gmail.com)
- Write the answers with a black ink ball pen.
- The answer script should have an index page.
- 30 minutes is allotted for scanning and uploading the answer script.
- Candidates are to check the readability and orientation of each scanned page of the answer script before uploading.
- **The Assessment script will be discarded if received after the specified date and time.**

Answer Question No. 1, 2, and any Four from the rest

**1. Answer any 5 questions:**

[5 x 2]

- a) Find the length of a half-wave dipole antenna required to generate a signal of frequency 98.6 MHz.
- b) Can we make a cluster of 37 cells in a cellular network? Justify your answer.
- c) How can you protect the replay attack in Mobile IP during registration of a care-of address?
- d) State the causes for generating immediate advertisement in DSDV. Why is it not periodic?
- e) State the contribution(s) of MARCH MAC protocol over MACA for an Adhoc network.
- f) How the packet generation can be minimized within the route discovery phase in DSR?

**2. Answer any 5 questions**

- a) List the parameters of an antenna. With a neat diagram describe the architecture of the LTE network. [1+3]
- b) Suppose you are calling from a land phone, a 4G mobile which is currently in roaming. Describe the procedure in detail for the connection establishment between your land phone and the 4G mobile. [4]
- c) How does the mobility of nodes affect the network layer protocols? Describe a solution, in brief, to support mobility in network-layer protocols. [1+3]
- d) Suggest a routing protocol that can be used for “search and rescue” by a disaster management group. State reason(s) in favour of your answer. [4]
- e) What do you mean by fluctuation? How can DSDV tackle it? [4]
- f) In what type of network TORA performs better than DSR? Justify your answer. [4]

- 3 a) Describe a frequency reuse scheme used in a cellular system. Differentiate between Cell Splitting and Cell Sectoring in order to increase the capacity of a cellular system.
- b) Estimate the path loss of a 900 MHz signal if the height of the transmitter and receiver are 40m and 5m, respectively. The receiver is 10km away from the transmitter. [3+3]+4]
4. a) Describe a physical layer scheme for wireless communication where multiple users access the medium at the same time using the same frequency.
- b) Describe the advantages and disadvantages of using Foreign Agent provided Care-of Address vs Collocated Care-of Address.
- c) Derive the data rate of TCH/F and TCH/H logical channels in the GSM network. [3+3+4]
5. a) How does the wireless environment affect the performance of transport layer protocols.
- b) “S-TCP preserves end-to-end TCP semantics while it can’t incorporate end-to-end security” – Justify the statement with the working principle of S-TCP.
- c) What kind of TCP improvements are needed to handle frequent disconnections. [2+5+3]
6. Illustrate Hidden Station problem. Comment on the performance of MACA for addressing the said problem. Do you think that MACA-W is handling the problem in a better way? Justify your answer. [2+5+3]
7. a) Discuss the topology information management process in OLSR.
- b) “Choice of routing algorithm used in an ad-hoc network depends on the rate of topological change.” Explain.
- c) In practice, in multi-hop networks with heavy traffic, most of the CTS packets are destroyed while MACA is used as a MAC protocol. Do you suggest an alternative that performs better in this situation? [4+2+4]
8. a) Describe the communication process in ZRP, where the destination is not within the zone of the sender. Illustrate through an example. Compare the performance in terms of suitable metrics provided the AODV is used instead of ZRP.
- b) How the link failure situation is tackled in AODV? Illustrate with an example. [5+2+3]

**2019**

**COMPUTER SCIENCE AND ENGINEERING**

**Paper : CSCL-1001**

**(Wireless and Mobile Computing)**

**Full Marks : 70**

*The figures in the margin indicate full marks.*

*Candidates are required to give their answers in their own words  
as far as practicable.*

Answer **question no. 1** and **any five** questions from the group of **question no. 2** to  
**question no. 8** and **any four** questions from the rest.

1. Answer **any five** from the following questions : 2×5
  - (a) Determine the signal to interference ratio for a hexagonal cellular system.
  - (b) How can you auto configure an IPv6 address in the absence of DHCP server?
  - (c) How does anti-spoofing software create problem to packet delivery in Mobile IP?
  - (d) How is the TCP performance affected by nomadic users?
  - (e) State a specific situation where an adhoc network suits better than the conventional approach.
  - (f) State the principal reason(s) behind not using CSMA/CD in wireless LAN.
  - (g) Distinguish between Contention and Contention-free MAC services as used in Wireless LAN.
  - (h) Clarify the term “Promiscuous Mode” in context of a status of a node in Adhoc network.
2. What do you mean by an ideal antenna? How do we measure the power density of an ideal antenna at distance ‘r’ unit from the Antenna? Define antenna Gain of real antenna. 1+2+1
3. Critically comment on the following statement : “A limited number of frequencies are sufficient to support a large number of users over a wide area for wireless communication”. 4
4. Discuss the role of HLR and VLR in establishing a connection in GSM network. How does GSM authenticate a user before establishing the connection? 2+2
5. Describe various operational states and their transition in a Bluetooth network. How is a scatternet formed in a Bluetooth network? 3+1
6. Illustrate the utility of Network Allocation Vector in CSMA/CA. 4
7. “The performance of the DSR routing can be improved through caching.” — Comment on the statement with justification. 4

