**CSC017 Fall 2024 Final Exam Sample Questions**

**Student Name： ID：**

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| **Total Points** |  |

Each multiple choice question has exactly one correct choice as answer. If there are multile choices that are correct, please select the choice “All of the above”. If there are no choice that is correct, please select the choice “None of the above”.

Lec 5.0

1. Which of the following statements about the Dijkstra’s algorithm is true?

 - A. It cannot handle graphs with negative weights.

 - B. It uses a stack data structure for edge relaxation.

 - C. It can detect negative weight cycles in graphs.

 - D. It is slower than the Bellman-Ford algorithm for all graph types.

 Answer: A

2. Which of the following statements about the Bellman-Ford algorithm is true?

 - A. It cannot handle graphs with negative weights.

 - B. It uses a priority queue for edge relaxation.

 - C. It can detect negative weight cycles in graphs.

 - D. It is faster than Dijkstra's algorithm for all graph types.

 Answer: C

3. In a graph with positive edge weights, how do the shortest paths produced by Dijkstra's and Bellman-Ford algorithms compare?

 - A. They always produce different paths and path weights.

 - B. They may produce different paths but the path weights are always the same.

 - C. They always produce identical paths and path weights.

 - D. Bellman-Ford produces shorter paths than Dijkstra's algorithm in such graphs.

 Answer: B

4. What is the main difference between Dijkstra's algorithm and Bellman-Ford algorithm?

 - A. Dijkstra's algorithm can handle negative edge weights, while Bellman-Ford cannot.

 - B. Bellman-Ford uses a priority queue, while Dijkstra does not.

 - C. Bellman-Ford can detect negative weight cycles, while Dijkstra cannot handle negative weights at all.

 - D. Both algorithms are identical in functionality and efficiency for all graph types.

 Answer: C

5. Which of the following is NOT a step in Dijkstra’s algorithm?

 - A. Initialize distances from the source vertex to all vertices as infinity, except for the source itself which is set to 0.

 - B. Relax all edges V-1 times to compute shortest paths from the source vertex to all others.

 - C. Use a priority queue to select the unvisited vertex with the smallest tentative distance for processing next.

 - D. Update distances and previous nodes for neighbors of the currently processed vertex if a shorter path is found through it.

 Answer: B

6. What is the purpose of edge relaxation in shortest-path algorithms?

 - A. To remove cycles from the graph before computing shortest paths.

 - B. To update tentative distances to vertices if a shorter path through an edge is found.

 - C. To ensure that all edges are processed exactly once.

 - D. To reduce computational complexity by skipping unnecessary edges.

 Answer: B

7. What happens if there is a negative weight cycle reachable from the source vertex in a graph where Bellman-Ford is applied?

 - A. The algorithm will fail to compute any shortest paths.

 - B. The algorithm will terminate early without detecting any issues.

 - C. The algorithm will detect it during an additional relaxation step after $$V-1$$ iterations.

 - D. The algorithm will compute incorrect shortest paths due to infinite reductions in path costs.

 Answer: C

Lec 5.1 5.2

1. What are the two main functions of the network layer?

 - A) Forwarding and Switching

 - B) Forwarding and Routing

 - C) Routing and Addressing

 - D) Switching and Addressing

 Answer: B

2. Which of the following is a characteristic of the per-router control plane?

 - A) Centralized control

 - B) Each router computes its own routing tables independently

 - C) Uses SDN controllers for routing decisions

 - D) Requires a global view of the network topology

 Answer: B

3. What is the primary goal of a routing protocol?

 - A) To minimize bandwidth usage

 - B) To determine "good" paths through a network

 - C) To maximize router processing speed

 - D) To eliminate congestion in all routers

 Answer: B

4. Which algorithm is used in Link-State Routing?

 - A) Bellman-Ford Algorithm

 - B) Dijkstra's Algorithm

 - C) Distance Vector Algorithm

 - D) Spanning Tree Algorithm

 Answer: B

5. What is the key idea behind Distance Vector Routing?

 - A) Each router broadcasts its entire routing table to all nodes in the network.

 - B) Each router shares its distance vector with its neighbors only.

 - C) Each router maintains a global view of the network topology.

 - D) Each router computes paths using centralized control.

 Answer: B

6. In Software-Defined Networking (SDN), what is the role of the controller?

 - A) To compute and install forwarding tables in routers remotely.

 - B) To independently compute routes for each router.

 - C) To broadcast link-state information to all routers.

 - D) To manage distance vector tables for all routers.

