

第一大題：單選題 (20%)

說明：本大題共包含十小題，每小題二分。每小題請依題意選擇 ABCDE 其中一個選項，答案請依題號於「答案卡」上作答。答案空白者不計分，答錯不倒扣。

1. In IEEE 802.11, the process for a wireless station to get an IP address and gain Internet access is called
(A) scan (B) authentication (C) beacon (D) association (E) probe
2. How many of the following technologies are related to the security mechanisms in IEEE 802.11? (i) WEP (ii) WPA (iii) TLS (iv) SSL (v) PGP
(A) 0 (B) 1 (C) 2 (D) 3 (E) 4
3. In a two-dimensional parity check scheme, the minimum number of parity bits for protecting 64 bits of data is
(A) smaller than 10 (B) between 10 and 20 (C) between 21 and 30 (D) between 31 and 40 (E) larger than 40
4. In slotted ALOHA, let the number of contending nodes be N and the probability that a node transmits be $2/N$. What is the efficiency of the protocol as N approaches infinity?
(A) $1/e$ (B) $1/(2e)$ (C) $1/(e^2)$ (D) $1/(2e^2)$ (E) none of the above
5. Which of the following technologies does not help to mitigate the problem of IPv4 address exhaustion?
(A) CIDR (B) DHCP (C) NAT (D) IP aliasing (E) private networking
6. Which of the following terms in routing has the least relevance to the rest?
(A) OSPF (B) Bellman-Ford algorithm (C) distance vector (D) routing loop (E) poisoned reverse
7. Consider two TCP connections with the same round-trip time. The first connection suffers from an average loss rate of 0.01 and the second of 0.0001. The throughput ratio of the first to the second connection is equal to
(A) 100 (B) 10 (C) 0.1 (D) 0.01 (E) none of the above
8. Which of the following TCP variants has the most distinct behavior from the rest for performing congestion control?
(A) TCP Tahoe (B) TCP Reno (C) TCP NewReno (D) TCP Vegas (E) TCP SACK
9. Which of the following terms is not a common technique/phenomenon in peer-to-peer applications?
(A) distributed hash table (B) overlay network (C) free riding (D) information indexing (E) none of the above
10. Which of the following services is not typically associated with DNS servers?
(A) IP address lookup (B) load distribution (C) host aliasing (D) virtual hosting (E) none of the above

第二大題：多重選擇題 (20%)

說明：本大題共包含五小題，每小題四分。每小題請依題意選擇 ABCDE 其中至少一個選項，答案請依題號於「答案卡」上作答。答案完全正確才給分，答錯不倒扣。

11. For the following TCP states, first list the sequence of states visited by a TCP server (starting from the CLOSED state), and then choose the first and the third states in the sequence as your answer:
(A) ESTABLISHED
(B) CLOSE_WAIT
(C) LISTEN
(D) SYN_RCVD
(E) LAST_ACK
12. A DNS query is made by the host www.ntu.edu.tw for the IP address of www.mit.edu. The local DNS server then makes a sequence of queries for various DNS servers before the desired IP address is found. Assuming interactive queries from the local DNS server, 8 DNS messages are generated among the following machines. First list the machines that generate the 8 DNS messages in sequence (starting from the request host as the first machine in the sequence). Then choose the third, sixth, and the seventh machines in the sequence as your answer:
(A) Local DNS server
(B) Authoritative DNS server
(C) Root DNS server
(D) TLD DNS server
(E) Requesting host

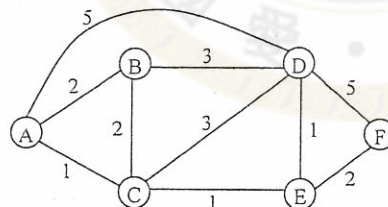
13. The Dijkstra's algorithm runs in iterations to find shortest paths between a node and the rest of nodes in the network. For the following piece of pseudo-codes, first list the correct sequence in the iteration for executing the algorithm at node u , and then choose the second and the third pseudo-code in the sequence as your answer:
 (A) Set $N' = \{u\}$ and initialize cost $D(v)$ between nodes u and v for the first iteration
 (B) Add node w to N'
 (C) Update $D(v)$ for each neighbor v of w that is not in N'
 (D) Find w not in N' such that $D(w)$ is a minimum
 (E) Break if $N' = N$ (the set of nodes N in the network)
14. For the following random access protocols, first list their efficiencies (normalized throughput) from low to high under the same traffic load, and then choose the second and the fourth in the sequence as your answer:
 (A) Pure ALOHA
 (B) Slotted ALOHA
 (C) 1-persistent CSMA
 (D) 0.5-persistent CSMA
 (E) 0.1-persistent CSMA
15. For the following historic events, first list the events in chronological order (from past to recent), and then choose the second and fourth events in the sequence as your answer:
 (A) Development of the TCP/IP protocol suite by V. Cerf and R. Kahn
 (B) Installation of the first node of the ARPANet at UCLA, USA
 (C) Invention of the World Wide Web (WWW) by T. Berners-Lee
 (D) Commencement of the first Bulletin Board System (BBS) at Chicago, USA
 (E) Publication of the packet switching technology by L. Kleinrock

