

Name_____ Student ID_____ Department/Year_____

Final Examination

Introduction to Computer Networks

Class#: 901 E31110

Fall 2009

9:30-11:10 Tuesday

January 12, 2010

Prohibited

1. You are not allowed to write down the answers using pencils. Use only black- or blue-inked pens.
2. You are not allowed to read books or any references not on the question sheets.
3. You are not allowed to use calculators or electronic devices in any form.
4. You are not allowed to use extra sheets of papers.
5. You are not allowed to have any oral, visual, gesture exchange about the exam questions or answers during the exam.

Cautions

1. Check if you get 10 pages (including this title page), 41 questions.
2. Write your **name in Chinese**, student ID, and department/year down on top of the first page.
3. There are in total 100 points to earn. You have 100 minutes to answer the questions. Skim through all questions and start from the questions you are more confident with.
4. Use only English to answer the questions. Misspelling and grammar errors will be tolerated, but you want to make sure with those errors your answers will still make sense.
5. If you have any extra-exam emergency or problem regarding the exam questions, raise your hand quietly. The exam administrator will approach you and deal with the problem.

- a 1. What does AIMD, TCP's congestion control mechanism, stands for? (2%)
- (a) Additive Increase Multiplicative Decrease
 - (b) Aggressive Increase Moderate Decrease
 - (c) Additive Increase Moderate Decrease
 - (d) Aggressive Increase Multiplicative Decrease
 - (e) None of the above
- c 2. Assume that the packet size is always 1 byte, the slow start threshold is 20, there is no loss, and transmission delay is negligible. Which of the following window size sequence resembles the behavior of TCP in the slow start state? (2%)
- (a) 1 2 3 4 5
 - (b) 2 3 4 5 6
 - (c) 2 4 8 16 32
 - (d) 2 4 6 8 10
 - (e) 1 3 5 7 9
- a 3. Assume that the packet size is always 1 byte, the slow start threshold is 10, there is no loss, and transmission delay is negligible. Which of the following window size sequence resembles the behavior of TCP in the congestion avoidance state? (2%)
- (a) 21 22 23 24 25
 - (b) 2 3 4 5 6
 - (c) 22 44 88 176 352
 - (d) 2 4 6 8 10
 - (e) 21 23 25 27 29
- c 4. Given the TCP throughput model derived from one of the homework exercises, select from below the connection with the highest throughput. (2%)
- (a) RTT=100ms, Loss Rate=3%
 - (b) RTT=50ms, Loss Rate=3%
 - (c) RTT=50ms, Loss Rate=1%
 - (d) RTT=200ms, Loss Rate=3%
 - (e) RTT=200ms, Loss Rate=1%
- e 5. Which of the following is a valid IP address? (2%)
- (a) 140.112.42.0/28
 - (b) 140.112.42.192/28
 - (c) 140.112.42.224/28
 - (d) 140.112.42.240/28
 - (e) All of the above
- e 6. How many IP addresses can a machine have simultaneously? (2%)
- (a) 1
 - (b) 2

- (c) 3
 - (d) 4
 - (e) All of the above
- a 7. How many IP addresses can a network interface be configured with simultaneously? (2%)
- (a) 1
 - (b) 2
 - (c) 3
 - (d) 4
 - (e) All of the above
- d 8. Which of the following does not add delay to the transmission of packets over a network router? (2%)
- (a) Input queue
 - (b) Output queue
 - (c) HOL blocking
 - (d) Buffer overflow
 - (e) Switching
- c 9. Which of the following does not exist in the network header of an IPv4 packet? (2%)
- (a) Source address
 - (b) Destination address
 - (c) Port number
 - (d) Checksum
 - (e) IP protocol version number
- e 10. Which of the following does exist in the network header of an IPv6 packet? (2%)
- (a) Option
 - (b) Header length
 - (c) Port number
 - (d) Checksum
 - (e) IP protocol version number
- d 11. Which of the following is not a benefit of using NAT? (2%)
- (a) Allowing multiple machines in a local area network given only 1 IP address to access the Internet
 - (b) Allowing the local administrator to assign the IP addresses for local machines freely
 - (c) Preventing the local administrator from reassigning the IP addresses when the IP address allocated by the ISP changes
 - (d) Allowing the local administrator to host Web server freely
 - (e) Reducing the chance of the local machines being probed by the hackers
- d 12. Which of the following is the institute having the authority to assign IP addresses? (2%)
- (a) DNS

