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Level: M2

Solution

Exam of : Wireless Networks@Mobile Networks

(Duration: 1h30)

Name: Solution	Family Name:	Gr:

Exercise 01 : (06)pts

A. List and briefly describe four propagation phenomena that affect wireless signals:

(1pt)
1. Reflection : signals bounces off surfaces
2. Diffraction : " bends around obstacles
3. Refraction : " change direction passing through media
4. Absorption : " energy absorbed by materials

(2pt) B. Compare the multiple access techniques used in each generation:

1G: FDMA, 2G: (GSM) TDMA 3G: WCDMA, 4G: OFDMA

Why did the industry change the access techniques, and what are the benefits of developing the access techniques?

- TDMA and FDMA : limited number of users and waste of spectrum
- CDMA : Near-Far problem + complex power control

(1pt) C. What is the Roaming service? Exist it in 1G?

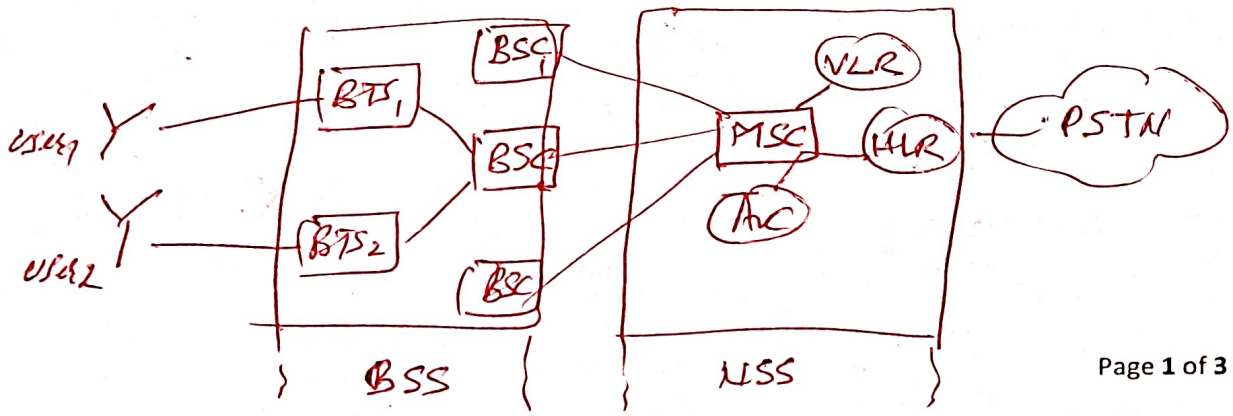
- Ensuring the mobile network service in foreign countries
- Not exist in 1G

(1pt) D. What is the Handover service? Exist it in 1G?

A process that ensuring the continuous communication between the user and the BTS when changing cells

- Yes, it exists

(1pt) E. Give the architecture of GSM network.



Exercise 02 : Make a (X) after the correct(s) answer(s) (05)pts

1) Shannon's theorem states that channel capacity depends on:
   a) Only bandwidth
   b) Bandwidth and latency
   c) Bandwidth and signal-to-noise ratio X
   d) Only modulation type

2) The OSI model is used to:
   a) Define hardware specifications
   b) Standardize communication into layers X
   c) Increase internet speed
   d) Replace TCP/IP

3) Which is an example of an access protocol?
   a) OSPF
   b) CSMA X
   c) TCP
   d) HTTP

4) Which metric measures successful data delivery over time?
   a) Latency
   b) Packet loss
   c) Throughput X
   d) Jitter

5) An ad-hoc network is characterized by:
   a) Central access point
   b) Peer-to-peer connections X
   c) Wired backbone
   d) Satellite links

6) In a Bluetooth piconet, how many active slaves can connect to a master?
   a) 7 X
   b) 8
   c) 15
   d) 255

7) An IBSS in Wi-Fi refers to:
   a) Infrastructure network
   b) Ad-hoc network X
   c) Cellular network
   d) Internet Network

8) A reactive routing protocol:
   a) Maintains routes constantly
   b) Discovers routes only when needed X
   c) Uses fixed tables
   d) Is used only in wired networks

9) In an IEEE 802.11 network, which of the following topologies requires an Access Point (AP)?
   a) Independent Basic Service Set
   b) Wi-Fi Direct
   c) Mesh Basic Service Set X
   d) Basic Service Set

10) Which of the following best describes the CSMA/CA protocol used in Wi-Fi?
   a) Devices transmit immediately if the channel is idle.
   b) Devices transmit after a random backoff period if the channel is idle. X
   c) Devices transmit only during assigned time slots.
   d) Devices use frequency hopping to avoid collisions.

Exercise 03 : (08pts)

Given the following scenarios, **identify** the Wi-Fi topology used (BSS, ESS, IBSS, MBSS, Wi-Fi Direct):

a. A laptop and a smartphone connected directly to share files without an AP. (IBSS) (0.5pt)

b. Three APs in a university building all broadcasting "Campus-WIFI." (ESS) (0.5pt)

c. A smartphone acting as a hotspot for a tablet and a laptop. (wifi direct (0.5pt)

d. A smart home where light bulbs, thermostats, and sensors relay data through each other to reach the router. (MBSS) (0.5pt)

Exercise 04 : (05)pts

A Wi-Fi station wants to transmit a data frame. The channel has been busy and just became idle.

Describe the exact backoff process step-by-step:

a. How long does the station wait before starting its backoff timer? (0.5pt)

Wait for DIFS (= 34µs / 802.11g)

b. How is the backoff timer value chosen? (0.5pt)

Choose random backoff timer from (0, CW-1) / CW = 15

c. What happens if the channel becomes busy again during backoff? (1pt)

Freeze timer, resume after idle again after DIFS

d. What happens after a successful transmission? After a collision? (1pt)

Success → Reset CW to CWmin

e. What is the better: to set CWmin verry small (e.g: 3)or big (eg: 31)? (1pt)

Small CWmin → (+) : Less waiting time → Faster access

→ (-) : More collisions

Large Cwmin → (+) : Fewer collisions

(-) : More waiting → wasted idle time

Good luck