**Please Turn Over**

8. State the specific requirements (challenges) for an Adhoc network routing protocol. 4
9. (a) Describe a frequency reuse scheme used in a cellular system. Differentiate Cell Splitting and Cell Sectoring in order to increase the capacity of a cellular system.  
(b) Estimate the path loss of a 900 MHz signal if the height of the transmitter and receiver are 40m and 5m respectively. The receiver is 10km away from the transmitter. (3+3)+4
10. (a) What is the basic operational difference between a GSM and a LTE network? With a neat diagram describe the architecture of these networks.  
(b) What are the various logical channels used in a GSM network? (1+5)+4
11. Why do we need Mobile IP for communication in wireless environment? How does the wireless environment affect the performance of transport layer protocol? Describe a solution to stop such performance degradation. What are the strengths and weaknesses of your solution? 2+2+4+2
12. Discuss the performance of DSDV with DSR with respect to overheads and route optimality. Does DSR incur larger or smaller overheads for route discovery compared to the AODV protocol? Justify your answer. 6+4
13. Do you suggest using Link State routing in Adhoc network routing protocol? Why or why not? How the performance of a reactive routing can be improved using location information? Illustrate with suitable example. Describe the necessity of “Route maintenance” in Adhoc network. 3+5+2
14. How is the link reversal algorithm used in an Adhoc network to explore multipath routes towards destination? Explain with an example. State the factors of an adhoc network, based on which, the specific routing algorithm could be chosen. Justify your selection with reasons. 6+4
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**2018**

**COMPUTER SCIENCE AND ENGINEERING**

**Paper - CSCL : 1001**

**(Wireless And Mobile Computing)**

**Full Marks : 70**

*The figures in the margin indicate full marks.*

*Candidates are required to give their answers in their own words  
as far as practicable.*

Answer **question no. 1** and **any five** questions from the group of questions **2** through **8**, and **any four** questions from the group of questions **9** through **14**.

1. Answer **any five** from the following: 2×5
  - (a) Is a directional antenna useful for cellular communication? Justify.
  - (b) What is the use of Visitor Location Register (VLR) in GSM network?
  - (c) What is reverse tunneling?
  - (d) What are the uplink and downlink frequency bands for a GSM network?
  - (e) What do you mean by ‘Promiscuous mode’ in Ad-hoc network?
  - (f) What do you mean by incremental update as used in DSDV?
  - (g) “A wireless network can be considered as an Ad-hoc network”.— Comment.
2. A cellular system decides the value of  $i$  and  $j$  to be 1 and 2 respectively, for implementing the frequency assignment algorithm. Determine the number of channels per cluster and the total channel capacity of such a cellular network area comprised of 10 clusters and 10 channels per cell. 4
3. What is the purpose of agent advertisement and agent solicitation for packet forwarding in mobile environment? Explain the message format of an agent advertisement packet with internet control message protocol and mobile extension. 4
4. Explain the role of snooping agent and the flow of segments from server to mobile host and vice-versa in Snooping TCP. 4
5. In what type of network TORA performs better than DSR? Explain. 4
6. Discuss, in brief, the typical requirements of routing in Ad-hoc network. 4
7. How the packet generation can be minimized within route discovery phase in DSR? 4
8. “Knowledge about location of the node(s) helps to improve performance.”— Comment on this statement with reasons. 4

**Please Turn Over**

9. (a) What do you mean by ‘hidden terminal problem’ and ‘exposed terminal problem’?  
(b) With a neat diagram, explain the topology of two operational modes of an IEEE 802.11 wireless LAN.  
(c) How can you achieve non-trivial QoS in IEEE 802.11 wireless LAN? 2+3+5
10. (a) Foreign Agent is optional in Mobile IPv6. Why?  
(b) Is it possible to send a packet by a mobile node, visiting a foreign network, direct to a correspondent node? Explain your answer.  
(c) How is the session key generated between a correspondent node and the mobile node in Mobile IP environment? 3+3+4
11. (a) What do you mean by multipath propagation of wireless signals? What are its advantages and disadvantages?  
(b) Discuss, in brief, the voice and data connectivity in UMTS network. (3+2)+5
12. (a) ‘Using Sequence number DSDV prevents looping.’— Explain with the help of an example.  
(b) What do you mean by fluctuations? How can it be tackled by DSDV? 5+5
13. Compare between Proactive and Reactive routing protocols used in Ad-hoc network. Suggest a routing protocol that can be used for ‘search and rescue’ by a disaster management group. State reason(s) in favour of your answer. 4+5+1
14. Compare between Distance vector and Link State routing approach. Is it possible to use the Link state routing approach in Ad-hoc network? Discuss with justification. 4+6
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**2017**

**COMPUTER SCIENCE AND ENGINEERING**

**Paper : CSE – 203**

**(Mobile and Wireless Computing)**

**Full Marks – 100**

*The figures in the margin indicate full marks*

*Candidates are required to give their answers in their own words as far as practicable*

**Answer *questions 1* and *5*; answer *four* more taking *any two* from *questions 2* to *4* and *any two* from *questions 6* and *8***

1. Answer *any five* of the following :

**2×5**

(a) Do you feel that a cluster should have multiple gateways for inter-cluster communication ? Justify your opinion.

(b) Can a node be a common member for multiple physical subnets in the Virtual Subnet Architecture (VSA) ?

(c) What is the fundamental difference between DSDV and AODV routing protocols ?

(d) What is a virtual subnet ?

(e) What is promiscuous mode of communication for wireless ad-hoc networks ?