 Answer: A

7. What does OSPF stand for in intra-ISP routing?

 - A) Open Shortest Path Forwarding

 - B) Open Shortest Path First

 - C) Optimal Shortest Path First

 - D) Operational Shortest Path Forwarding

 Answer: B

8. Which protocol is primarily used for routing among ISPs?

 - A) OSPF

 - B) RIP

 - C) BGP

 - D) ICMP

 Answer: C

9. What is a key difference between Link-State and Distance Vector algorithms?

 - A) Link-State uses local information, while Distance Vector uses global information.

 - B) Link-State broadcasts link costs to all routers, while Distance Vector exchanges information with neighbors only.

 - C) Distance Vector has higher message complexity than Link-State.

 - D) Link-State relies on Bellman-Ford, while Distance Vector uses Dijkstra's algorithm.

 Answer: B

10. What does ICMP stand for?

 - A) Internet Control Message Protocol

 - B) Internet Configuration Management Protocol

 - C) Internet Communication Management Protocol

 - D) Integrated Control Management Protocol

 Answer: A

11. Which issue can arise when link costs depend on traffic volume in Dijkstra’s algorithm?

 - A) Infinite loops in routing decisions

 - B) Route oscillations

 - C) Increased message complexity

 - D) Incorrect shortest-path calculations

 Answer: B

12. What is the purpose of Poisoned Reverse in Distance Vector Routing?

- A: To prevent circular dependencies by setting certain distances to infinity.

- B: To prevent circular dependencies by setting certain distances to zero.

 - C: Notify neighbors only when DV changes .

 Answer: A

Lec 6.1 6.2

1. What is the primary responsibility of the link layer in a network?

- A. Transferring datagrams between adjacent nodes over a link

- B. Managing end-to-end reliability protocols

- C. Routing packets across multiple networks

- D. Encrypting data for secure transmission

Answer: A

2. Which of the following statements about error detection is true?

- A. Error detection methods can detect all types of errors with 100% reliability.

- B. Larger error detection and correction (EDC) fields improve error detection reliability.

- C. Parity checking can detect both odd and even numbers of bit errors equally well.

- D. Error correction always requires retransmission of data.

Answer: B

3. In even parity checking, how is the parity bit set for a data block with an odd number of 1s?

- A. Set to 0

- B. Set to 1

- C. Set to match the first bit of the data block

- D. Not used in even parity checking

Answer: B

4. What is a key advantage of two-dimensional parity checking over single parity checking?

- A. It can detect and correct single-bit errors without retransmission.

- B. It eliminates all types of errors, including burst errors.

- C. It requires fewer parity bits than single parity checking.

- D. It can detect but not correct errors in data transmission.

Answer: A

5. Why is link-level error detection used in addition to end-to-end reliability protocols like TCP?

- A. To replace end-to-end reliability protocols entirely

- B. To reduce the burden on higher-level protocols by detecting errors earlier

- C. To ensure encryption of transmitted data

- D. To manage flow control between nodes

Answer: B

6. What is the purpose of the generator G in Cyclic Redundancy Check (CRC)?

- A. To generate random noise for testing error detection systems

- B. To define the bit pattern used for computing CRC bits R

- C. To determine the size of the transmitted data block

- D. To ensure that all transmitted data is encrypted

Answer: B

7. Which type of link-layer transmission allows nodes at both ends to transmit simultaneously?

- A. Half-duplex

- B. Full-duplex

- C. Simplex

- D. Asynchronous

Answer: B

8. In Internet checksum calculation, what happens if there is an overflow during addition?

- A. The checksum calculation fails, and an error is detected immediately.

- B. The overflow bits are discarded entirely.

- C. The overflow bits are added back into the low-order bits.

- D. The checksum value is set to zero.

Answer: C

9. What type of errors can a Cyclic Redundancy Check (CRC) detect effectively?

- A. All types of errors, including transpositions and burst errors longer than $$ r+1 $$ bits

- B. All burst errors less than r+1 bits long

- C. Only single-bit errors in a transmission block

- D. Errors caused by encryption mismatches

Answer: B

10. Which component implements the link layer in a host system?

- A. Central Processing Unit (CPU) only

- B. Network Interface Card (NIC) or on-chip hardware/firmware/software combination

