Chapter 1 - Intro to Comp

1. Match the following terms to the most appropriate description.

- **Embedded System -> Not necessarily connected**
- **Pervasive/Ubiquitous Computing -> Focus on anytime/anywhere computing**
- **Cyber-Physical Systems -> Focus on Interaction between Physical and Cyber systems**
- **Real-time Systems -> Focus on time constraints**

2. Which of the following is NOT a component in an IoT device

- **Power Supply**

3. Arrange the various layers for the IoT Reference Model, assuming the following sequence:

7. Collaboration & Processes
6. Application
5. Data Abstraction
4. Data Accumulation
3. Edge Computing
2. Connectivity
1. Physical Devices & Controller

4.Which of the following allows a bunch of heterogeneous systems to communicate and interact with each other?

- **Middleware**

5. The various factors (range, power, data rate, scalability, security and cost) have the same level of importance in any IoT solution.

- **False**

6. Which of the following supports the longest range?

- **LoRa**

7. Which choice represents the ultimate aim for IoT.

- To reduce network bandwidth
- To collect as much data as possible
- To connect as many ‘things’ together
- **To transform raw data into insights**

8. IoT refers to ... (select the best answer)

- Exchange of data between devices in a network
- An ecosystem of devices, accessible through internet
- Interconnections of devices in a network
- **All of them.**

9. Devices in IoT support ... (select the best answer)

- Actuating
- Sensing
- Data Collection
- **All of them.**

10. Which of the following technologies uses 2.4Ghz frequency?

- **WiFi**
- 2G/3G
- SigFox
- **Wireless HART**
- **ZigBee**
- **LoRa**
- **Bluetooth/BLE**
- Weightless
- NB-IoT
- Z-Wave

Chapter 2 - Narrow Band IOT

1. Assume that you are a network operator, and you are allocated a frequency spectrum of bandwidth equal to 1000kHz for carrying out 4G cellular operation. How many subcarriers (maximum) can you support given the above bandwidth. Assume that the bandwidth of the guard band on each side of the spectrum must be equal to 50kHz.

- 50
- 60
- 40
- 70

2. Consider the following two statements and select the appropriate option below:
Statement A: Any mobile connected to a 4G network can move while retaining an active connection.
Statement B: As NB-IoT devices rely on coverage provided by 4G, they can also move while maintaining an active connection.

- Both Statements are false.
- Statement A is true, but Statement B is false.
- Statements A and B are true. Statement B is the perfect explanation for Statement A.
- Statement B is true, but Statement A is false.
- Statements A and B are true. Statement B and Statement A are independent of each other.

3. Why is NIDD particularly suitable for NB-IoT?

- It eliminates IP overhead, optimizing for small data packets
- It uses a broadcast communication model
- It allows direct device-to-device communication
- It supports high-bandwidth applications

4. Which of the following IoT applications is best suited for NB-IoT? Choose the best one.

- High-speed asset tracking
- Real-time video streaming
- Wearable fitness trackers
- Smart metering in rural areas

5. Which of the following organizations is responsible for the development of NB-IoT standards?

- IETF
- Wi-Fi Alliance
- IEEE
- 3GPP

6. Consider the following two statements and select the appropriate option below:
Statement A: NB-IoT devices are not suitable for indoor placement due to insufficient coverage, making it challenging to support devices located inside buildings.
Statement B: NB-IoT devices rely on coverage provided by LTE and 5G-NR cellular technologies.

- Both Statements are false.
- Statements A and B are true. Statement B is the perfect explanation for Statement A.
- Statement A is true, but Statement B is false.
- Statements A and B are true. Statement B and Statement A are independent of each other.
- Statement B is true, but Statement A is false.

7. Consider the following two statements and select the appropriate option below:
Statement A: NB-IoT requires the device to connect to an operator network via licensed or unlicensed spectrum. The spectrum in which the devices are transmitting information does not matter if the eNodeB (i.e., the 4G cellular tower) is aware of the same.
Statement B: Unlike normal LTE devices, NB-IoT devices need not listen to paging regularly. In fact, it is okay even if these devices do not listen to paging for a whole day as well.

- Both Statements are false.
- Statement A is true, but Statement B is false.
- Statements A and B are true.
- Statement B is true, but Statement A is false.

8. Assume that you are a network operator, and you chose to implement TDMA as the multiple access scheme. How much bandwidth is required to support 10 users if each user requires a bandwidth equal to 400kHz. Assume that the bandwidth of the guard band on each side of the spectrum must be equal to 50kHz.