(f) What is a piconet ? How many nodes are used to form a Gateway Slave Interconnection for connecting two piconets ?

(g) What is major difference between link-clustered architecture and Near-Term Digital Radio Network (NTDR) in terms of inter-cluster communication ?

2. (a) Describe link cluster architecture.

(b) How do you differentiate between direct routing and long-path routing for virtual subnet architecture ?

(c) Describe the SPIN-2 routing protocol. State major limitations of SPIN routing protocol.

(d) Critically comment on the following statement : "When mobility of nodes increases, the connectivity-based clustering becomes unstable". **6+3+6+5**

3. (a) Why Link State Routing protocol (LSR) is not suitable for wireless ad-hoc networks ?

(b) Define Multi Point Relays (MPR) for OLSR routing protocol. Why are these important for OLSR routing ?

[Turn Over]

(c) Describe the MPR selection process for OLSR routing protocol using a suitable example with at least 10 nodes and 22 edges connecting those.

(d) What would be the number of nodes in the MPR set, after phase 1 of the MPR selection process described in your answer above, if nodes at 1-hop and 2-hop distances from a node A form a completely connected topology among them ? What will be the total number of nodes in the MPR set for A after the final phase ? Justify your opinion.

(e) Critically comment on the statement : "For an ad-hoc network with n nodes, proactive routing requires each of the n nodes to maintain and update a table of size  $O(n^2)$  for routing decisions".

2+4+6+3+5

4. (a) State advantages and disadvantages of promiscuous mode or operation for nodes in ad-hoc networks.

(b) What is count-to-infinity problem in ad-hoc network routing ? Explain with an example.

(c) How DSDV avoids count-to-infinity problem ?

(d) Why ZRP is classified as a hybrid routing protocol ?

(e) What are the different fields that the routing table contains for DSDV protocol ?

(f) When two paths in DSDV protocol bear the same sequence number, how do you select one of these two paths for routing ?

(g) Critically comment on the statement : "The route acquisition latency is more for reactive routing protocols as compared to their proactive counter-parts".

3+4+2+2+2+2+5

5. Answer the following questions :

2×5

(a) What is paging in the context of GSM cellular network ?

(b) Determine the signal to interference ratio for a hexagonal cellular system.

(c) How does anti-spoofing software block topologically incorrect IP packets ?

(d) Describe how the frequencies are assigned to a pair of communicating nodes in FHSS system ?

(e) What is the difference between Half Rate and Full Rate TCH GSM channel ?

6. (a) If 20 MHz of total spectrum is allocated for a wireless cellular system and each channel has 25 kHz bandwidth, find

(i) the total number of channels available in the system.

(ii) the total number of channels available per cell if i=2 and j=1 is used in the frequency reuse algorithm.

(b) Differentiate between Cell Sectoring and Cell Splitting technique of increasing capacity of a cellular system.

(c) What is the advantage of hexagonal structure over rectangular one for a cell in a cellular system ?

(d) Users are getting disconnected frequently in a mobile environment. Describe how such disconnections affect the overall performance of TCP in the mobile environment. Suggest a technique to improve the performance of TCP in the presence of frequent disconnections of the mobile environment.  $6+4+3+(3+4)$

7. (a) What do you mean by hidden terminal problem exposed terminal problem in wireless communication ?

(b) Explain how CSMA/CA handles hidden terminal and exposed terminal problem with detailed explanation of the working principle of CSMA/CA protocol.

(c) Discuss various path loss models used in a wireless communication system.  $4+10+6$

8. Write short notes on the following :  $5 \times 4$

(a) GSM Frame Structure

(b) Transaction-oriented TCP

(c) Multipath Propagation

(d) Reverse Tunneling in Mobile IP.



2016

**COMPUTER SCIENCE AND ENGINEERING**

**Paper – CSE – 203**

**(Mobile and Wireless Computing)**

**Full Marks – 100**

*The figures in the margin indicate full marks*

*Candidates are required to give their answers in their own words as far as practicable*

Answer **Question No.1** and **5**; answer **four** more taking **any two** from questions **2 to 4** and **any two** from questions **6 to 8**

1. Answer the following questions : 2×5

(a) What is promiscuous mode of communication for wireless ad-hoc networks?

(b) What is a piconet? How many nodes are used to form a Gateway Slave Interconnection for connecting two piconets?

(c) What is the major difference between link-clustered architecture and Near-Term Digital Radio Network (NDTR) in terms of inter-cluster communication?

(d) In DSR protocol, what happens when an intermediate node receives the same route request (RREQ) packet from multiple paths?

(e) Why ad-hoc networks are often more vulnerable than infrastructure-based networks in terms of undesired intrusion?

2. (a) How is the address of a node formed for virtual subnet architecture for cluster formation?

(b) What are the typical parameters contained in a beacon from a Cluster Head (CH) for NTDR network that are used by other nodes to determine affiliation with a CH or not? Why checks for CH relinquishment are staggered for NTDR?

(c) How route maintenance is done in case of a failure in transmission for DSR algorithm?

(d) Explain with an illustrative example that using route cache could actually lead to inefficient route discovery for DSR algorithm.

(e) Critically comment on the statement : “Supporting promiscuous mode 2+6+ of operations could result in potential security threats for wireless, ad-hoc networks”. 3+4+5

[Turn Over]

3. (a) Why multi-hop routing is predominantly used for ad-hoc networks?  
State four important basis for designing routing protocols for wireless, ad-hoc networks.

