

FINAL EXAMINATION
COMPUTER NETWORKS : 03-60-367-01
UNIVERSITY OF WINDSOR
SCHOOL OF COMPUTER SCIENCE
Fall 2013 - 2 Hours

This examination document contains all questions for the examination. Each student must surrender **only** their answer sheets. Each student may take this examination question paper for future reference. Although you may write on this document, it will not be graded if it is submitted. There is no need to place your name on this document.

PLEASE READ CAREFULLY BEFORE YOU START

1. This is a CLOSED book test; no notes, textbooks, calculators or computer aids are allowed.
2. You will be asked to sign your name once before leaving the exam room (sign-out) and after submitting your exam answer sheet (Scantron computer sheet).
3. PLACE YOUR NAME AND STUDENT ID NUMBER on the Scantron sheets provided – you must use a pencil (NO PENS). Your examination is Course/Section: 03-60-367-01
4. PLACE ANSWERS on the Scantron sheets provided – you must use a pencil (NO PENS).
5. You are not allowed to give or receive unauthorized help with your test. Any misconduct, as outlined by the Senate bylaw 31 article I, will be reported accordingly.
6. **You have 75 minutes to complete this test, starting from the time stated by the instructor.**
7. **When the instructor indicates that time has elapsed all students must stop writing answers and surrender their Scantron answer sheets immediately to the proctors.**
8. Photocopies of Scantron answer sheets will be returned to students after marking. Examination questions and answers will be provided using the course website.
9. The total (maximum possible) mark on this exam is **111**.

Good Luck!

All questions are either Multiple Choice or True-False. For each Multiple Choice question, you are to choose **only one** response which **best answers** the question. For True-False questions you may **only** choose one option (True or False). There may be up to five (5) response options for some questions. Place all answers on the Scantron sheet provided. The examination will be marked using the campus computer.

If an error is made you must carefully and completely erase your mistake and then indicate your choice of answer. Completely and carefully fill the circle that indicates your answer to each question. Make sure you have selected the correct question number on the Scantron sheet corresponding to the question on the examination question paper.

WARNING !

Read and think carefully about each question before answering.
Questions have been scrambled by topic. Keep your attention on your own test paper and answer sheet.

1. The term ARP refers to _____.
A) Address Resolution Protocol
B) Address Reservation Protocol
C) Asynchronous Routing Protocol
D) None of the above responses are correct.
2. In pipelining protocols, the selective repeat approach requires _____.
A) Receiver only sends cumulative **acks**
B) Sender maintains timer for cumulative **unacked** packets
C) Receiver **acks individual packets**
D) Both B and C responses are correct
3. Datagram networks do not require call setup at the network layer.
A) True
B) False
4. The data link layer takes the packets from the _____ layer and encapsulates them into frames for transmission.
A) network
B) physical
C) transport
D) application
5. Which one of the following tasks is not done by data link layer?.
A) framing
B) error control
C) flow control
D) channel coding
6. Which sublayer of the data link layer performs data link functions that depend upon the type of medium?.
A) logical link control
B) media access control
C) network interface control
D) None of the responses above is correct.
7. The main goal of Bellman-Ford's algorithm is to ensure that all network nodes have the same information to provide shortest path service for message routing.
A) True
B) False

8. Internet transport-layer protocols provide delay and bandwidth guarantees.
A) True
B) False
9. If a router malfunctions, using Link-State protocols, _____.
A) node can advertise incorrect link cost
B) each node computes only its own table
C) each node's table is used by others so error propagates through network
D) Both A and B are correct responses.
10. Network layer protocols must be defined in every router.
A) True
B) False
11. BGP messages are exchanged using _____.
A) ICMP
B) TCP
C) UDP
D) Proprietary Cisco protocols
12. The purpose of a network interface card is to implement the link and physical layer interface.
A) True
B) False
13. ICMP (Internet Control Message Protocol) messages are carried in IP datagrams.
A) True
B) False
14. A MAC address has length _____ bytes.
A) 2
B) 4
C) 6
D) 8
15. Amplitude modulation refers to rapid variations of signal strength to indicate bits or other tokens.
A) True
B) False

