Master of Engineering in Software Engineering Examination, 2011

(3rd Semester)

Network Technologies

Time : Three hours

Full Marks : 100

(Answer must be brief and to the points)

Answer question 1 and any five questions from the rest

1. Choose the correct alternative: (10x2=20)

a. In a network, a packet of length L bits takes link L1 with a probability of p_1 or link L2 with a probability of p_2. Link L1 and L2 have bit error probability of b_1 and b_2 respectively. The probability that the packet will be received without error via either L1 or L2 is:

i. $(1-b_1)^L p_1+(1-p_2)^L p_2$ iii. $[1-(b_1+b_2)^L]p_1p_2$

ii. $(1-b_1)^L(1-b_2)^L p_1p_2$ iv. $1-(b_1^L p_1+b_2^L p_2)$

b. In a packet switching network, packets are routed from source to destination along a single path having two intermediate nodes. If the message size is 24 bytes and each packet contains a header of 3 bytes, then the optimum packet size is:

i. 4 bytes ii. 6 bytes iii. 7 bytes iv. 9 bytes

c. Let G(x) be the generator polynomial used for CRC checking. What is the condition that should be satisfied by G(x) to detect odd number of bits in error?

i. G(x) contains more than two terms

ii. G(x) does not divide $1+x^k$, for any k not exceeding the frame length

iii. 1+x is a factor of G(x)

iv. G(x) has an odd number of terms

d. Frames of 1000 bits are sent over a 10^6 bps duplex link between two hosts. The round trip propagation time is 25 ms. Frames are to be transmitted into this link to maximally pack them in transit. What is the minimum number of bits required to represent sequence numbers distinctly?

i. 2 ii. 3 iii. 4 iv. 5

e. A network with CSMA/CD protocol in the MAC layer is running at 1 Gbps over a 1 km cable with no repeaters. The signal speed in the cable is 2×10^8 m/sec. The minimum frame size for this network should be

i. 10000 bits ii. 10000 bytes iii. 5000 bits iv. 5000 bytes

f. For which one of the following reasons does Internet Protocol (IP) uses the time-to-live (TTL) field in the IP datagram header?

i. Ensure packets reach destination within that time

ii. Discard packets that reach later than that time

iii. Prevent packets from looping indefinitely

iv. Limit the time for which a packet gets queued in intermediate routers

g. Two computers C1 and C2 are configured as follows: C1 has IP address 203.197.2.53 and netmask 255.255.128.0. C2 has IP address 203.197.75.201 and netmask 255.255.192.0. Which one of the following statements is true?

i. C1 and C2 both assume they are on the same network

ii. C2 assumes C1 is on same network, but C1 assumes C2 is on a different network

iii. C1 assumes C2 is on same network, but C2 assumes C1 is on a different network

iv. C1 and C2 both assume they are on different network

h. Packets of the same session may be routed through different paths in:

i. TCP, but not UDP iii. TCP and UDP

ii. UDP, but not TCP iv. Neither TCP nor UDP

i. Which of the following statements is false regarding a bridge

i. Bridge is a layer 2 device

ii. Bridge reduces collision domain

iii. Bridge is used to connect two or more LAN segments

iv. Bridge reduces broadcast domain

1. Trace-route reports a possible route that is taken by packets moving from some host A to some other host B. Which of the following options represents the technique used by trace-route to identify these routes?
   i. By progressively querying routers about the next router on the path to B using ICMP packets, staring with the first router
   ii. By requiring each router to append the address to the ICMP packet as it is forwarded to B. The list of all routers en-route to B is returned by B in an ICMP reply packet
   iii. By ensuring that the ICMP reply packet is returned to A by each router en-route to B, in the ascending order of their hop distance from A
   iv. By locally computing the shortest path from A to B

2. (7+3+6)
   a. What are the disadvantages of connectionless services? In spite of the disadvantages, why do you like to use connectionless services? What actions you would like to take to eliminate the problems, but still use connectionless services?.
   b. List some ways by which postal and telephone networks differ.
   c. Describe how packet size affects the performance of a computer network.