第三大題：複選倒扣題 (60%)

說明：本大題共包含十五小題，每小題四分。每小題請依題意選擇 ABCDE 其中至少一個選項，答案請依題號於「答案卡」上作答，答案空白者不計分，答錯倒扣如下述：每個選項選對得 0.8 分，選錯（應選而未選或不應選而選）倒扣 0.8 分。舉例而言，某小題正確答案為 ABC，某生答 BCD，則該生此題 3 個選項（BCE）選對，2 個選項（AD）選錯，故得 $0.8 \times 3 - 0.8 \times 2 = 0.8$ 分。每小題倒扣至該小題得分零分為止。

16. Choose the correct statement(s) from the following about sending and reading emails:
 (A) SMTP restricts the body of all mail messages to 7-bit ASCII characters, and hence all binary data in the mail needs to be converted before transmission.
 (B) In addition to SMTP, mail servers can also use IMAP for mail delivery.
 (C) POP3 allows a user agent to obtain parts of messages, but IMAP does not.
 (D) A POP3 mail server is stateless such that it cannot maintain user state information across POP3 sessions.
 (E) SMTP uses TCP as the underlying transport protocol for mail delivery.
17. Choose the correct statement(s) from the following about HTTP:
 (A) In persistent HTTP, all objects in a web page are sent in one HTTP message.
 (B) A proxy server is both a HTTP server and client for caches of web contents.
 (C) A HTTP server is stateless but it can use cookies to keep track of user.
 (D) The HTML5 standard is a new version for HTTP.
 (E) HTTP can also be used for reading emails from a mail server.
18. Choose the correct statement(s) from the following about reliable data transfer protocols:
 (A) The Go-Back-N (GBN) protocol and Selective Repeat (SR) protocol are both sliding-window protocols, where the number of unacknowledged packets is limited by the window size.
 (B) In setting the window size of a sliding window protocol for maximal performance, a path with a larger bandwidth should always have a larger window than one with a smaller bandwidth.
 (C) TCP with the use of the cumulative acknowledgement mechanism can be considered as a SR protocol.
 (D) TCP with the use of the selective acknowledgement option can be considered as a GBN protocol.
 (E) An SR protocol requires a more complex acknowledgement mechanism at the receiver than the GBN protocol.

19. Choose the header field(s) not present in a TCP segment header from the following:
 - (A) Congestion window size.
 - (B) Urgent data pointer.
 - (C) Maximum segment size.
 - (D) URG flag.
 - (E) Acknowledgement number.
20. Choose the header field(s) present in both IPv4 and IPv6 datagram headers from the following:
 - (A) Version.
 - (B) Header checksum.
 - (C) Fragmentation.
 - (D) Flow label.
 - (E) Time-to-live.
21. Assume that TCP measures 4 RTT values as follows: 8ms, 16ms, 12ms, and 20ms. Also assume that $\alpha=0.125$ and $\beta=0.25$ for calculating RTT estimate and deviation. Choose the correct statement(s) from the following:
 - (A) The estimated RTT (EstimatedRTT) is between 10ms and 12ms.
 - (B) The estimated RTT is between 12ms and 15ms.
 - (C) RTT variation (DevRTT) is larger than 10ms.
 - (D) Timeout interval is set to EstimatedRTT + 2*DevRTT.
 - (E) Timeout interval is less than 40ms.
22. Choose the correct statement(s) from the following about TCP congestion control:
 - (A) In the slow start phase, TCP increases the congestion window by 1 MSS for every ACK received.
 - (B) TCP moves from the slow start phase to the congestion avoidance phase when the congestion window is larger than half of the slow start threshold.
 - (C) In the congestion avoidance phase, TCP increases the congestion window by 1 MSS for every RTT.
 - (D) When timeout occurs, TCP drops the congestion window by half and enters the fast recovery phase.
 - (E) For two TCP connections sharing the same bottleneck link, the connection with a longer RTT will achieve higher average throughput than the one with a shorter RTT when other conditions are the same.
23. Choose the correct statement(s) about IP addresses from the following:
 - (A) The number of networks with class A address is 128.
 - (B) For each class C network, the number of host addresses is at most 128.
 - (C) The network address 172.30.X.X is a private class B network.
 - (D) In the CIDR notation, the network mask for 10.4.12.0/22 is 255.255.252.0.
 - (E) The block of 224.0.0.0/4 is designated for multicast addresses.