(b) Explain with an example of your choice, how quasi-hierarchical routing is expected to perform better than strictly hierarchical routing in terms of lower number of hops in the selected route.

(c) Why LAR is classified as a reactive routing protocol?

(d) Describe the MPR selection process for OLSR routing protocol using a suitable example with at least 10 nodes and 22 edges connecting those.

(e) What would be the number of nodes in the MPR set, after phase 1 of the MPR selection process described in your answer above, if nodes at 1-hop and 2-hop distances from a node A form a completely connected topology among them? What will be the total number of nodes in the MPR set for A after the final phase? Justify your opinion.

3+4+3+6+4

4. (a) What is attribute-based addressing in a WSN? Explain with an example.

(b) What are the different data-reporting categories used in WSN? Why data-reporting mode is crucial in WSN?

(c) Critically comment on the statement : "Malfunctioning of some sensor nodes due to power failure may cause significant topological changes and might require rerouting of packets and reorganization of routes in the WSN".

(d) Describe the SPIN routing protocol. Suggest an application scenario for which SPIN would be highly beneficial.

3+5+5+7

5. Answer the following questions :

2×5

(a) Specify the fields of minimal encapsulation method used in mobile network layer.

(b) How does the signal propagate from sender to receiver in wireless medium?

(c) List the low power states that a Bluetooth device can reside.

(d) Are directional antennas useful for mobile phones? Why? What kind of antennas are useful for such environment?

(e) What do you mean by "freezing" in the context of CSMA/CA?

6. (a) Discuss various mechanisms of TCP that influence the efficiency of TCP in mobile communication.

(b) How do indirect TCP and Mobile TCP resolve such influences?

(c) Determine signal to interference ratio for cellular system with cluster size of N.

5+10+5

7. (a) Suppose  $S_1$  and  $S_2$  send data to common destination D using IEEE 802.11 (DCF). All of  $S_1$ ,  $S_2$  and D are within the receive range of each other. Describe a collision (what happens before, during and after the collision) if the basic scheme is used (i.e. no RTC/CTS). What happens if we use RTC/CTS?

(b) Explain the steps involved in the call delivery procedure in GMS network in the following cases :

(i) GSM mobile terminated call.

(ii) GSM mobile originated call.

(c) Consider 4 stations A, B, C and D which communicate with each other through CDMA technology. If the code assigned to A is  $(1, -1, 1, -1)$ , determine the possible codes that may be assigned to B, C and D. Justify your answer. 8+(4+4)+4

8. (a) Specify the inefficiencies of Mobile IP v4 regarding data forwarding from a Correspondent Node to a Mobile Node.

(b) How are such inefficiencies reduced in Mobile IP v6?

(c) State the general problems of Mobile IP regarding security and quality of service.

(d) Discuss various techniques to get rid of such problem. 4+6+4+6



**2019**

**COMPUTER SCIENCE AND ENGINEERING**

**Paper : CSEL – 843**

**(Wireless Sensor Network)**

**Full Marks : 70**

*The figures in the margin indicate full marks.*

*Candidates are required to give their answers in their own words  
as far as practicable.*

Answer **question nos. 1, 2 and any four** from the rest.

1. Answer **any five** of the following : 2×5
  - (a) State the principal feature of a “Contention based protocol”.
  - (b) Define “Extended Service Set” (ESS).
  - (c) Name two applications (with brief justification) where ad-hoc network is suitable compared to infrastructure based network.
  - (d) State the reason(s) for using hierarchical routing instead of flat routing approach.
  - (e) “Energy is the most crucial metric for routing in WSN”— Comment.
  - (f) Why is the DSR termed as “source routing”?
  - (g) Asymmetric (or unidirectional) links occur when node A can hear node B, but B cannot hear node A. State whether this could be a problem for the AODV protocol or not.
  
2. Answer **any five** of the following : 4×5
  - (a) Explain the “implosion” and “overlap” problem in WSN with a suitable diagram.
  - (b) State the unique features and constraints of a Wireless Sensor Network.
  - (c) Comment on the bandwidth requirement of Distance Vector and Link State with brief justification.
  - (d) Describe the role of “Network Allocation Vector” in CSMA protocol.
  - (e) Distinguish between Broadcasting and Boarder casting.
  - (f) Describe the role of PCF; even if DCF exists in the same layer for medium access.
  - (g) State a WSN application for each of the following categories : time-driven, event-driven and query-driven.
  
3. (a) State the reason(s) for not using CSMA/CD in Wireless LAN.  
(b) How the “exposed station problem” affects the performance of a MAC protocol?  
(c) Do you think the “location information” of a node may help to reduce the overhead of the routing?  
Explain your answer. 2+4+4