16. In order to establish a virtual connection (also called a virtual circuit) that permits datagrams to flow between communicating end hosts, it is necessary to _____.
A) involve both the end hosts and all intervening routers
B) initiate the connection using specialized datagrams that carry historical information about the end-end route
C) complete the connection using receiver and sender acknowledgements
D) All of these responses are correct.
17. Which one of the following is a data link layer protocol?
A) ethernet
B) point to point protocol
C) HDLC
D) All of the responses above are correct.
18. Which one of the following is the multiple access protocol for channel access control?
A) CSMA/CD
B) CSMA/CA
C) CSMA/CB
D) Both A and B responses are correct.
E) All of A, B and C responses are correct.
19. At the network layer, a spanning tree is used to ensure that no redundant packets are received by any node.
A) True
B) False
20. UDP and TCP are examples of _____ layer protocols.
A) Application
B) Link
C) Transport
D) Network
E) Physical
21. Frequency Division Multiplexing (FDM) divides time into time frames and further divides each time frame into time slots.
A) True
B) False
22. TCP abstracts data communication to appear as an apparent stream of flowing data.
A) True
B) False

23. The protocol that requires a master node to grant access to each node in a collision domain, in a round-robin fashion is called a _____ .
A) token-passing protocol
B) **polling protocol**
C) random access protocol
D) None of the responses above is correct.
24. Which protocol is not related to the network layer?
A) **UDP**
B) BGP
C) RIP
D) ICMP
25. This protocol is used for error reporting in network layer.
A) OSPF
B) ARP
C) TCP
D) **ICMP**
26. Within LANs, link layer addressing is accomplished by using _____.
A) IP addresses
B) MAC addresses
C) **MAC and IP addresses**
D) All of the above responses are correct.
27. Network services and protocols provide logical communication between hosts.
A) **True**
B) False
28. A network's speed is expressed in terms of _____.
A) Routing protocol
B) Round trip time
C) **Bit rate and latency**
D) I/O buffer response
29. The _____ protocol translates MAC addresses to IP addresses in a Local Area Network (LAN).
A) TCP
B) ARP
C) **RARP**
D) HTTP

30. Both MAC addresses and IP addresses are usually written in dotted-decimal notation.
A) True
B) False
31. TCP congestion control uses a congestion window to implement _____.
A) Timeout acknowledgment
B) Congestion avoidance
C) Message traffic scheduling
D) None of the above responses is correct
32. Ethernet is considered to be both connectionless and unreliable.
A) True
B) False
33. A large-scale data center employs a hierarchy of routers and switched. At the top of the hierarchy are the Top of Rack (TOR) switches.
A) True
B) False
34. Applications require which of the following transport services.
A) Data loss and Security
B) Timing
C) Throughput
D) All of the above responses are correct.
35. The MAC address is _____.
A) Burned into the NIC ROM
B) Set locally on the host using software
C) Assured to be unique by standards bodies control over issuance
D) All of these responses are correct.
36. The main difference between a switch and a router is _____.
A) switches do not store and forward packets
B) switches work at layer 3
C) switches forward packets using IP addresses
D) switches forward packets using MAC addresses

37. Which of the following is not true about a load balancer, in a data center?
- A) It distributes requests to the hosts.
 - B) Each one is devoted to a specific cloud application.
 - C) It makes decisions based on the destination port and the destination address in the packet.
 - D) It relays the response from the hosts back to the external client.
 - E) None of the responses above is correct.
38. Modern network security provides _____.
- A) Authorization
 - B) Message integrity
 - C) Secure access and general availability
 - D) All of these responses are correct.
39. The header of a frame generally contains _____.
- A) synchronization bytes
 - B) addresses
 - C) frame identifier
 - D) All of the responses above are correct.
40. Transport services and protocols provide logical communication between hosts.
- A) True
 - B) False
41. Router buffer sizes should be selected based on _____.
- A) message round-trip time (eg. as determined by acknowledgements)
 - B) link capacity
 - C) tolerance for data loss due to overflow
 - D) All of these responses are correct.
42. An automatic repeat request error management mechanism is provided by the _____.
- A) logical link control sublayer
 - B) media access control sublayer
 - C) network interface control sublayer
 - D) None of the responses above is correct.
43. IPSec provides encryption of IP datagram payloads and data integrity.
- A) True
 - B) False

44. When 2 or more bits in a data unit have been changed during the transmission, the error is called _____.
A) random error
B) burst error
C) inverted error
D) None of the responses above is correct.
45. Given the CRC coding bits 101110001 and generator 1001, is an error detected?
A) Yes, there is an error.
B) No, there is no error.
46. Which one of the following does not use channel partitioning?
A) TDM
B) FDM
C) CSMA
D) None of the responses above is correct.
47. RIP, OSPF and BGP are examples of _____.
A) application layer routing protocols
B) transport layer routing protocols
C) network layer routing protocols
D) Both B and C responses are correct.
48. Forwarding refers to _____.
A) the manner by which datagrams are routed from source to destination ports of end hosts
B) the manner by which datagrams are routed from input to output ports of individual routers
C) the set of algorithms required to ensure near-optimal path selection of datagrams
D) the manner by which datagrams are routed from source to destination between adjacent routers
49. Which of the following router topologies has the highest reliability?
A) Bus
B) Star
C) Ring
D) Mesh
50. In Ethernet networks, the Preamble pattern is used to synchronize receiver and sender clock rates.
A) True
B) False