- (b) DHCP
- (c) NAT
- (d) ICANN
- (e) TCP/IP

- a 13. Which of the following is not a network layer protocol? (2%)
- (a) NAT
 - (b) IPv6
 - (c) PIM
 - (d) BGP
 - (e) ICMP
- b 14. Which of the following routing algorithms requires the information of entire topology? (2%)
- (a) DV
 - (b) LS
 - (c) Flooding
 - (d) DVMRP
 - (e) None of the above
- e 15. Which of the following routing mechanisms computes the shortest path? (2%)
- (a) RIP
 - (b) OSPF
 - (c) DV
 - (d) LS
 - (e) All of the above
- b 16. Which of the following routing algorithms computes the shortest path tree? (2%)
- (a) Steiner tree
 - (b) Dijkstra
 - (c) Flooding
 - (d) RPF
 - (e) All of the above
- c 17. Count to infinity is a problem specific to which of the following mechanism? (2%)
- (a) RIP
 - (b) DVMRP
 - (c) DV
 - (d) LS
 - (e) None of the above
- c 18. Which of the following is not characteristic of BGP? (2%)
- (a) Using TCP for connections between gateway routers
 - (b) Loop-free routing

- (c) Shortest path routing
 - (d) Hot potato routing
 - (e) Path vector routing
- e 19. Which of the following cannot be an intra-AS routing mechanism? (2%)
- (a) Hierarchical routing
 - (b) DV
 - (c) LS
 - (d) Random walk
 - (e) BGP
- c 20. Which of the following is not a function of a link layer protocol? (2%)
- (a) MAC
 - (b) Flow control
 - (c) Congestion control
 - (d) Error detection
 - (e) Error correction
- e 21. Which of the following component of a computer system can't possibly contain implementations of a link layer protocol? (2%)
- (a) Network card hardware
 - (b) Network card firmware
 - (c) Network card driver
 - (d) Operating system
 - (e) None of the above
- e 22. Which of the following can detect errors in communication? (2%)
- (a) Internet Checksum
 - (b) CRC
 - (c) Single Parity Bit Check
 - (d) CDMA
 - (e) All of the above
- d 23. Which of the following can correct errors in communication? (2%)
- (a) Internet Checksum
 - (b) CRC
 - (c) Single Parity Bit Check
 - (d) CDMA
 - (e) None of the above
- e 24. Which of the following is a MAC protocol? (2%)
- (a) CSMA/CD
 - (b) Ethernet
 - (c) CDMA

- (d) WiFi
 - (e) All of the above
- c** 25. Which of the following is not a random access MAC protocol? (2%)
- (a) CSMA/CD
 - (b) Ethernet
 - (c) CDMA
 - (d) WiFi
 - (e) CSMA/CA
- b** 26. Which of the following MAC protocol requires time synchronization? (2%)
- (a) Aloha
 - (b) Slotted Aloha
 - (c) CSMA
 - (d) Bluetooth
 - (e) None of the above
- e** 27. How long is the Ethernet address? (2%)
- (a) 32 bits
 - (b) 36 bits
 - (c) 40 bits
 - (d) 44 bits
 - (e) 48 bits
- b** 28. Which of the following is the mechanism used to translate IP address to MAC address? (2%)
- (a) NAT
 - (b) ARP
 - (c) DNS
 - (d) Manchester Coding
 - (e) None of the above
- b** 29. Which of the following network topology is the one created by a network hub? (2%)
- (a) Star
 - (b) Bus
 - (c) Ring
 - (d) Mesh
 - (e) Switch
- a** 30. Which of the following network topology is the one created by a network switch? (2%)
- (a) Star
 - (b) Bus
 - (c) Ring
 - (d) Mesh