**Please Turn Over**

4. (a) "Rumour routing attempts to combine the characteristics of event flooding and query flooding"— Explain.
- (b) "Route caching can reduce route discovery overhead in DSR"— Explain. 6+4
5. (a) How does the SPIN family of protocols address the basic challenges faced by flooding? Which one is more suitable for environmental monitoring : SPIN or Directed Diffusion? Justify your answer.
- (b) Discuss the problem of fluctuation in DSDV. Also suggest a solution to overcome this. (5+1)+(3+1)
6. (a) Define Directed Acyclic Graph (DAG).
- (b) How is the link reversal algorithm used in a DAG to explore multipath routes towards destination? Explain with an example.
- (c) What advantages and disadvantages does multipath routing have?
- (d) Do you suggest a network where this technique performs better than others? Give reasons. 1+6+2+1
7. (a) Consider the following WSN scenarios and explain why you would choose either a proactive or a reactive routing for the given use cases :
- (i) A WSN is used to detect the presence of vehicles, where each sensor locally records the times of vehicle detection. These records are delivered to the base station only when the sensor is explicitly queried.
- (ii) A WSN is used to monitor air pollution in a city where every sensor reports its sensor data once every minute to a single remote base station. Most sensors are mounted on lamp posts, but some are also mounted on city buses.
- (b) Describe the classical looping problem in Distance Vector. How is it solved in DSDV? Discuss. 4+(3+3)
-

**2022**

**COMPUTER SCIENCE AND ENGINEERING**

**Paper : CSEL-843**

**(Elective IV : Wireless Sensor Networks)**

**Full Marks : 70**

*The figures in the margin indicate full marks.*

*Candidates are required to give their answers in their own words  
as far as practicable.*

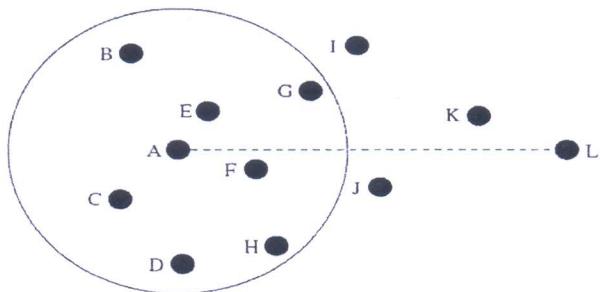
Answer **question nos. 1, 2 and any four** questions from the rest.

1. Answer **any five** from the following : 2×5
- (a) State the principal advantages and disadvantages of multi-hop communication.
  - (b) Why the sensor nodes in WSN must be self-configurable?
  - (c) State examples of delay sensitive and delay tolerant WSN based applications.
  - (d) The key idea behind CSMA/CD is that the sender detects collisions, allowing it to react correspondingly. Why is this approach not practical in wireless networks?
  - (e) In a CSMA/CA network, nodes use a random delay before accessing the medium. Why is this being done?
  - (f) Is overhearing a problem in a wireless sensor network? Give reasons.
  - (g) Why DSDV uses ‘immediate advertisement’ instead of periodic advertisement for any change in network?
2. Answer **any five** from the following : 4×5
- (a) How does the S-MAC protocol reduce the duty cycles of sensor nodes?
  - (b) State Hidden Station problem. How is it addressed in MACA?
  - (c) What is data-centric routing? Why is data-centric routing feasible (or even necessary) compared to routing based on identities (addresses)?
  - (d) Asymmetric (or unidirectional) links occur when node A can hear node B, but B cannot hear node A. Is it a problem for the AODV protocol? If so, how this can be addressed?
  - (e) In AODV, is it possible that route discovery packets travel in the network forever? Why or why not?
  - (f) Discuss the role of PCF; even if DCF exists in the same layer for medium access.
  - (g) Consider an application where WSN is used to measure humidity in a field. Low-power sensors report measurements only when certain thresholds are exceeded. What type of routing will be effective for this scenario? Justify your answer.

**Please Turn Over**

3. Comment with justification for using a schedule based protocol in WSN. State the motivations behind proposing TRAMA (Traffic Adaptive Medium Access Protocol) compared to TDMA. Describe, in brief, each of the phases of the TRAMA protocol highlighting the contribution of the said protocol. 2+2+6
4. (a) Energy efficiency, Scalability, Adaptability and Low latency are the four important requirements of WSN. Describe concrete WSN applications where a specific requirement would be more important than the others.
- (b) "Knowledge about location of the node(s) helps to improve performance of routing protocol in Ad-hoc network." —comment on this statement with justification. 6+4
5. (a) In general, the large sensor networks are clustered. State the reasons.
- (b) Explain Query driven routing in WSN through an example.
- (c) Discuss a receiver-initiated MAC scheme (used in WSN) highlighting the advantages over sender-initiated approaches. 3+3+4
6. Flooding is a simple strategy for distributing data to all sensor nodes in a network with limitations. Answer the following questions:
- (a) State the limitations (Challenges) of flooding.
- (b) Which of these can be addressed by gossiping and how can they be addressed?
- (c) How do sequence numbers contribute to reducing unnecessary transmissions? Are sequence numbers alone sufficient and, if not, what other information is needed to use them correctly?
- (d) How does the SPIN family of protocols address the said challenges?
- (e) Comment about the addressing of the said challenges by Directed Diffusion compared to the strategies used by SPIN. 2+2+2+2

7. (a)



Consider the above topology. Node A wishes to forward a packet toward destination L via one of its neighbours (its communication range is indicated with the circle). Which neighbour will A choose for each of the following forwarding strategies?