- 500kHz
- 400kHz
- 4000kHz
- 4100kHz

9. Assume that the subcarrier band size has been increased from 15kHz to 25kHz. Using this information, calculate how much would be the bandwidth of one physical resource block. Select which of the following is the answer:

- 300kHz
- 375kHz
- 500kHz
- 250kHz

10. Which network element is responsible for interfacing NIDD with IoT application servers in NB-IoT?

- EPC
- S-GW
- MME
- SCEF

11. A network manager chose to use QPSK (Quadrature Phase Shift Keying) as the modulation scheme for the NB-IoT network. Given this scenario, select how many bits can an NB-IoT transmit at any given point of time. (Select only the possible option)

- None of the above
- Two bits
- Only one bit
- All of the above
- Three bits

12. Which factors determine the bit rate of a communication system?

- The type of modulation and the size of the communication channel
- The modulation scheme and the symbol rate
- The noise level and the power of the transmitted signal
- The carrier frequency and the signal bandwidth

13. NB-IoT is introduced in which of the following standards?

- LTE – NB Advanced
- LTE – Advanced Pro
- LTE
- LTE – Advanced

14. Which of the following is NOT a mode of operations for NB-IoT?

- Out-Band
- Stand Alone
- Guard band
- In-Band

15. Which of the following codes, used in CDMA, are considered orthogonal codes?

- All of the above
- <0,0,1,1> and <1,0,1,0>
- <0,1,0,1> and <1,0,0,1>
- <0,1,0,1> and <1,0,1,0>

16. Assume NB-IoT scenario and calculate the minimum transmit power for a link budget equal to 170dB and receiver sensitivity equal to -150dBm. Enter the numerical number only in dBm.

20

17. Which of the following features of NB-IoT reduces power consumption by allowing devices to "sleep" for extended periods?

- NIDD
- PSM
- VoLTE
- eDRX

18. Why is HTTP not always suitable for IoT devices?

- It is not an IP-based protocol
- It is incompatible with IoT hardware
- It lacks support for small data transfers
- It has high overhead and power consumption

19. Assume that you are a network operator, and you are allocated a frequency spectrum of bandwidth equal to 1000kHz for carrying out cellular operation. You chose to implement FDMA as the multiple access scheme. How many users can you support if each user requires a bandwidth equal to 40kHz. Assume that the bandwidth of the guard band on each side of the spectrum must be equal to 50kHz.

- 25
- 24
- 22
- 23

20. Which of the following is a key advantage of NB-IoT over traditional cellular networks?

- Low Power Consumption
- High Reliability
- Wide Coverage Area
- High Data Rates

21. Which of the following is not a feature of NB-IoT?

- Long Battery Life
- High Receiver Sensitivity
- Extended Coverage
- Extended Idle Mode

Chapter 3 - Wifi & HaLow

1. What is the operating frequency of HaLow?

- **Sub-1 Ghz**
- **2.4 Ghz**
- **900 Hz**
- **5 Ghz**

2. Using which one of the following parameters will the modulation and coding scheme be decided?

- Wireless Communication technique
- Data Transmission Rate
- None of the options are correct
- **Signal to Noise Ratio**

3. WiFi HaLow is also known as?

- 802.11f
- 802.11ac
- 802.11ax
- **802.11ah**

4. Which if the following channel access technique is used in HaLow?

- Carrier Sense Multiple Access with Collision Anticipation
- Carrier Sense Multiple Access with Collision Prevention
- Carrier Sense Multiple Access with Collision Detection
- **Carrier Sense Multiple Access with Collision Avoidance**

5. The "Data Unit" gets larger as it goes _____ the OSI stack.

- **Down**
- **crisscross**
- **up**
- **across**

6. What is the typical range of HaLow compared to traditional Wi-Fi?

- **Longer range**
- **Unlimited range**
- **Shorter range**
- **Same range**

7. Which standard does HaLow follow for wireless communication?

- **802.11ah.**
- **802.11n**
- **802.11ac**
- **802.11b**

8. Which of the following packets help in solving the **hidden node problem** in 802.11 networks? (You can select more than one answer)

- **Request to Send Packet (RTS)**
- **Clear To Send Packet (CTS)**
- **Request to Share Packet**
- **Clear to Share Packet**
- **Acknowledgement Packets**

14. Which of the following frames use the **Null Data Packet** (NDP) MAC frame structure in 802.11ah? (You can select more than one)

- **RTS (Request to Send)**
- **CTS (Clear to Send)**
- **ACK (Acknowledgment)**
- **Beacons**
- **PS-Poll Frame**

9. Which of the following is included in the beacon to notify stations about the buffered frames?

- Traffic Notification Map
- Traffic Availability Map
- Traffic Intimation Map
- **Traffic Indication Map (TIM)**

10. All 802.11 devices are compatible with each other.

- **False**

11. Which of the frames are transmitted by the Access Point when a node is attempting to join a Basic Service Set using active scanning? (You can select more than one)

- Probe Request Frame
- Association Request Frame

- **Probe Response Frame**
- **Association Response Frame**

12. Which of the following frames are transmitted by a node when it is attempting to join a Basic Service Set using passive scanning? (You can select more than one)

- Probe Response Frame
- Association Response Frame
- Probe Request Frame
- **Association Request Frame**

13. What is the main advantages of HaLow over traditional Wi-Fi technologies

- **Lower power consumption**
- **Greater range**
- **Faster speeds**
- **Better security**

15. Which of the following power management modes are available for stations in 802.11 networks? (You can choose more than one answer)

- **Active Mode**
- **Power Save Mode**
- **Doze Mode**
- **Awake Mode**

16. Select the standards that are typically common across IEEE 802.

- **802.1 Bridging**
- **802.2 Logical Link Control**
- **802.3 Ethernet**
- **802.16 WiMAX**
- **802.17 Resilient Packet Ring**

