MOBILE COMPUTING
(CSEN 4246)

Time Allotted : 3 hrs   **Full Marks : 70**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and
<u>any 5 (five)</u> from Group B to E, taking <u>at least one</u> from each group.

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

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**

   (i)   MAHO stands for _____
          (a) MSC assisted handoff   (b) Mobile assisted handoff
          (c) Machine assisted handoff   (d) Man assisted handoff.

   (ii)   In spread spectrum technique, the multiple users are assigned with
          (a) Same spectrum and same PN code
          (b) Same spectrum and different PN code
          (c) Different spectrum and different PN code
          (d) Different spectrum and same PN code.

   (iii) The process of subdividing a congested cell into smaller cells is called _____
          (a) Cell splitting   (b) Sectoring
          (c) Micro cell technique   (d) Repeaters.

   (iv)   If both Bluetooth and WiFi are ON for a particular mobile device:
          (a) Both will coexist and be perfectly operational
          (b) Bluetooth will subdue WiFi as it has higher power
          (c) Both will cancel each other and hence won't be operational
          (d) WiFi will subdue Bluetooth as it has higher power.

   (v)   What are adjacent cells?
          (a) Cells having different base stations   (b) Cells using different frequency
          (c) Cells using adjacent frequency   (d) Cells using common boundary.

   (vi)   The co-located care of address in Mobile IP is assigned by the
          (a) HLR   (b) VLR   (c) HA   (d) FA.

   (vii) A,B,C,D are four stations in a WLAN placed consecutively. Two neighbours are
          within the transmission range of each other but not to others. Ex: If B transmits,
          both A and C can hear but not D.

Which of the following is permitted in the above configuration?
(a) A and C can transmit to B at the same time
(b) A can transmit to B and C can transmit to D at the same time
(c) B can transmit to A and C can transmit to D at the same time
(d) B can transmit to A and D can transmit to C at the same time.

(viii) Which of the following is true about mobility enhancement to TCP?
(a) I-TCP requires ACKS be sent between a Mobile Node and the Correspondent Node only
(b) S-TCP requires buffering only for the traffic directed to the Mobile Node at the Foreign Agent
(c) S-TCP eliminates need for end to end ACK
(d) No mobility enhancement is needed for TCP to operate properly in a wireless environment.

(ix) Which of the following is the entry point of an Android application?
(a) Main class   (b) MainActivity class
(c) MainService class   (d) None of the above.

(x) In AODV routing, which of the following happens:
(a) The forward path from a source S to destination D is setup first using RREQ messages
(b) Using RREQ messages that travel from S to D, a reverse path from D to S is set up first
(c) If there is a current path already setup between an intermediate node I and D, then RREQ reaches upto I and RREP flows backward to S; it does not reach D
(d) The algorithm requires a path to be setup between every such S and D, before any communication can take place.

Group – B

2. (a) Consider a deployment region of area 2100m² is covered by imaginary hexagonal cells of area 3m² each. Now, if the total number of channels is 150, calculate the system capacity for cluster size 7.
What will be the system capacity if the cluster size in the above problem is reduced from 7 to 3? Give a suitable explanation of the observation.

(b) What is the reason hexagonal shaped cells are used instead of circular or rectangular cells?

(c) What does 'i' and 'j' in the standard equation for cells given below refer to?
$$N=i^2+ij+j^2$$
Show the cell configuration inside a cluster for N = 7 that clearly identifies 'i' and 'j'.

(4 + 2) + 3 + (1 + 2) = 12

3. (a) Mention the similarities and differences between AMPS and D-AMPS.

(b) Mention (without any details) how 3G CDMA networks handle the issues related to:

(i) orthogonality synchronization between MS (mobile stations),
(ii) variable data rates for different types of traffic and
(iii) different receive / transmit power requirements for MS es at different distances from the BS (Base Station).

(c) Please answer the following questions based on the GSM technology:
(i) What is the frequency spacing between two adjacent channels (either uplink or downlink)?
(ii) How many users can share a GSM channel in TDMA and how much time is given to each of them to send their frame (in normal cases?
(iii) What way Broadcast Control Channel differs from Paging Control Channel?
(iv) When a mobile call is generated in a GSM network, mention the various participating elements participate and also a few important messages / signals they exchange (names only, no details are required).