*Greedy forwarding, Most forwarding progress, Nearest with forwarding progress, Compass routing*

- (b) Discuss the cluster head election policy in the LEACH protocol and explain how LEACH can consider the available energy on each node in this election process. State your opinion, with necessary justifications, regarding the choice of TDMA within a cluster by LEACH. 4+(4+2)

( 3 )

**BT(8th Sm.)-Computer Science and  
Engineering-CSEL-843**

8. (a) Define the usefulness of the terms ‘Coverage’ and ‘Connectivity’ in context of WSN design.  
(b) Distinguish between point coverage and barrier coverage problem through an example.  
(c) Discuss an algorithm to ensure area coverage with minimum number of sensor nodes. 2+3+5
9. (a) Through a concrete example, state the need of time synchronization in a WSN.  
(b) Discuss two new challenge(s) for designing time synchronization protocol for WSN.  
(c) Node A sends a synchronization request to node B at 3150 (on node A’s clock). At 3250, node A receives the reply from node B with a time stamp of 3120.
  - What is node A’s clock offset with respect to the time at node B (you can ignore any processing delays at either node)?
  - Is node A’s clock going too slow or too fast?
  - How should node A adjust the clock?
- (d) Discuss the differences in the design of the TPSN and the LTS synchronization protocols.

3+2+2+3

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**2023**

**COMPUTER SCIENCE AND ENGINEERING**

**Paper : CSEL-843-Elective-IV**

**(Wireless Sensor Network)**

**Full Marks : 70**

*The figures in the margin indicate full marks.*

*Candidates are required to give their answers in their own words  
as far as practicable.*

Answer **question nos. 1, 2 and any four** questions from the rest.

1. Answer **any five** questions : **2×5**
- (a) Which data forwarding approach is better suited for WSN based environment monitoring — push based or pull based? Justify.
  - (b) How does MACAW extend MACA and what is the purpose of the additional control messages?
  - (c) The key idea behind CSMA/CD is that the sender detects collisions, allowing it to react correspondingly. Why is this approach not practical in wireless networks?
  - (d) State the motivation behind proposing MARCH protocol at MAC layer.
  - (e) Can you think of an application scenario where contention based MAC performs better than contention free MAC protocol?
  - (f) In general, the large sensor networks are clustered. — State the reasons.
  - (g) Why DSDV uses ‘immediate advertisement’ instead of periodic advertisement for any change in network?
2. Answer **any five** questions : **4×5**
- (a) How are the idle-listening and overhearing reduced in S-MAC protocol?
  - (b) Compare the performance between receiver-initiated and sender-initiated Preamble based MAC with necessary reasons.
  - (c) How the ‘exposed station problem’ affects the performance of a MAC protocol? Can you suggest a solution?
  - (d) Define the importance of the terms ‘Coverage’ and ‘Connectivity’ in context of Density Control in WSN.
  - (e) In AODV, is it possible that route discovery packets travel in the network forever? Justify.

**Please Turn Over**

- (f) Consider the following WSN scenarios and explain why you would choose either a proactive or a reactive routing for the given use cases :
- A WSN is used to detect the presence of vehicles, where each sensor locally records the time of vehicle detection. These records are delivered to the base station only when the sensor is explicitly queried.
  - A WSN is used to monitor air pollution in a city where every sensor reports its sensor data once every minute to a single remote base station. Most sensors are mounted on lamp posts, but some are also mounted on city buses.
- (g) How is the location information used to enhance the routing performance in adhoc networks? Discuss with an example.
3. (a) In what sense, TRAMA is better performer than TDMA in WSN?
- (b) Describe the methods for slot allocation among contender nodes in TRAMA and Zebra MAC Protocol.
- (c) Mention the performance of Zebra-MAC in low load. 2+6+2
4. (a) State the advantage(s) of SPIN and Directed Diffusion.
- (b) Describe a method with suitable illustration that uses the strength of the above said protocols.
- (c) Comment on the metric (parameter) based performance for establishing the contribution of the protocol. 3+5+2
5. (a) Define ‘Lifetime of a WSN’. Why is it so important?
- (b) Describe the strategies, in detail, for increasing the lifetime in TEEN routing protocol.
- (c) Discuss the contribution of APTEEN over the TEEN in terms of adaptability. 2+5+3
6. (a) Illustrate with an example the inherent problem of ‘looping’ in context of Distance Vector Routing. Discuss the role of Destination Sequence Number in DSDV in this context.
- (b) State the process of cache updation in DSR.
- (c) State the contribution of DBTMA over MACA-W in terms of performance metrics. (3+3)+2+2
7. (a) Explain the difference between external and internal time synchronization through an example.
- (b) Consider two nodes, where the current time at node A is 1100 and the current time at node B is 1000. Node A’s clock progresses by 1.01 time units once every 1 s and node B’s clock progresses by 0.99 time units once every 1 s. Explain the terms clock offset, clock rate, and clock skew using this concrete example. Are these clocks fast or slow, and why?
- (c) Describe a sender-receiver synchronization approach within WSN. 3+3+4

**2024**

**COMPUTER SCIENCE AND ENGINEERING**

**Paper : CSCL-1001**

**(Wireless and Mobile Computing)**

**Full Marks : 70**

*The figures in the margin indicate full marks.*

*Candidates are required to give their answers in their own words  
as far as practicable.*

Answer **question nos. 1, 2 and any four** from the rest.

**1. Answer any five** questions :

**2×5**

- (a) How does M-TCP solve the problem of frequent disconnections?
- (b) Why do we use reverse tunneling in Mobile IPv6?
- (c) What is the justification for using hexagonal cells in cellular networks?
- (d) State the causes for generating ‘immediate advertisement’ in DSDV. Why is it not periodic?
- (e) Is there a chance of collision between route request packets in DSR? If yes, how can it be avoided?
- (f) Does an ad hoc network suffer any disadvantage for lacking infrastructure compared to a cellular network?
- (g) Distinguish between the Push-based and Pull-based data forwarding approach in a sensor network.