- (e) Switch
- e 31. Which of the following is a characteristic of Ethernet? (2%)
 - (a) Carrier sense
 - (b) Exponential backoff
 - (c) Collision detection
 - (d) Unreliable
 - (e) All of the above
- c 32. Which of the following is not a sequence of K in the Exponential Backoff mechanism of Ethernet? (2%)
 - (a) 1 1 1
 - (b) 1 2 3
 - (c) 2 4 6
 - (d) 1 3 5
 - (e) 1 2 6
- e 33. Which of the following does not exist in an Ethernet packet header? (2%)
 - (a) CRC
 - (b) Source address
 - (c) Destination address
 - (d) Preamble
 - (e) Manchester code
- e 34. Which of the following is a wireless link? (2%)
 - (a) Satellite
 - (b) WiFi
 - (c) 3G
 - (d) WiMAX
 - (e) All of the above
- a 35. Which of the following is not a wireless link's characteristic? (2%)
 - (a) Received wireless signal strength decreases as the distance between the sender and receiver increases.
 - (b) Data are modulated on electromagnetic waves.
 - (c) Data traveling a wireless link might be interfered by other radio sources.
 - (d) Wireless signals might be blocked by obstacles in the space.
 - (e) Wireless signals might be attenuated during propagation.
- d 36. Which of the following is the MAC protocol running on IEEE 802.11? (2%)
 - (a) CSMA
 - (b) CSMA/CD
 - (c) CDMA
 - (d) CSMA/CA

- (e) None of the above
- e 37. Which part of the IEEE 802.11's mechanism helps avoid collisions? (2%)
 - (a) Exchange of RTS and CTS
 - (b) Random DIFS and SIFS
 - (c) Channel selection
 - (d) Random backoff
 - (e) All of the above
- d 38. How many address fields are there in an IEEE 802.11 packet header? (2%)
 - (a) 1
 - (b) 2
 - (c) 3
 - (d) 4
 - (e) 5
- d 39. Which of the following is the mechanism used to handle mobility in IP network? (2%)
 - (a) BGP
 - (b) Roaming
 - (c) Direct routing
 - (d) Indirect routing
 - (e) None of the above
- c 40. Making an international roaming call today is equivalent of making which combination of calls? (2%)
 - (a) 1 local cellular phone call + 1 international (PSTN) call
 - (b) 1 local cellular phone call + 2 international (PSTN) calls
 - (c) 2 local cellular phone calls + 1 international (PSTN) call
 - (d) 2 local cellular phone calls + 2 international (PSTN) calls
 - (e) None of the above

41. Assess the future of the wireless Internet access. There are multiple ways to access the Internet wirelessly. WiFi and 3G are currently dominating the market. WiMAX is catching up having a number of base stations built and experimental operations running.
- (1) Compare WiFi, 3G and WiMAX by the transmission range. (5%)
 - (2) Compare WiFi, 3G and WiMAX by the transmission throughput. (5%)
 - (3) Among WiFi, 3G, and WiMAX, discuss which service a busy salesman who makes voice calls and read/send emails taking the Taipei city MRT a lot will choose. (5%)
 - (4) Follow (3). WiFly costs about 400 NTD/month. 3G costs about 850 NTD/month. If WiMAX is going to cost 400 NTD/month, do you think the busy salesman will prefer to switch to WiMAX? If WiMAX is going to cost 950 NTD/month, what would the busy salesman choose? Justify your answers. (5%)

Sample Solution:

- (1) WiFi 10s meters
3G kilometers
WiMAX kilometers
- (2) WiFi 100s Mbps
3G 100s Kbps
WiMAX 10s Mbps
- (3) One can discuss the case from different viewpoints. One example: In case of reading/sending emails, there is not much difference using WiFi at the hotspots vs. 3G. However, to be able to keep call on the move, 3G, having a wider transmission range is more sustaining.
- (4) Again, take your stand and justify. Provided here is just an example: If WiMAX costs 400 NTD/month, the salesman is definitely going to switch. The bandwidth and range requirements are both satisfied and yet it is cheaper than 3G. If it's 950 NTD/month, the salesman only needs to make 10s Kbps calls at a time. There's no obvious need to switch and spending more for services that are not necessary isn't quite what a businessman would do.