17. How many overlapping WiFi channels are there for 2.4Ghz Band?

- **11**
- **3**
- **14**
- **12**

18. Select the true statements for WiFi

- Its frequency ranges from 5Ghz to 5.15Ghz
- The 2.4Ghz Band has a 150Mhz bandwidth
- **The 5 GHz Band has a 150 MHz bandwidth**
- **Its frequency ranges from 2.4 GHz to 2.5 GHz**

19. Which of the following are advantages of using Relays in HaLow? (select the correct answers)

- When a relay is present, the devices do not require to exchange data with the Root Access point.
- Relays require the devices to transmit at a lower data rate thereby consuming low power
- **Relays improve reliability of data transmission.**
- **Relays enable the devices to transmit at high data rate.**

20. How does HaLow address the shortage of Duration/ID field that is required for Network Allocation Vector?

- **HaLow uses a mechanism called Response Indication Deferral**
- **HaLow does not need any such mechanism as the length of the data payload is fixed.**
- **HaLow uses the Association ID for determining the length of the frame.**
- **HaLow introduced the Restricted Access Window mechanism for the same.**

21. Consider the following two statements and select the appropriate option below:
Statement A: Centralized and Distributed Authentication Control are introduced in HaLow to overcome collisions between the devices in the network.
Statement B: HaLow introduced mechanisms to limit the set of devices accessing the channel and to spread their access attempts over a long period of time.

- **Statement B is true, but Statement A is false.**
- **Statement A is true, but Statement B is false.**
- **Both Statements are false.**
- **Statements A and B are true.**

Chapter 4 - Bluetooth

1. What is a characteristic of BLE 'Advertising' mode?

- **Device discovery and connection establishment**
- **Secure data encryption.**
- **High data transfer rate.**
- **Long-range communication.**

2. Which feature distinguishes BLE from Classic Bluetooth?

- **Lower energy consumption**
- **Higher data transfer rates.**
- **Longer range.**
- **Better audio quality.**

3. Which of the following supports low energy radio operation. / What does BLE stand for?

- **Bluetooth Low Energy**
- Bluetooth Long Engagement
- Basic Link Encryption
- Bluetooth Low Efficiency

4. Which of the following supports low energy radio operation.

- BLE
- WiFi
- HaLow
- Bluetooth

5. Which frequency band does BLE operate in?

- **2.4 GHz**.
- 433 MHz
- 5.0 GHz
- 868 MHz
- 915 MHz

6. In BLE terminology, what is a 'GATT'?

- **Generic Attribute Profile**

7. BLE is particularly designed for:

- **Short-range, low-power communication.**
- **High-speed data transfer.**
- **Long-distance communication.**
- **Audio streaming.**

8. What is the maximum data rate of latest BLE?

- **2 Mbps**.
- 3 Mbps
- 4 Mbps5
- 1 Mbps

9. What is the range typically achievable with BLE technology?

- **Up to 100 meters.**
- **Up to 150 meters**
- **Up to 50 meters**
- **Up to 10 meters**

10. Which version of Bluetooth introduced BLE?

- **Bluetooth 4.0.**
- **Bluetooth 3.0**
- **Bluetooth 5.0**
- **Bluetooth 2.0**

11. Which of the following scheme is used by Bluetooth?

- **Frequency hopping TDD scheme**
- **DSSS TDD scheme**
- **DSSS FDD scheme**
- **Pyramid scheme**
- **Frequency hopping FDD scheme**
- **ABCDEFG scheme**
- **VWXYZ scheme**

12. In BLE, what is the role of a 'Central' device?

- **It connects to and controls peripheral devices**
- **It acts as an intermediary between two devices.**
- **It only receives data.**
- **It broadcasts data to peripheral devices.**

13. Which of the following Topology does Bluetooth 4.0 support? Use SS

- **Star**
- **Scatter Net**
- **Mesh**
- **Ring**

14. BLE supports which kind of communication topology? Use StaMP

- **Point-to-Point**
- **Star**
- **Mesh**
- **Bus**

15. If the hopping time, assuming FHSS, is equal to 500μs, how many times would the signal hopped in one second? (you can select more than one option)

- **2000**
- **1750**
- **1500**
- **2500**
- **2250**

16. What does 'Pairing' in BLE involve?

- **Exchanging security keys for secure communication.**
- **Broadcasting data to multiple devices.**
- **Adjusting the power level for optimal connection.**
- **Connecting two devices for data transfer.**

Short Answer Question

17. If the number of carrier frequencies is equal to 25, how many outputs bits must be generated by the PRN generator? (Assume FHSS)

- **5**

18. Bluetooth is designed for short broadcast. There are forty 2-Mhz channels. How many of these channels are reserved for advertising? (enter numerical number)

- **3**

19. If the bandwidth of the spread spectrum signal is 180MHz and the signal bandwidth is 15MHz. How many carrier frequencies are required for generating the spread spectrum signal?