**2. Answer any five** questions :

**4×5**

- (a) How does T-TCP perform well for a series of short HTTP request and reply messages?
- (b) Explain the Authentication Process used in the GSM network.
- (c) Explain the GSM-900 frame hierarchy. Which TDMA frames of TCH-F are used to communicate signal strengths?
- (d) Discuss the performance of DSDV with DSR with respect to overheads and End-to-End delay with necessary justifications.
- (e) What motivates creating a zone in ZRP instead of using a flat network? What would the situation be if the destination was not within the zone?
- (f) Can a Link state routing strategy perform effectively in a Mobile Adhoc network? Justify your answer.
- (g) Illustrate the role of Destination Sequence no. in DSDV through an example.

**Please Turn Over**

3. (a) Explain how to improve wireless system capacity by reusing frequencies.  
 (b) Derive the expression of the co-channel interference due to frequency reuse in terms of signal-to-noise ratio.  
 (c) A GSM network uses uplink frequencies of 800MHz-840MHz and downlink frequencies of 850MHz-890MHz. It uses a guard band of 25kHz. It also uses a TDMA with 8 time slots and each channel has BW100kHz. Determine the number of physical channels available in this GSM system.

3+4+3

4. (a) Discuss multipath propagation of wireless signals in an indoor environment.  
 (b) Using Taylor's Expansion, derive a 2-ray path loss model.  
 (c) How can you fit this into the following simplified path loss model?

$$P_r = P_t K \left[ \frac{d_r}{d} \right]^\gamma, \quad 2 \leq \gamma \leq 8.$$

3+5+2

5. (a) Discuss the various tables and their attributes used in Home Agent and Foreign Agent in Mobile IPv4.  
 (b) How does a packet from a correspondent node tunnel to the mobile node currently visiting a foreign network?  
 (c) What is the use of the Identification field of the Registration Request message?

4+3+3

6. (a) "MACA partially solves the hidden station problem." — Comment with justification.  
 (b) Describe the contributions of MACA-W over MACA with a necessary illustration.  
 (c) Is MACA-W able to address the exposed station problem? Explain your answer.

3+5+2

7. (a) How can the performance of a reactive protocol (say DSR) be improved using location information?  
 (b) Discuss the topology information management process in OLSR.  
 (c) How can the packet generation be minimized within the route discovery phase in DSR?

4+3+3

8. (a) State the importance of network lifetime in the context of a routing protocol in WSN.  
 (b) Describe the cluster head selection process in LEACH. Justify the motivation behind such selection.  
 (c) Discuss the basic principle of data transfer in TORA. For what type of network it performs better than the others?

2+5+3

M. Tech Semester – (Mid-Semester) Examination, 2024

Subject: Computer Science

Paper Code & Name: CSCL 1001 (Wireless and Mobile Computing)

Full Marks: 30

Date: 21.05.2024

Time and Duration: 12.00 PM – 1:30 PM

Answer question no 1 and any three from the rest

- ✓ 1. Answer any five questions. [5 x 3]
- "CSMA/CD can't be applied in the MAC layer of wireless communication" – critically comment on the statement, describing the issues with proper examples.
  - Suppose 16 wireless devices are connected in a grid numbered (1,1) to (4,4). Determine the hidden nodes and exposed nodes if the node (2,2) wants to send data to node (2,3).
  - Determine the length of the Aluminium plate needed to generate a wireless signal of frequency 98MHz using a Half-wave dipole antenna.
  - Describe the leaky bucket algorithm to run the isochronous (time-dependent) application for intermittent communication systems.
  - With a suitable diagram, describe the multipath propagation of wireless signals in an indoor environment.
  - What is the architectural difference between ad-hoc network and wireless LAN?
2. CSMA/CA uses a random backoff algorithm during communication which creates problem to run the isochronous (time-dependent) application over wireless communication. How is this problem solved in wireless LAN? Describe the solution in detail. 5
3. State and derive the Two-Ray Path Loss model. 5
4. State two different techniques to detect congestion in TCP. How does TCP control the congestion in these two cases? Consider the effect of using slow start on a line with a 10 msec RTT and no congestion. The receiver window is 24 KB and the maximum segment size is 2 KB. How long does it take before the first full window can be sent? [1+2+2]
5. "I-TCP solves the last mile delivery problem at the cost of reliability and security" – critically comment on the statement. How is the reliability issue solved in S-TCP? Suppose in S-TCP the snoop\_data() module receives a duplicate packet from the fixed host whose sequence number is less than the sequence number of the last packet acknowledged by the mobile host. Determine why does the fixed host send the duplicate packet. [2+2+1]

**M.Tech 2<sup>nd</sup> Semester Examination 2024**  
**Subject: Wireless and Mobile Computing**

**Full Marks: 30**

**Duration:  $1\frac{1}{2}$  hour**

1. Answer any five of the following questions. [5x2=10]
  - a. State Friis Free space Path Loss model and Two-Ray Path Loss model.
  - b. Determine the length of a dipole antenna to generate a career signal of 98 MHz.
  - c. What are the factors that affect the performance of TCP in wireless and mobile environments?
  - d. "IPv6 provides more features compared to IPv4 in handling mobility with MobileIP" - Justify this statement by citing any two features of IPv6 to support mobility.
  - e. Does an ad hoc network suffer any disadvantage for not having infrastructure when compared to a cellular network?
  - f. What do you mean by "On-demand routing"?
  - g. "Link State routing becomes impractical for a large network" - Comment.