51. Which of the following is not correct about OSPF?
- A) It is an intra-AS routing approach.
 - B) It is used in lower-tier ISPs.
 - C) It uses flooding of link-state information.
 - D) It runs Dijkstra's algorithm.
52. The property that a network should operate efficiently when deployed on a small-scale as well as on a large-scale is called _____ .
- A) Migration
 - B) Determinism
 - C) Scalability
 - D) Autoconfigurability
53. Internet Control Message Protocol (ICMP) is used by hosts and routers to communicate network-level information.
- A) True
 - B) False
54. Multiple TCP streams can distinguished on a given machine using _____ .
- A) Ports
 - B) IP addresses
 - C) network interface cards
 - D) All of the above responses are correct.
55. Assume that four (4) datagrams are received in sequence and are then checked for parity errors. The first datagram bit string contains the 7-bit pattern 1011010, followed by the second datagram pattern 0000111, third datagram pattern 1111110, and fourth datagram pattern 0110011. Each of the bit patterns consists of a leading (leftmost) 6-bit pattern that is the data payload followed by the rightmost parity bit (parity is defined as 0/1 if the number of 1-bits in the data payload is even/odd). The fourth datagram pattern bits are the parity values of the first three datagram bits in the corresponding positions (taken as a column). The error checking scheme is the two-dimensional parity bit check. Which of the following statements is most correct?
- A) There is certainly an error in the first datagram
 - B) There is certainly an error in the second datagram
 - C) There is certainly an error in the third datagram
 - D) There is no apparent error, but it is impossible to be fully certain about the data correctness in this case
56. In Ethernet networks, the Preamble pattern is used to synchronize receiver and sender clock rates. **NOTE: This is a duplicate of Q50. Students were not to answer this.**
- A) True
 - B) False

57. In pipelining protocols, the Go-back-N approach requires _____.
A) Sender can have up to N **unacked** packets in pipeline
B) Receiver **acks** individual packets
C) If sender timer expires, retransmit all N packets
D) Sender has timer for each **unacked** packet
58. When the link cost increases suddenly between two routers in a network, poisoned reverse is used to _____.
A) accelerate the convergence to a stable routing table
B) replace all update link costs initially to infinity for all routes through the affected routers
C) guarantee unique routing solutions in the final routing tables
D) **Both A and B responses are correct.**
59. The reasons for handling routing differently in Inter-AS and Intra-AS routing are based on _____.
A) differences in router capabilities
B) distance vector versus link state information
C) **policy, scale and performance**
D) imposed standards for packaging messages
60. In Ethernet networks, the Preamble consists of 7 bytes with pattern 10101010 followed by one byte with pattern _____.
A) 11101010
B) 01010101
C) **10101011**
D) None of the above responses are correct.
61. Demultiplexing _____.
A) involves gathering data from multiple sockets
B) involves enveloping data with header
C) **involves delivering received segments to correct sockets**
D) Both A and B are correct responses.
62. One role of a NIC is to accept a datagram from the next higher layer and encapsulate the datagram into a frame, along with frame header and trailer bit fields, such as rdt and CRC.
A) **True**
B) False

63. Routers provide feedback to end systems to assist _____.
A) network-assisted congestion control
B) network-assisted flow control
C) end-end congestion control
D) end-end flow control
64. Consider a packet of length 1024 bytes. Assuming the packet must travel over a link of distance 2500 kilometers with propagation speed 2.5×10^8 m/s and transmission rate 2 Mbps, what is the propagation delay?
A) 1 msec
B) 10 msec
C) 21 msec
D) 100 microsec
65. Which layer has the responsibility of transferring datagrams from one node to adjacent node(s) over a link?
A) Application layer
B) Transport layer
C) Link layer
D) Network layer
66. Which layer has the responsibility of moving individual bits from one node to adjacent node(s) over a link?
A) Physical layer
B) Transport layer
C) Link layer
D) Network layer
67. A subnet may be defined as any interconnected set of computers and routers (or switches) that can operate in isolation from other subnets, or in cooperation with other subnets.
A) True
B) False
68. With half duplex at the link layer, nodes at both ends of the link can transmit at the same time.
A) True
B) False
69. All datagrams contain 2 ports.
A) True
B) False