- C. Application Layer Software Modules

- D. Transport Layer Protocols like TCP or UDP

Answer: B

Lec 6.3

1. What are the two main types of links in multiple access protocols?

a) Point-to-point and broadcast

b) Wired and wireless

c) Ethernet and Wi-Fi

d) Token-based and polling

Answer: a) Point-to-point and broadcast

2. Which of the following is NOT a characteristic of an ideal multiple access protocol?

a) Fully decentralized

b) Synchronization of clocks

c) Simple design

d) Ability to send at rate $$ R $$ when one node transmits

Answer: b) Synchronization of clocks

3. In TDMA (Time Division Multiple Access), what happens to unused slots?

a) They are reallocated dynamically

b) They remain idle

c) They are used by other nodes

d) They are merged with the next slot

Answer: b) They remain idle

4. What is the key difference between FDMA (Frequency Division Multiple Access) and TDMA?

a) FDMA divides the channel into frequency bands, while TDMA divides it into time slots

b) FDMA is used only in wireless networks, while TDMA is for wired networks

c) FDMA allows dynamic allocation, while TDMA does not

d) FDMA is more efficient than TDMA

Answer: a) FDMA divides the channel into frequency bands, while TDMA divides it into time slots

5. What does CSMA stand for?

a) Carrier Sense Multiple Access

b) Channel Sharing Multiple Access

c) Collision Sense Media Access

d) Centralized Synchronization Media Access

Answer: a) Carrier Sense Multiple Access

6. In Slotted ALOHA, what happens if two nodes transmit in the same time slot?

a) Both transmissions succeed

b) One transmission succeeds, and the other fails

c) A collision occurs, and both transmissions fail

d) The transmission is delayed until the next slot

Answer: c) A collision occurs, and both transmissions fail

8. How does CSMA/CD handle collisions?

a) It retransmits immediately after detecting a collision

b) It aborts transmission and retries after a backoff period

c) It ignores collisions and continues transmitting data

d) It switches to polling to avoid further collisions

Answer: b) It aborts transmission and retries after a backoff period

9. Which protocol uses a "token" to control access to the channel?

a) CSMA/CA

b) Token Passing Protocols

c) Slotted ALOHA

d) Polling Protocols

Answer: b) Token Passing Protocols

10. What is one major disadvantage of polling protocols?

a) High collision overhead at low loads

b) Single point of failure at the centralized controller

c) Requires clock synchronization among nodes

d) Inefficient use of bandwidth at high loads

Answer: b) Single point of failure at the centralized controller

11. Which MAC protocol is used in Ethernet networks?

a) CSMA/CA

b) CSMA/CD

c) Slotted ALOHA

d) Token Ring

Answer: b) CSMA/CD

12. What is one advantage of random access protocols over channel partitioning protocols?

a) Efficient under low loads when only one node transmits frequently

b) No collisions occur during transmission

c) Bandwidth is divided equally among all nodes

d) Centralized control ensures fairness

Answer: a) Efficient under low loads when only one node transmits frequently

13. Which MAC protocol involves dividing the channel into smaller "pieces" like time slots or frequency bands?

a) Random Access Protocols

b) Channel Partitioning Protocols

c) Token Passing Protocols

d) Polling Protocols

Answer: b) Channel Partitioning Protocols

14. What does "taking turns" in MAC protocols refer to?

a) Nodes transmit data simultaneously but recover from collisions later

b) Nodes transmit data sequentially based on either polling or token passing mechanisms

c) Nodes divide the channel into time slots for exclusive use

d) Nodes coordinate transmissions using out-of-band channels

Answer: b) Nodes transmit data sequentially based on either polling or token passing mechanisms

Lec 7.1

1. What is the primary difference between wireless and mobility challenges in networking?

 - A) Wireless deals with communication over a wired link, while mobility focuses on fixed users.

 - B) Wireless deals with communication over a wireless link, while mobility focuses on handling mobile users changing their point of attachment to the network.

 - C) Wireless focuses on higher-layer protocols, while mobility focuses on physical layer protocols.

 - D) Wireless and mobility are the same challenges.

 - Answer: B

2. Which wireless network mode does not use a base station?

 - A) Infrastructure mode

 - B) Ad hoc mode

 - C) Cellular mode

 - D) Mesh mode

 - Answer: B

3. What does the term "free space path loss" in wireless communication depend on?

 - A) Frequency and distance

 - B) Signal-to-noise ratio (SNR)

 - C) Coherence time

 - D) Number of users

 - Answer: A

4. What is the hidden terminal problem in wireless networks?

 - A) Nodes can only transmit to other nodes within link coverage.

 - B) Two nodes cannot hear each other but interfere at a common receiver.

 - C) Base stations are hidden from mobile users.

 - D) Nodes fail to organize into a network.