3. (4+6+6)
   a. Assuming that each is correctly implemented, should the selective repeat protocol perform much better than go-back-n on a fiber optic link between two nodes about a half-mile apart?
   b. Consider the go-back-n algorithm with a window size of 5. Draw the sender and receiver windows and also describe the actions of both sending and receiving protocols, specifying the buffer contents in the following case:
   Station A sends frames 0-6. Station B receives them in order, but frame 4 was damaged.
   c. Consider a 100 kbps satellite link with 550 msec roundtrip propagation delay. A sliding window protocol with 5-bit sequence number is used on the link. The frame size is 1000 bits. Find out the percentage of time the sender is blocked.

4. (5+5+6)
   a. Ethernet frames must be at least 64 bytes long to ensure that the transmitter is still going in the event of a collision at the far end of the cable. Fast Ethernet has the same 64 byte minimum frame size, can get the bits out ten times faster. How is it possible to maintain the same minimum frame size?
   b. Prove that the maximum utilization of slotted ALOHA occurs at G=1 and the maximum throughput is 36.8%.
   c. A ring network runs at 1 Mbps and has a length of 1000 meters. The speed of signal propagation is 2×10^8 m/sec. How much time a frame of 1000 bits will take to round the ring? Will the frame arrive back to the station before the station completes its transmission? What should the minimum size of the ring so that leading edge of the frame does not return back before the station completes its transmission?

5. (3+4+3+6)
   a. Imagine two LAN bridges, both connecting a pair of 802.4 networks. The first bridge is faced with 1000 512 byte frame per second that must be forwarded. The second is faced with 200 4096 byte frames per second. Which bridge do you think will need the faster CPU? Discuss.
   b. Describe the working principle of transparent bridge. Compare between transparent bridge and source routing bridge.
   c. In a TDM medium access control bus LAN, each station is assigned one time slot per cycle for transmission. Assume that the length of each time slot is the time to transmit 100 bits plus the end-to-end propagation delay. Assume a propagation speed of $2 * 10^8$ m/sec. The length of the LAN is 1 km with a bandwidth of 10 Mbps. Find out the

maximum number of stations that can be allowed in the LAN so that the throughput of each station can be $\frac{2}{3}$ Mbps.

(2+4+3+7)

a. What are the two approaches to packet switching? Distinguish between them.

b. Computer A sends a packet to computer B with port number 1000. There is no process running at port number 1000 in computer B. What action computer B will take?

c. The routing table of a router is shown below:

Destination	Subnet Mask	Interface
128.75.43.0	255.255.255.0	Eth0
128.75.43.0	255.255.255.128	Eth1
192.12.17.5	255.255.255.255	Eth3
Default		Eth2

On which interface will the router forward packets to destinations 128.75.43.16 and 192.12.17.10 respectively?

(3+3+2+2+6)

a. Suppose that a datagram network has a routing algorithm that generates routing tables so that there are two disjoint paths between every source and destination that is attached to the network. Identify the benefits of this approach. What problems are introduced with this approach?

b. A host in an organization has an IP address 150.32.64.34 and a subnet mask 255.255.240.0. What is the address of this subnet? What is the range of IP addresses that a host can have on this subnet?

c. A university has 150 LANs with 100 hosts in each LAN. Suppose the university has one class B address. Design an appropriate subnet-addressing scheme. Draw the diagram of the network showing subnet mask, subnet ID, and IP addresses.

(7+3+6)

a. What problem does TCP Reno have with multiple packet losses from a window? Give an example to illustrate.

b. In addition to having acknowledgement field in the TCP header, ACK bit is also provided. What would happen if the ACK bit were not provided?

c. What is the maximum data rate at which a host can send 1000 byte TCP payload if the packet lifetime is 100 seconds without having sequence number wrap-around? Assume TCP header of 20 bytes and IP header of 20 bytes.