COMP4336/9336 Mobile data networking
Quiz: Bluetooth

Q1. Bluetooth can interfere with

a) 802.11a
b) 802.11ax
c) 802.11ac
d) 802.11af
e) 802.11ad

A1. Bluetooth operates within 2.4 GHz band and hence can interfere with any WiFi that also operates within 2.4GHz band. 802.11ax can operate at either 2.4 GHz or 5GHz band, so BT can interfere with 11ax.

Q2. Consider a new version of Bluetooth in which the master device is allowed to start transmissions only in odd-numbered slots and the slave device only in even-numbered slots. Could this Bluetooth version support the transmission of 2-slot packets?

a) Yes
b) No

A2. The correct answer is b) because the use of even number of slots would break the rule that Master always start transmission in odd-numbered slots and slaves at even-numbered slots.

Q3. In Bluetooth Classic with Enhanced Data Rate (EDR), the higher data rate is achieved primarily by:

a) Increasing the number of channels used for transmission.
b) Using adaptive frequency hopping.
c) Employing faster frequency hopping sequences.
d) **Utilizing more advanced modulation schemes.**
e) Reducing the number of retransmissions.

A3.

The correct answer is d).

2 Mbps is achieved by using DQPSK (2 bits per symbol) and 3 Mbps with 8DPSK (3 bits per symbol).

Q4. In Bluetooth, active devices are identified

a) using 3 bits

b) using 2 bits
c) using a 48-bit MAC address
d) using a single bit flag

A4.

The correct answer is a).

3-bit = 8 addresses, 7 for active slaves and 1 for the master.

Q5. If Bluetooth was using a 6400 Hz clock, how many clock ticks would be required to manage a slot?

A. 1/6400 = 156.25 us. Therefore, to manage a 625 us slot, we need 625/156.25 = 4 clock ticks.

Q6. In Gaussian Frequency Shift Keying (GFSK), the key characteristic is:

a) The signal switches between frequencies with minimal abrupt changes.
b) A large number of frequencies with Gaussian distribution are used.
c) Both phase and frequency modulate the signal simultaneously.
d) The signal's amplitude remains constant while frequencies vary smoothly.
e) The signal uses Gaussian noise to modulate frequency transitions.

A6.

Both a) and d) are correct.

The Gaussian here refers to the shape of the frequency change curve for the binary FSK, which is very smooth (no abrupt changes) and looks like a Gaussian distribution.

Q7. How many slots are occupied to transmit a Bluetooth Basic Rate packet carrying 63 bytes of data, while carrying a 9-byte piconet identifier as its Access Code?

A7. Non-payload bits = 9x8+54 = 126 bits
63-byte data = 63x8 = 504 bits of payload
Total packet size = 504+126 = 630 bits, which cannot fit within one slot (slot = 625 us = 625 bits maximum). Although 2 slots would be sufficient, Bluetooth does not allow 2-slot packets. Therefore, 3-slots are to be used for this packet (the third slot would be basically wasted).

Q8. A garbage bin sensor uses Bluetooth Classic basic rate to upload bin level data to the cloud. If the bin level generates a 156-byte Bluetooth packet, how many Bluetooth slots would be required to upload this data?

a) 1 slot
b) 2 slots
c) 3 slots

d) 4 slots
e) 5 slots

A8. The correct answer is 3 slots.
156 bytes = 1248 bits.

Basic rate has a bit rate of 1 Mbps.

1248 bits would require 1248 μs. Each slot is 625 μs.

Although two slots (625x2 = 1250 μs) would be sufficient to carry the 1,248 bits, Bluetooth Classic does not permit 2-slot packets. As a result, the packet must be transmitted over 3 slots, with padding applied.

Q9. Which of the following wireless technologies use different modulations for different parts (fields) of the same packet?

a) WiFi 802.11ad
b) WiFi 802.11af
c) WiFi 802.11ax
d) 1 Mbps Bluetooth
e) 2 Mbps Bluetooth

A9. BT EDR uses GFSK for Access Code and Header fields and then switch to either DQPSK (2 Mbps) or 8DPSK (3 Mbps) for the remaining fields of the packet.

Q10. Bluetooth 5 can

a) increase the range and speed at the same time.
b) either increase the range or the speed, but not at the same time.
c) only increase the speed, but not the range.
d) only increase the range, but not the speed.

A10.

The correct answer is b).

It can support 2x data rate increase compared to BLE when the range remains the same.

It can keep the speed the same, but increase the range by 4x by using FEC.

End of Quiz-5