 - Answer: B

5. Which characteristic of wireless networks allows multiple users to coexist using orthogonal codes?

 - A) Time Division Multiple Access (TDMA)

 - B) Frequency Division Multiple Access (FDMA)

 - C) Code Division Multiple Access (CDMA)

 - D) Spatial Division Multiple Access (SDMA)

 - Answer: C

6. What is the spreading factor in Direct-Sequence Spread Spectrum (DSSS)?

 - A) The ratio of frequency to distance

 - B) The ratio of code length to data bit length

 - C) The ratio of signal power to noise power

 - D) The ratio of data bits transmitted to total bits received

 - Answer: B

7. What happens when the Signal-to-Noise Ratio (SNR) increases in a wireless network?

 - A) Bit Error Rate (BER) increases

 - B) BER decreases

 - C) Coherence time decreases

 - D) Path loss increases

 - Answer: B

8. In CDMA, what ensures minimal interference between users?

 - A) Users sharing the same frequency without codes

 - B) Orthogonal chipping sequences assigned to each user

 - C) Higher signal power for all users

 - D) Time synchronization among users

 - Answer: B

9. Which type of wireless network requires relaying through several nodes to connect to the Internet?

 - A) Single-hop infrastructure network

 - B) Multi-hop infrastructure network (Mesh network)

 - C) Single-hop ad hoc network

 - D) Multi-hop ad hoc network (MANET, VANET)

 - Answer: B

10. What is the primary cause of multipath propagation in wireless networks?

 - A) Signal attenuation due to obstacles

 - B) Reflection of radio signals off objects and the environment

 - C) Interference from other devices on the same frequency band

 - D) Lack of base stations in ad hoc networks

- Answer: B

Lec 8.1

1. What is the primary purpose of the Diffie-Hellman key exchange?

   - A) Encrypting messages

   - B) Exchanging public keys to establish a shared secret

   - C) Generating digital signatures

   - D) Authenticating users

   Answer: B

2. Which of the following is NOT required for the Diffie-Hellman key exchange?

   - A) A large prime number p

   - B) A primitive root g

   - C) Private random values a and b

   - D) A symmetric encryption algorithm

   Answer: D

3. What is the role of the shared secret in Diffie-Hellman key exchange?

   - A) It is used as a private key.

   - B) It serves as a symmetric key for encryption.

   - C) It replaces public keys in communication.

   - D) It is transmitted over the network.

   Answer: B

Lec 8.1

1. What are the three components of the CIA triad in cybersecurity?

- A) Confidentiality, Availability, Authentication

- B) Confidentiality, Integrity, Availability

- C) Confidentiality, Integrity, Authorization

- D) Confidentiality, Encryption, Access

Answer: B) Confidentiality, Integrity, Availability

2. Which type of attack involves an attacker intercepting and retransmitting a message to produce unauthorized effects?

- A) Masquerade

- B) Replay

- C) Denial of Service

- D) Traffic Analysis

Answer: B) Replay

3. In symmetric encryption, what is required for both the sender and receiver to communicate securely?

- A) Public key

- B) Private key

- C) Shared secret key

- D) Initialization vector

Answer: C) Shared secret key

4. What is the main advantage of Cipher Block Chaining (CBC) over Electronic Codebook (ECB)?

- A) Faster encryption speed

- B) Each plaintext block is encoded differently each time

- C) Requires no initialization vector (IV)

- D) Uses asymmetric encryption instead of symmetric

Answer: B) Each plaintext block is encoded differently each time

5. Which encryption algorithm is considered secure today and uses block lengths of 128 bits with key lengths of 128, 192, or 256 bits?

- A) DES (Data Encryption Standard)

- B) Triple DES (3DES)

- C) AES (Advanced Encryption Standard)

- D) RSA

Answer: C) AES (Advanced Encryption Standard)

6. What is the purpose of Diffie-Hellman in cryptography?

- A) Encrypt messages using public and private keys

- B) Generate a shared secret key between two parties

- C) Perform brute-force attacks on encrypted data

- D) Replace symmetric encryption algorithms

Answer: B) Generate a shared secret key between two parties

7. What is a key feature of public-key cryptography?

- A) Both keys are kept private by the user.

- B) The same key is used for both encryption and decryption.

- C) It uses one public key and one private key.

- D) It requires a shared secret between sender and receiver.

Answer: C) It uses one public key and one private key.

8. In an XOR operation used in stream ciphers, what is the result of $$1 \oplus 1$$?

- A) 0

- B) 1

- C) Undefined

- D) Same as input

Answer: A) 0

9. What is the primary vulnerability of using a monoalphabetic substitution cipher?

- A) Requires too much computational power to encrypt.

- B) Easy to break using frequency analysis.

- C) Cannot be used with symmetric keys.

- D) Generates too many ciphertext blocks.

Answer: B) Easy to break using frequency analysis.

10. Which type of random number generator relies on measuring unpredictable natural processes?

- A) Pseudorandom Number Generator (PRNGs)

- B) True Random Number Generator (TRNGs)

- C) Deterministic Random Generator (DRG)

- D) Modular Arithmetic Generator

Answer: B) True Random Number Generator (TRNGs)