- **12**

20. Assume Bob can send 300 bits in one slot while using Bluetooth. How many slots does it take to send 600 bits?

- **3**

21. Assume Bob can send 300 bits in one slot while using Bluetooth. How many slots does it take to send 1200 bits?

- **5**

Chapter 5 - Thread

1. The full form of 6LoWPAN is …

- **IPv6 over Low-Power Wireless Personal Area Networks**
- **6 Low Power Wide Personal Area Network**
- **IPv6 over Low-Power Wide Area Networks**
- **6 Low Power Wireless Personal Area Network**

2. Which type of modulation is used in IEEE 802.15.4?

- **Direct Sequence Spread Spectrum (DSSS)**
- **Frequency Shift Keying (FSK)**
- **Phase-Shift Keying (PSK)**
- **Orthogonal Frequency-Division Multiplexing (OFDM)**

3. 6LowPAN technology sits on top of …

- **IEEE 802.15.4**
- **Anything within IEEE 802**
- **IEEE 802.15.11**
- **IEEE 802.15.16**

4. 6LowPAN uses traditional IPv6 as its networking layer.

- **False**

5. Which of the following are not true about 6LowPAN?

- **6LoWPAN is based on IPv4 and IPv6 protocols for transmitting packets**
- **None of the statements are false.**
- **6LoWPAN is a networking layer protocol for Internet of Things**
- **6LoWPAN has the capability of optional mesh routing in the data link layer**

7. Which of the following is NOT true about Border Routers in a Thread Network?

- **There cannot be more than 3 border routers in a Thread Network**
- **Border Router provide services to devices within the Thread Network only.**
- **Border Router can provide connectivity from Thread Network to 802.11 networks.**
- **A REED can be configured as a Border Router in the Thread Network.**

8. If the 16-bit address assigned to a device in a 6LowPAN network is 4EA1, what is the IPv6 link local address?

- **FE80::4EA1**
- **FE80:4EA1::0**
- **FE80::1111:4EA1**
- **PAN ID is unknown**

9. If the 16-bit address assigned to a device in a 6LowPAN network is 4EA1, what is the IPv6 link local address? Assume the **PAN ID is 5678**.

- **FE80::5678:4EA1**
- **FE80::4EA1**
- **FE80:5678:4EA1::0**
- **FE80:5678::4EA1**

10. What does IEEE 802.15.4 primarily focus on?

- **Low-rate wireless personal area networks**
- **Long-range wireless communication**
- **High-bandwidth local area networking**
- **High-speed internet connectivity**

11. 6LowPAN is the same as IEEE802.15.4

- **False**

12. The size of MTU for an 802.15.4 network is equal to 127 bytes. Of which, 802.15.4 header occupies 25 bytes, security option occupies 21 bytes, IPv6 and UDP compressed headers occupy 10 bytes. Given this situation, choose which of the following application layer payloads (only the size of the payload is shown) can be transmitted over the network. Assume Thread protocol is used for the higher layers.

- **All of the above**
- **71**
- **80**
- **120**
- **127**

13. Which of the following is true about Thread Network?

- **None of the above**
- **IPV6 ULA address is used for mesh establishment and link maintenance.**
- **Every Thread device is assigned only one Mesh local address.**
- **Thread enables full mesh connectivity between all the devices in the network.**
- **A thread network can employ more 10 routers in the network.**

14. IEEE 802.15.4 is a basis for which popular IoT communication protocol?

- **ZigBee**
- **Thread**
- **LTE**
- **Bluetooth**

- **WiFi**

15. Which of the following frames are required to be transmitted using CSMA/CA?

- **Data Frames**
- **All the mentioned frames**
- **Beacons**
- **Acknowledgements**

16. What kind of network topology is supported by IEEE 802.15.4?

- **Point-to-Point**
- **Star**
- **Mesh**
- **Bus**

17. IEEE 802.15.4 defines the operation of which network layers?

- **Physical (PHY)**
- **Data Link Layer**
- **Application Layer**
- **Session Layer**
- **Transport Layer**
- **Network Layer**

18. If the EUI64 address of a device is 62::1, what would be its link local IPv6 address. Assume 6LowPAN protocol.

- **FE80:0:0:0:22::1**
- **FE80:0:0:0:66::1**
- **None of answer mentioned**
- **FE80:0:0:0:62::1**
- **FE80:0:0:0:60::1**

19. Which of the following is not a characteristic of Thread?

- **Devices can easily join the network**
- **All the options are characteristics of Thread.**
- **Thread can support large networks.**
- **The range of the network is more than enough to cover a home.**
- **There is no single point of failure.**

20. Which of the following are used by IEEE 802.15.4?

- **Direct Sequence Spread Spectrum**
- **CSMA with Collision Avoidance**
- **CSMA with Collision Detection**
- **Frequency Hopping Spread Spectrum**

21. Which of the following phases are required for a device to re-attach to a Thread Network? (You can select more than one)

- **Attaching**
- **Commissioning**
- **Configuring**
- **Discovery**

22. Consider an IEEE 802.15.4 network using Beacon-enabled CSMA/CA. Given this, choose which of the following statements are false:

- **Contention Access Period is reserved for real-time services.**
- **Contention Free Period uses slotted CSMA.**
- **A part of the beacon interval is busy as coordinator requires it to send out MAC command packets.**
- **Contention Access Period is reserved for real-time services.**
- **Devices can sleep during the inactive interval of the beacon interval.**
- **Contention Access Period uses slotted CSMA.**

23. Which of the following Full Thread Devices have routing capabilities? (You can select more than one)

- **Router**
- **Router Eligible End Device**
- **Leader**
- **PAN coordinator**
- **Intermediate Routing Device**
- **Full End Device**

Short Answer Question

23. Assume that a user wants to transmit bit 1 using Direct Sequence Spread Spectrum. The user using "XOR" to generate the same. What is the transmitted signal (in binary) if the chipping sequence is 101011010011?