24. For the network and link cost as shown in the figure, choose the correct statement(s) from the following about the link state algorithm for finding the shortest path from node A to all other nodes in the network:
 - (A) In the first step, the least-cost path from A to B has cost 2.
 - (B) In the second step, the least-cost path from A to E has cost 2.
 - (C) In the second step, the least-cost path from A to D has cost 4.
 - (D) In the third step, the least-cost path from A to F has cost 4.
 - (E) After the algorithm ends, the least-cost path from A to D has cost 3.

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25. Choose the correct statement(s) from the following about routing algorithms:
- (A) IGMP is used for multicast routing in the Internet.
 - (B) Reverse path forwarding (RPF) is used for controlled flooding in broadcast routing.
 - (C) Spanning-tree broadcast routing can be used to ensure that there is no redundant transmission of broadcast packets.
 - (D) BGP is an intra-AS routing protocol used popularly in the Internet.
 - (E) None of the above.
26. CRC is a popular error-detection technique used in today's computer networks. Let the data $D=101110$, and the generator $G=1001$. Choose the correct statement(s) from the following:
- (A) The CRC bits $R=010$.
 - (B) The transmitted bit sequence at the sender= 101110110 .
 - (C) To detect bit errors, the receiver first divides the received 9-bits by G . If the remainder is zero, then there is no error during transmissions.
 - (D) Any consecutive bit errors of 3 bits or fewer will be detected at the receiver.
 - (E) None of the above.
27. Choose the correct statement(s) from the following about the Ethernet technology:
- (A) IEEE 802.4 is a standard for Ethernet based on CSMA/CD.
 - (B) In CSMA/CD, if collision is detected during transmission, a sender will transmit a jam signal to make all other senders also stop transmission.
 - (C) The transmission efficiency of Ethernet increases as the propagation delay between any two hosts decreases. If the propagation delay is zero, Ethernet can achieve 100% efficiency without collisions.
 - (D) To support Gigabit Ethernet over twisted pair cables (1000BASE-T), Category 5 (Cat 5) or higher cabling should be used.
 - (E) None of the above.
28. Choose the correct statement(s) from the following about link layer technologies:
- (A) To prevent cycling of broadcast frames, a switched network (hosts interconnected using only switches) is restricted to a spanning tree.
 - (B) A hub does not provide any traffic isolation, whereas a switch can properly isolate traffic between connected segments.
 - (C) PPP data frame is similar to HDLC, and it uses a special bit pattern for delineating the beginning or end of the frame.
 - (D) There is no need for using PPP in DSL service since most client modems are connected to the DSLAM using Ethernet.
 - (E) None of the above.
29. Choose the correct statement(s) from the following about wireless networks:
- (A) An IEEE 802.11 network can be consider as a single-hop, infrastructure-based wireless network.
 - (B) A wireless mesh network can be considered as a multi-hop, infrastructure-based wireless network.
 - (C) The HSDPA/HSUPA service is based on the UMTS WCDMA technology.
 - (D) The LTE-Advanced standard is considered as the next-generation technology for WiMaX.
 - (E) None of the above.
30. Mobile IP facilitates routing between a correspondent node (CN) and a mobile node (MN) through the provision of the home agent (HA) and foreign agent (FA) in the network. Consider a transaction between CN and MN, where CN first sends a request to MN, and then MN sends a reply to CN. Choose from the following the communication paths involved during the transaction:
- (A) CN and HA
 - (B) CN and FA
 - (C) HA and FA
 - (D) FA and MN
 - (E) MN and CN