2. Answer any four of the following questions. [4x5=20]
  - a. What is the role of Mobile IP in mobile computing? Explain how it addresses the challenges of mobility.
  - b. Differentiate the approaches of handling the socket and buffer migration by I-TCP and S-TCP in case of Node migration.
  - c. What do you mean by orthogonal codes? How does CDMA use orthogonal codes to communicate using the same frequency simultaneously? Illustrate with an example.
  - d. Describe the route optimization process as used in DSR through an example.
  - e. Discuss, with necessary justification, the relative performance(s) of DSDV and DSR in terms of End-to-End delay, Power consumption and packet delivery in high mobility.
  - f. Illustrate through an example the inherent problem of "looping" in context of Distance Vector routing. Discuss the role of Destination Sequence Number in DSDV in this context.

**2024**

**COMPUTER SCIENCE AND ENGINEERING**

**Paper : CSE-903**

**[Wireless and Mobile Computing (Elective-II)]**

**Full Marks : 70**

*The figures in the margin indicate full marks.*

*Candidates are required to give their answers in their own words  
as far as practicable.*

**Answer question nos. 1 & 2, and any four questions from the rest.**

**2×5**

**1. Answer any five questions :**

- (a) What is the structure of a cell in a cellular system? Justify the use of such a structure.
- (b) List the factors that affect the performance of TCP in a wireless environment.
- (c) What are the main features of M-TCP? How does it enhance TCP performance in mobile environments?
- (d) Is a table-driven routing protocol suitable for high-mobility environments? Why, or why not?
- (e) Why is the SPIN considered a push-based protocol?
- (f) State the specific advantage of using MARCH protocol compared to existing MAC protocols for Adhoc Networks.
- (g) State the role of the Network Allocation Vector in MACA protocol.

**4×5**

**2. Answer any five questions :**

- (a) Describe the concept of tunneling in Mobile IP. How is encapsulation achieved during the tunneling process?
- (b) Consider five wireless stations A, B, C, D, and E. Station A can communicate with all other stations. B can communicate with A, C, and E. C can communicate with A, B, and D. D can communicate with A, C, and E. E can communicate with A, D, and B. Find the set of hidden nodes and exposed nodes
  - (i) When A is communicating to B.
  - (ii) When B is communicating to A.
  - (iii) When B is communicating to C.
- (c) Discuss the GSM Hyper-frame structure in detail.
- (d) Derive a 2-Ray path loss model for the transmitter and receiver with heights of  $h_t$  meters and  $h_r$  meters, respectively, separated by a distance of d meters.

**Please Turn Over**

**(8733)**

- (e) "Link State routing may not be a suitable approach for a large network."— Comment on the statement and justify.
- (f) Explain the contribution of MACA-W over MACA with the necessary illustration.
- (g) State the purpose of the Back-off algorithm used in MAC protocol. Compare the back-off strategies as used in MACA and MACA-W protocols.
3. (a) Discuss the roles of the Care-of Address (CoA) in Mobile IP and the Binding Update process in MobileIPv6.
- (b) Derive the relation between the cluster size and distance between co-channel cells.
- (c) Assuming the interference is caused by 6 co-channel cells in a hexagonal cellular network and that all cells transmit with equal power, derive the minimum cluster size  $N$  if the Signal to Interference Ratio (SIR) is at least 18dB. 3+4+3
4. (a) In a scenario with high packet loss due to wireless interference, which variant of TCP (I-TCP, T-TCP, S-TCP, or M-TCP) would perform best? Justify your choice.
- (b) Discuss the working principle of the variant of TCP used for the scenario in 4 (a).
- (c) What are the advantages and disadvantages of the variant of TCP used for the scenario in 4 (a)? 2+5+3
5. (a) Discuss the role of power control in mitigating the near-far problem in GSM cellular systems.
- (b) Show that the raw data rate of GSM Traffic channel TCH-F is 22.8 kbps.
- (c) Discuss UMTS cellular architecture briefly. 3+3+4
6. (a) In DSDV, when topological changes make a route invalid, what will be the reaction of the protocol? Discuss through an example.
- (b) "Choice of routing algorithm used in an ad-hoc network depends on the rate of topological change." Comment with justification.
- (c) Describe the communication process in ZRP where the destination is not within the sender's zone. Illustrate through an example.
- (d) State the problems that may affect the expected performance of ZRP. 2+2+4+2
7. (a) Can a loop (count to infinity problem) be formed while using AODV? Explain your answer through an example.
- (b) How does AODV tackle the situation mentioned above?
- (c) DSR caches the discovered routes for further data forwarding. Explain the strategy for refreshing the cache through an example. 3+3+4

8. Flooding is a simple strategy for distributing data to all sensor nodes in a network with limitations.  
Answer the following questions :

- (a) State the limitations (Challenges) of flooding.
- (b) Which of these can be addressed by gossiping, and how can they be addressed?
- (c) How do sequence numbers contribute to reducing unnecessary transmissions? Are sequence numbers alone sufficient, and if not, what other information is needed to use them correctly?
- (d) How does the SPIN family of protocols address the said challenges?
- (e) Comment about addressing the challenges by Directed Diffusion compared to the strategies used by SPIN.

1+2+2+2+3