- **010100101100**

24. Assume that a user wants to transmit bit 0 using Direct Sequence Spread Spectrum. The user using "XOR" to generate the same. What is the transmitted signal (in binary) if the chipping sequence is 011011000101?

- **011011000101**

25. Assume Bob is using DSSS to transmit his data to Alice. Bob decided to use the chipping sequence 101101 to transmit his bits. If the length of the packet is 100 bits, how many bit will Bob actually transmit?

- **600**

26. Assume Bob is using DSSS to transmit his data to Alice. Bob decided to use the chipping sequence 10110100110 to transmit his bits. Bob transmitted 330 bits to Alice. Using this information, calculate how many actual bits represent Bob's data?

- **30**

Chapter 6 - ZigBee and Zwave

1. What is the purpose of Zigbee communication?

- **All of the above**
- **Industrial Control**
- **Healthcare**
- **Home Automation**

2. Zigbee have a transport layer.

- **False**

3. Which of the following is not a feature of Zigbee? (choose the best one)

- **Large bandwidth**
- **Low Power Consumption**
- **High Security**
- **Real-time Communication**

4. Which frequency does Z-Wave operate on?

- **868 mHz**
- **5 Ghz**
- **2.4 Ghz**
- **915 Mhz**

5. Which if the following do not contribute in routing in a ZigBee network?

- **zigBee end device**
- **ZigBee Router**
- **ZigBee Coordinator**
- **ZigBee Master**

6. Which network topology is not supported by ZigBee?

- **Bus**
- **Mesh**
- **Cluster Tree**
- **Star**

7. Z-Wave is an implementation of a ZigBee protocol.

- **False**

8. What is the role of Zigbee coordinator in the Zigbee network?

- **Both**
- **None**
- **Controls the network**
- **Communicates with other nodes**

9. What is the role of Zigbee routers in the Zigbee network?

- **Act as a relay between other nodes**
- **Controls the network**
- **Both**
- **None**

10. What is the role of Zigbee end devices in the Zigbee network?

- **Communicates with other nodes**
- **Controls the network**
- **Both**
- **None**

11. Which of the following is needed to be a "ZigBee Compliant Product”

- **Application Profile**
- **IEEE 802.15.4**
- **ZigBee Stack**
- **IEEE 802.11**

Chapter 8 - LoRa

1. LoRaWAN's network server is responsible for:

- **Processing and forwarding data to application servers**
- **Managing the radio frequency spectrum**
- **Directly interacting with end-user applications**
- **Controlling the power output of end devices**

2. What is the main function of the Device EUI in LoRaWAN?

- **To identify the device uniquely on the network**
- **To define the device's operating frequency**
- **To specify the data rate**
- **To encrypt data**

3. What type of modulation is used in LoRa?

- **Chirp Spread Spectrum (CSS)**
- **Amplitude Modulation (AM)**
- **Phase-Shift Keying (PSK)**
- **Frequency Shift Keying (FSK)**

4. What does LoRa stand for?

- **Long range**
- **Long Radio**
- **Low Range**
- **Long Resonance**

5. Link Budget …

- **refers to the amount of loss that a data link (transmitter to receiver) can tolerate in order to operate properly.**
- **refers to a connection between two entities.**
- **refers to the amount of loss that a data link (transmitter to receiver) should have.**
- **refers to the difference between the minimum expected power received at the receiver's end, and the receiver's sensitivity.**

6. LoRa's spreading factor affects which of the following?

- **Data rate and range**
- **Power consumption only**
- **Modulation technique**
- **Operating frequency**

7. What does LoRaWAN stand for?

- **Long range Wide Area Network**
- **Low Radiation Wireless Access Network**
- **Low Range Wide Area Network**
- **Logical Routing WAN**

8. In LoRa, which class does the following end device fall under:

Battery powered actuators. Energy efficient with latency controlled downlink. Slotted communication synchronized with a beacon.

- **B**
- **D**
- **C**
- **A**

9. In LoRa, what does increasing the spreading factor (SF) do to the signal's range and data rate?

- **Increases range and decreases data rate**
- **Decreases both range and data rate**
- **Increases range and data rate**
- **Decreases range and increases data rate**

10. LoRa modulation a variation of ....

- **Chirp Spread Spectrum**
- **Chirp Spectrum Sector**
- **Chord Space Spectrum**
- **Chord Spread Spectrum**

11. Which Sub-GHz ISM frequency does LoRa operate in Singapore?

- **923 Mhz**
- **466 Mhz**
- **868 Mhz**
- **2.4 Ghz**

12. Which class of LoRaWAN is designed for **bidirectional end-devices** with scheduled receive slots?

- **Class B**
- **Class C**
- **Class D**
- **Class A**

13. Which Class of LoRaWAN is best suited for applications **requiring minimal latency**?

- **Class C**
- **Class B**
- **Class D**
- **Class A**

14. What is the main drawback of using LoRa for IoT applications?

- **Limited data rate**
- **High power consumption**
- **Long range**
- **Short range**

15. What is the main advantages of using LoRa for IoT applications?

- **Low power consumption**
- **Long range**
- **Low data rate**
- **High data rate**

16. **LoRaWAN** modulation technique sits at which OSI layer?