70. A Multiprotocol Label Switching (MPLS)-capable router uses destination-based IP datagram forwarding infrastructure.
 A) True
 B) False
71. RIP advertisements typically announce the number of hops to various destinations. BGP updates, on the other hand, announce the _____ to the various destinations.
 A) link costs
 B) adjacent link nodes
 C) "I'm alive" message
 D) previous link path table
72. Consider sending a 5000 byte datagram into a link that has a maximum transfer size (MTU) of 1000 bytes. How many fragments are generated?
 A) 8
 B) 7
 C) 6
 D) 5
73. A host, mounted on a rack, in a data center is called a _____.
 A) Rack-server
 B) Top of Rack (TOR) switch
 C) Blade
 D) Rack-mount
 E) None of the responses above is correct.
74. Among the unethical or illegal acts that "bad guys" can do to messages travelling on a computer network is (are) included _____.
 A) eavesdropping, actively inserting messages into connection
 B) impersonation
 C) hijacking, denial of service
 D) All of these responses are correct.
75. Assume that three routers, U, V and W, have link costs: $c(U,V) = 4$, $c(U,W) = 6$ and $c(V,W) = 1$. Using the Bellman-Ford algorithm, the common routing table for all routers is:
- | | U | V | W |
|---|---|---|---|
| U | 0 | 4 | 5 |
| V | 4 | 0 | 1 |
| W | 5 | 1 | 0 |
- A) True
 B) False

76. The first item in an IP datagram is the _____.
A) header length (in bytes)
B) total datagram length (in bytes)
C) protocol version number
D) type of service
77. The main idea for the use of Multiprotocol Label Switching (MPLS) is to _____.
A) improve the forwarding speed of IP routers
B) forward datagrams based on fixed-length labels
C) use Virtual Circuits (VC) techniques
D) abandon the destination-based IP datagram forwarding infrastructure
E) All of the responses above are correct.
78. Most local area networks (LANs) use electrostatic network hardware.
A) True
B) False
79. The routing methods that compute the least-cost path between source and destination using complete, global knowledge about the network are called _____.
A) link-state
B) distance-vector
C) OSPF
D) All of the responses above are correct.
80. In this class of IP address, each subnet can accommodate up to 254 hosts.
A) A
B) B
C) C
D) D
81. The motivation(s) for utilizing Network Address Translation include(s) _____.
A) making available a range of unique IP addresses for all devices in every subnet
B) ability to change addresses of devices in local network without notifying outside world
C) ability to change ISP without changing addresses of devices in global network
D) establishing direct addressability to local devices inside subnet
82. Network Address Translation is used because it expands the available device address space through use of port numbers and thereby satisfies the end-end argument at the network layer.
A) True
B) False

83. In order to deal with the situation where, too many sources send too much data too fast for a network to handle, it is necessary to use a technique called _____.
A) Flow control
B) Congestion control
C) Routing control
D) Dynamic packet management
84. Message encapsulation refers to _____.
A) embedding payloads and protocol headers within logically layered packages
B) allowing for message content verification
C) reliance upon IP for transmitting messages
D) designating message contents with descriptive data
85. Which of the following responses is not a desirable property of secure communication?
A) Confidentiality
B) Operational security
C) End-point authorization
D) Message integrity
86. Connectionless demultiplexing may be performed using _____.
A) TCP
B) UDP
C) ICMP
D) All of the above are correct responses.
87. HTTP is referred to as a stateless protocol because _____.
A) clients do not maintain historic information about transactions with servers
B) servers and clients do not maintain open connections
C) server maintains no information about past client requests
D) All of the above responses are correct
88. The IPv6 datagram header has length _____ bytes.
A) 20
B) 40
C) 32
D) 128

89. As used in computer science and engineering networking, the term MAC refers to _____ .
A) Message authentication code
B) Medium Access Control
C) the first three characters of MACchine
D) Both A and B are correct responses.
90. IPv6 has _____-bit addresses..
A) 48
B) 64
C) 128
D) Variable length
91. Which protocol is used in order to configure IP addresses automatically?
A) ARP
B) DHCP
C) ICMP
D) RARP
92. Which of the following options hides the details of a home network from the rest of the Internet?
A) ARP
B) DHCP
C) ICMP
D) NAT
93. If a router malfunctions, the link state algorithm is affected because _____.
A) a node can advertise incorrect path cost
B) each node recomputes its table and forwards it to other nodes
C) errors are contained locally within the network
D) a node can advertise incorrect link cost
94. Assume that a University of Windsor student has booted their laptop computer while waiting for a flight in Vancouver, but have not yet connected wirelessly to a wireless server in the airport. Their intention is to connect to the Computer Science website in Windsor. How many network transactions would be required to obtain a network connection and eventually establish the return of the Computer Science webpage?
A) Fewer than 10
B) More than 10, but less than 20
C) More than 20, but less than 30
D) More than 30