(d) "GPRS attempts to reuse the existing GSM network elements as much as possible, but....<snip>. Some new network elements.. <snip>... are required"
Explain the above statement with a suitable reference architecture diagram for GPRS.

$$2 + (3 \times 1) + (4 \times 1) + 3 = 12$$

Group – C

4. (a) Assume a correspondent node (CN) wants to send packets with sequence numbers 1, 2, 3 to a mobile host (MH). The MH is under the care of a foreign agent FA1.
Assume the link between CN and FA1 is error free and the wireless link between FA1 and MH is error prone.
The Snooping TCP protocol is used.
Case 1: Packets 1 and 3 are received alright by MH, but 2 is lost. How many ACKs are sent back by MH and what are their sequence numbers? Do all of these make it back to the CN?
Case 2: Assume FA1 retransmits a packet to MH if it does not get an ACK within the Timeout interval TO1. The corresponding timeout interval at CN is TO2. Who will retransmit the missing packet 2 to MH if TO1<TO2? What about if TO1>TO2?
Case 3: Assume that FA1 retransmits packet 2 after timeout. The ACK takes too much time to get back to CN. Does CN retransmit packet 2? How does the protocol ensure packet 2 is not received in duplicates?
Case 4: Comment on the version of TCP (standard or Snooping) used inside CN, MH and FA1. What happens if MH moves from FA1 and reaches under the care of a different foreign agent FA2 while not all packets are received by it and some packets are "inflight"?

(b) There are two stations S1 and S2 using CSMA/CA protocol competing for the wireless media. S1 gets ready to send a packet of duration 10 at time 5. S2 has a similar packet to send at time 8.
Each backoff slot is of duration 2.

Value for DIFS is 8 and SIFS is 5.
The backoff times for S1 is 2,4,... slots respectively in various rounds. These values for S2 are 1,3,... slots respectively in various rounds.
Compute the start and end times of the packet transmission for both S1 and S2.

(2 + 2 + 2 + 2) + 4 = 12

5. (a) A mobile node (MN) has 199.54.40/24 has as its home network. The home agent (HA) address is 199.54.40.2. Suggest a suitable home address for MN.
MN is currently visiting a foreign network 179.129.13/24. The foreign agent (FA) address is 179.129.13.3. Suggest a suitable care of address (CoA) for MN. Is it mandatory for the FA to provide a CoA to an MN?
Describe the flow of Registration message sets.
Why can't we use triangular routing for communication between a mobile host in a foreign network and a corresponding node?

(b) Explain the various connection states in Bluetooth using suitable diagram. Draw the Bluetooth protocol stack and explain the functionalities of each module.

(1 + 2 + 2 + 1) + (3 + 3) = 12

Group – D

6.
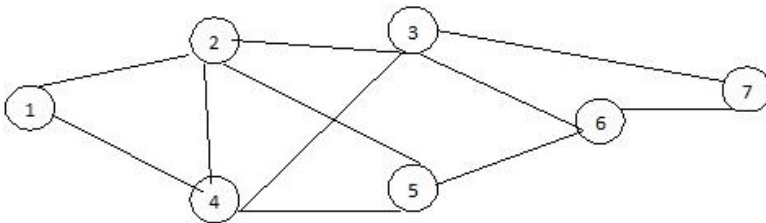
The above graph corresponds to a mobile adhoc network. Nodes are numbered. Edge cost(s) is a function of the associated node numbers,
i.e., $c(i,j) = \min(i,j)$.
Consider the following situations.
Case 1: 1 wants to send traffic to 6 for the first time. Show the Reverse Path and Forward Path setup if AODV protocol is used.
Case 2: Around the same time 4 wants to send traffic to 6. Show the Reverse and Forward Path setup in this case also.
Case 3: Mention how the above two cases would be different if DSR protocol is used instead.

(4 + 4 + 4) = 12

7. (a) You have to design an application ABC that is specifically targeted to run on a mobile device. ABC can connect to a peer over the Internet and exchange voice and data in a secured manner. What are the design choices or resource constraints you have to consider while coming up with a solution?
Implement ABC at the architectural level using the WAP stack. You have to clearly point out the various components used and how they interact with each other to make ABC work properly.

(b)   In context of Cognitive Radio Network explain the following terminologies:
  (i)   Cognitive Underlay
  (ii) Cognitive Overlay
  (iii) Miss Detection.

(2 + 4) + (3 × 2) = 12

Group – E

8.   (a)   What are the four essential states of an activity?

  (b)   Name and explain the three concepts related to Android Event Handling mechanism.

  (c)   How is the concept "resource" used in Android application development?
  Explain with the concept of a resource definition in XML and a code snippet in Java, how you can display the string "Hello World" on an Android screen.

4 + 3 + (2 + 3) = 12

9.   (a)   Name the dialog boxes supported in android.

  (b)   What are the exceptions available in android?

  (c)   What is a Sticky Intent in android?

  (d)   Show the high level diagram of various software components organized as a stack inside an Android OS.

  (e)   What is the importance of settings permissions in app development?

2 + 2 + 2 + 4 + 2 = 12

Department & Section	Submission Link
CSE A + B (group 1)	https://classroom.google.com/c/Mjk4ODY5ODAzODQ1/a/MzYwNjYxNzEwOTcw/details
CSE B (group 2) + C	https://classroom.google.com/c/Mjk5OTgyNTkxMzgy/a/MzYwNjk1NDY5MDc1/details