- **DATALINK**
- **PHYSICAL**
- **Application**
- **Session**
- **Transport**
- **Network**
- **Presentation**

17. LoRa is primarily used for?

- **Long-range, low-power communication**
- **High-speed data transmission**
- **Audio and video transmission**
- **Short-range communication**

18.**LoRa** modulation technique sits at which OSI layer?

- **PHYSICAL**
- **Application**
- **Datalink**
- **Session**
- **Transport**
- **Network**
- **Presentation**

Chapter 9 - Wireless Mesh

1. What is a disadvantage of simple flooding in mesh networks?

- **It generates a large number of redundant messages (CORRECT)**
- Lack of data security
- It is too simple to implement
- It generates a large number of redundant messages
- Maximum use of battery power

2. In a distributed mesh network, how are routes between nodes established?

- **Nodes communicate to determine adjacency and routes (CORRECT)**
- Through a central authority
- All communication goes through a master node
- Using a single, static route

3. What does Adaptive Flooding adjust based on?

- **Network conditions and resource availability (CORRECT)**
- The time of day
- Static configurations
- Number of connected nodes

5. Which of the following is not a PROACTIVE mesh routing algorithm? Use DyAT

- Wireless Routing Protocol
- Better Approach To Mobile Adhoc Networking
- Optimized Link State Routing
- Destination-Sequenced Distance Vector
- **Dynamic Source Routing (CORRECT)**
- **Ad hoc On-Demand Distance Vector (CORRECT)**
- **Temporally-Ordered Routing Algorithm (CORRECT)**

6. Which of the following is not a REACTIVE mesh routing algorithm? Use DeWOB

- Ad hoc On-Demand Distance Vector (AODV) is a reactive protocol, not proactive
- Dynamic Source Routing (DSR) is a reactive protocol, not proactive
- Temporally-Ordered Routing Algorithm (TORA) is generally classified as a reactive protocol
- **Destination-Sequenced Distance Vector (CORRECT)**
- **Better Approach To Mobile Adhoc Networking (CORRECT)**
- **Optimized Link State Routing (CORRECT)**
- **Wireless Routing Protocol (CORRECT)**

7. Which characteristic is not a feature of wireless mesh networking?

- **Centralized architecture (CORRECT)**
- Scalability
- Self-healing
- Efficient data routing

8. Optimized Link State Routing Protocol uses triggered updates of their routing table whenever there is a topology change.

- **False (CORRECT)**

9. The Optimized Link State Routing (OLSR) protocol uses _____ to optimize transmission.

- Single point relays
- Dual point relays
- No relays
- **Multipoint relays (CORRECT)**

10. Which is not a challenge mentioned for wireless mesh networks?

- **Unlimited bandwidth (CORRECT)**
- Inteference and Reliability
- Timing and Sybnchronisation
- Bandwidth allocation

11. What is a typical method to prevent malicious nodes from joining a wireless mesh network?

- **Authentication (CORRECT)**
- Redundancy
- Decreasing signal strength
- Ignoring new nodes

12. Dynamic Source Routing have multiple routes per destination

- **True (CORRECT)**

13. Which flooding algorithm divides the network into subnets for routing?

- **Reduced Flooding (CORRECT)**
- Selective Flooding
- Adaptive Flooding
- Simple Flooding

14. In the context of mesh networks, what does the term 'self-healing' refer to?

- The process of adding new nodes to the network
- Healing of hardware issues without human intervention
- **The network's ability to automatically reroute data if a node fails (CORRECT)**
- The ability to manually repair physical damage

15. What is the primary feature of a wireless mesh network?

- Single-hop communication
- Centralized architecture
- Limited to indoor use only
- **Decentralized architecture (CORRECT)**

Chapter 10 - HTTP & REST

1. What is the primary role of a RESTful API's Uniform Interface constraint?

- **To standardize the way clients interact with the server**
- **To define specific operations like GET and POST**
- **To ensure that the API is stateful**
- **To separate client and server implementations**

2. What mechanism does RESTful APIs use to indicate the current state of the resource?

- **HTTP status codes**
- **HTTP headers**
- **API tokens**
- **Response body**

3. In RESTful APIs, what is used to uniquely identify a resource?

- **URI (Uniform Resource Identifier)**
- **Query parameters**
- **API key**
- **Session ID**

4. Which of the following is NOT a constraint of RESTful architecture?

- **Cookie-based authentication**
- **Statelessness**
- **Cacheability**
- **Client-server architecture**