95. If a router malfunctions, using Distance-Vector protocols, _____.
A) node can advertise incorrect path cost
B) each node computes only its own table
C) corrective actions occur immediately to isolate the error
D) Both A and B are correct responses.
96. If Bob and Alice are two peers and each is located behind a Network Address Translation (NAT) server across a wide-area network (WAN) then, in the absence of application-specific NAT configuration, _____.
A) they can establish a reliable UDP connection
B) they cannot establish a SMTP connection
C) they can establish a TCP connection
D) they cannot establish a TCP connection
97. IP datagrams may be fragmented into several smaller IP datagrams _____.
A) that are reassembled at the next router link
B) in order to adapt to the largest transport layer datagram
C) that are reassembled only at the final destination
D) Both B and C are correct responses.
98. Standard bus type Ethernet links are managed so that collisions are avoided.
A) True
B) False
99. Which of the following is a proper layer of the OSI stack?
A) Link
B) Network
C) Presentation
D) Session
E) All of responses above are correct.
100. Link layer services provide _____.
A) Framing and flow control
B) Reliable delivery between adjacent nodes
C) Error detection and correction
D) All of the responses above are correct.
101. In datagram networks _____.
A) routers maintain state about end-to-end connections
B) packets are forwarded using destination host address and virtual circuit number
C) packets between same source-destination pair may take different paths
D) None of these responses is correct.

102. In “ring” networks, using the “taking turns” MAC protocol, a _____ is passed from one node to the next node sequentially.
- A) link allocation schedule
 - B) control token
 - C) network synchronization signal
 - D) “network ready” polling signal
103. Virtual local area networks (VLANs) address the drawback of _____ in institutional LANs.
- A) lack of traffic isolation
 - B) MAC address management
 - C) inefficient use of switches
 - D) Both A and C are correct responses.
104. In order to provide multiple access to networks it is necessary to _____ .
- A) use a reserved channel to obtain communication information about channel sharing
 - B) specify a distributed algorithm that determines how nodes share channels
 - C) use only devices for which collisions do not occur
 - D) Both A and B responses are correct.
105. Both UDP and TCP require that the applications recognize their own data formats.
- A) True
 - B) False
106. Carrier signals are used to _____ .
- A) detect whether the network is currently in use by another host
 - B) provide a stable reference above noise levels
 - C) advise hosts that the network is active
 - D) All of the responses above are correct.
107. Routing algorithms may be classified based on _____ .
- A) availability of global information
 - B) availability of local information
 - C) rate of change of network paths
 - D) All of the responses above are correct.

108. Consider a datagram network using 8-bit host addresses. Suppose a router uses longest prefix matching to determine whether message traffic is to be routed through one of only four forwarding ports. The range of addresses to be routed through Port 2 is _____.
- A) 00000000 through 00111111
 - B) 00000000 through 11111100
 - C) 10000000 through 10111111
 - D) 01000000 through 10000000
109. Random access protocols in shared bus networks use _____ to provide “listen before speaking” and “stop talking if someone else already is talking” rules.
- A) CSMA
 - B) SMDP
 - C) ALOHA
 - D) Slotted ALOHA

Use the following Table for Questions **110 and 111**. The table contains the link costs (in arbitrary units) between routers S, T, U, V, W, X, Y and Z. A dash (hyphen) entry indicates that there is no connection between these pairs of routers.

	S	T	U	V	W	X	Y	Z
S	0	1	4	-	-	-	-	-
T	1	0	2	4	-	-	7	5
U	4	2	0	3	3	-	-	-
V	-	4	3	0	4	3	1	-
W	-	-	3	4	0	6	-	-
X	-	-	-	3	6	0	6	-
Y	-	7	-	1	-	6	0	12
Z	-	5	-	-	-	-	12	0

110. Based on the pairwise link costs in the Table above, and using Dijkstra’s algorithm, determine the shortest path route from X to Z.
- A) Infinity
 - B) 12
 - C) 16
 - D) 18
111. Based on the pairwise link costs in the Table above, and using Dijkstra’s algorithm, determine the shortest path route from X to S.
- A) Infinity
 - B) 10
 - C) 8
 - D) 9

END OF EXAMINATION