5. In RESTful APIs, what is the purpose of a payload in a POST request?

- **To contain the data being sent by the client**
- **To provide additional headers**
- **To carry control information**
- **To deliver the client's request to the server**

6. What does idempotence mean in the context of RESTful APIs?

- **The API produces the same result no matter how many times the same request is made**
- **The API produces different results with each request**
- **The API encrypts data for security**

- **The API can handle asynchronous requests**

7. Which of the following HTTP methods is used to retrieve a resource in RESTful architecture?

- **GET**
- **PUT**
- **DELETE**
- **POST**

8. Which HTTP method should be used to update an existing resource in RESTful web services?

- **PUT**
- **GET**
- **DELETE**
- **POST**

9. What is a resource in the context of RESTful web services?

- **An entity that can be accessed and manipulated through a URI**
- **A container for storing data in a web application**
- **A set of procedures for accessing a database**
- **A function that performs a specific action**

10. In RESTful APIs, what does a status code in the 5xx range signify?

- **Server error**
- **Redirection**
- **Successful operation**
- **Client error**

11. What is the HTTP method used to create a new resource in RESTful architecture?

- **POST**
- **GET**
- **PUT**
- **DELETE**

12. What does REST stand for?

- **Representational State Transfer**
- **Real-time State Transfer**
- **Relative State Transmission**
- **Remote Server Transaction**

13. Which HTTP status code indicates a successful GET request in a RESTful API?

- **200 OK**
- **201 Created**
- **400 Bad Request**
- **500 Internal Server Error**

14. What type of architecture does RESTful APIs follow?

- **Client-server architecture**
- **Microservices architecture**
- **Peer-to-peer architecture**
- **Monolithic architecture**
- **Publisher-Subscriber architecture**

Chapter 11 - CoAP & MQTT (DONE! ALL CORRECT)

1. MQTT is _____ oriented.

- **Message**
- **Network**
- **Device**
- **Data**

2. CoAP supports which of the following methods similar to HTTP?

- **GET, POST, PUT, DELETE**
- **None of them**
- **OPTIONS, HEAD**
- **CONNECT, TRACE, PATCH**

3. What is the maximum number of clients that can subscribe to a single topic in MQTT?

- **Unlimited**
- **100**
- **1**
- **10**

4. What transport layer protocol does CoAP use?

- **UDP**
- **ICMP**
- **TCP**
- **REST**

5. What type of protocol is MQTT?

- **Application protocol**
- **Presentation protocol**
- **Transport protocol**
- **Network protocol**

6. CoAP is specialized in?

- **Internet Application (CORRECT)**
- **Wireless applications**
- **Device applications**
- **Wired applications**

7. CoAP is a specialised _____ protocol.

- **Application**
- **Resource**
- **Web transfer**
- **Power**

8. **Select the TRUE statement(s) for CoAP protocol:**

- **Uses PUT message requests to create subscription**
- **Uses GET message requests to retrieve subscription**
- **Uses FETCH message requests to retrieve subscription.**
- **Uses PUSH message requests to create subscription.**

9. **CoAP is designed for which kind of networks?**

- **Resource-constrained networks**
- **Local Area Networks (LAN)**
- **Datacenter Networks**
- **Wide Area Networks (WAN)**

10. Which protocol is CoAP closely modeled after?

- **HTTP**
- **FTP**
- **AMQP**
- **MQTT**

11. MQTT uses the publish/subscribe model. How does the publisher know who is subscribing?

- **The publisher doesn't know**
- **The subscriber informs the publisher**
- **The publisher gets notified when they subscribe.**
- **Publisher uses the "Eye of Sauron"**

12. The Last Will Message is used to:

- **Notify clients of a failure in the publisher**
- **Guarantee that the message was delivered**
- **Gain inheritance**
- **Notify a publisher of a network failure**

13. Which of the following is not a characteristic of MQTT?

- **Request/response messaging model**
- **Publish/subscribe messaging model**
- **Quality of Service (QoS)**
- **Low overhead**

14. CoAP provides which of the following requirements?

- **Multicast support, lower overhead and simplicity**
- **Multicast support and simplicity**
- **Lower overhead and multicast support**
- **Simplicity and low overhead**

15. Which of the following is not a client type in MQTT?

- **Producer**
- **Publisher**
- **Subscriber**
- **Broker**

16. MQTT transmits data to and from a broker in which format. (Choose the best option)

- **Binary data**
- **JSON**
- **XML**
- **Text based data**

17. Which layer is CoAP?

- **Application layer**
- **Transport layer**
- **Service layer**
- **Control layer**

18. To receive a retained message?

- **You must subscribe to a topic that has been published with the retained message set.**
- **You must keep the message.**
- **You must subscribe with the retained message set.**
- **You must subscribe with a QOS of 1 or 2**

19. What does CoAP stand for?

- **Constrained Application Protocol**
- **Control Application Protocol**
- **Common Application Protocol**
- **Compact Application Protocol**

20. Which of the following QoS levels in MQTT ensures message delivery at least once?

- **QoS 1**
- **QoS 2**
- **QoS 0**
- **None of them.**

21. What is a topic in MQTT?

- **A string used to filter messages in a publish/subscribe model**
- **A unique identifier for a message**
- **A client identifier**
- **A message payload**

22. The core of the protocol is specified in _____?

- **RFC 7252**
- **RFC 7254**
- **RFC 7524**
- **RFC 7452**

23. What does MQTT stand for?

- **Message Queuing Telemetry Transport**
- **Message Queuing Transaction Transport**
- **Message Querying Telecommunication Transmission**
- **Message Quorum Transport Technology**

24. CoAP messages can be of which types?

- **Confirmable and Non-Confirmable**
- **Synchronous and Asynchronous**
- **Persistent and Transient**
- **Request and Response**

25. CoAP Protocol is comprised of which sub-layers?

- **Observation**
- **Message**
- **Request & Response**
- **UDP**

26. What is the default port number for MQTT?

- **1833 (CORRECT) Note: by right should be 1883 but might be typo please look out**
- **80**
- **8080**
- **8883**

Chapter 12 - aIoT & Cloud

1. IIoT stands for Industrial IoT.

- **True**

2. Which of the following is NOT an advantage of Edge Computing?

- **Significantly reduced data storage requirements**
- **Faster response time**
- **Reduces Network Bandwidth Requirements**
- **Low investment cost (CORRECT)**

3. Base on the lecture, which of the following is NOT an advantage of Cloud Computing?

- **Resilient**
- **Integration (CORRECT)**
- **Management**
- **Virtualisation**

4. Match the Edge computing platforms to how they perform inferencing on the device.

- **CPU-centric → Raspberry Pi**
- **GPU-centric → NVIDIA Jetson**

5. Based on the lecture, which of the following is not a typical deployment challenge for Edge computing devices.

- **Sound proofing (CORRECT)**
- **Waterproofing**
- **Power**
- **Thermal**
  (Thermal, waterproofing, and power are real-world challenges for edge device deployment.)

6. What is IaaS?

- **Infrastructure as a Service (CORRECT)**
- **Interaction as a Service**
- **Intelligence as a Service**
- **Internet as a Service**

7. Which of the following is a good example of an AIoT application?

- **A smart home thermostat that learns your preferences over time (CORRECT)**
- **A wearable device that tracks your steps and calories burned**

- **A wireless security camera that sends alerts to your smartphone**
- **A fitness tracker that monitors your heart rate and sleep patterns**

8. Which of the following is not a benefit of AIoT? (pick the best answer)

- **Decreased complexity (CORRECT)**
- **Improved energy efficient**
- **Enhanced Security**
- **Increased productivity**

9. What is Cloud Computing?

- **It is a way to access software and services over the internet. (CORRECT)**
- **It is a way to store data on your local computer.**
- **It is a way to physically connect multiple computers together.**
- **It is a way to protect data from unauthorized access.**

10. Which if the following statement is FALSE?

- **Type 2 Hypervisor are also known as Bare metal hypervisor. (CORRECT)**
- **Type 1 Hypervisor are also known as Bare metal hypervisor.**
- **Type 2 Hypervisor use host OS.**
- **Type 1 Hypervisor do not use host OS.**

11. Which of the following is not a potential use case for AIoT in industrial automation?

- **Employee time tracking (CORRECT)**
- **Quality control**
- **Inventory management**
- **Predictive maintenance**

12. Which of the following is a limitation of AIoT?

- **It is limited by the processing power of IoT devices (CORRECT)**
- **It can be expensive to implement**
- **It is only suitable for large-scale applications**
- **It requires a high degree of technical expertise to implement**

13. Which if the following is TRUE about Fog Computing?

- **Cloud is a centralized system, while the fog is a distributed decentralized infrastructure (CORRECT)**
- **Fog provides low latency (CORRECT)**
- **Fog computing are located nearer to the Cloud computing**
- **Fog computing is a separate architecture that can replace cloud computing.**

14. Match the following services to the components that are NOT managed by the Cloud operator (e.g. Microsoft)? (CORRECT ANSWER)

- **On Premises → 1. Networking, Storage, Servers, Virtualization, OS, Middleware, Runtime, Data and Applications**
- **IaaS → 2. OS, Middleware, Runtime, Data and Applications**
- **PaaS → 3. Data and Applications**
- **SaaS → 4. Nil**

15. Which of the following is a benefit of cloud computing?

- **Correct Answer: Lower maintenance costs**
- **Higher upfront costs**
- **Limited data accessibility**
- **Limited scalability**

16. AIoT stands for?

- **Artificial Intelligence on IoT**
- **Artificial Internet of Things**
- **Advanced IoT**
- **Artificial Intelligence of Things**

17. Which if the following is NOT a Cloud Service Model?

- **Platform as a Service**
- **Infrastructure as a Service**
- **Virtualization as a Service (CORRECT**
- **Software as a Service**

18. What is the name of the cloud service model that provides access to software applications over the internet?

- **Software as a Service(SaaS) (CORRECT)**
- **Function as a Service (FaaS)**
- **Infrastructure as a Service (IaaS)**
- **Platform as a Service (PaaS)**

19. What is the purpose of AIoT?

- **To replace IoT devices with AI-powered devices**
- **To improve the design of IoT devices**
- **To create a secure network for IoT devices**
- **To integrate artificial intelligence with the internet of things**