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End-Term Examination

November 2024, Computer Networks (CSN-341)

Maximum Marks: 50 **Time Allowed: 3 Hours**

Note:
1. Attempt ALL questions.
2. MOST IMPORTANT: Attempt all parts of a question together. Attempt questions in the same order as given in the question paper.
3. Symbols and abbreviations have their usual meaning.
4. In addition to correctness of answer, the quality of the answer will also be considered during evaluation.

Question 1

(a) In TCP, what is revealed by the event of receiving three duplicate ACKs at the sender side about the following segments: (2 Marks)

i. About the last three segments sent from the sender side.
ii. About the expected segment at the receiver side.

(b) With reference to error detection block codes, answer the following: (1+1 =2 Marks)

(i) During the transmission of a 16-bit word, if some bits are swapped, will the traditional checksum be able to detect error? Justify your answer.

(ii) In CRC, if dataword is 5 bits in size and codeword is 8 bits in size, what is the size of remainder and divisor?

(c) Consider a computer network scenario where the distance between the sender and receiver is 5000 Km. Given that the bandwidth is 1 Gbps. Further it is given that the propagation speed of the media is 2×10^8 m/sec and the packet size is 50000 bits. Answer the following if we need to design an efficient Selective-Repeat sliding window protocol for this scenario avoiding congestion as far as possible: (2+2+2+2=8 Marks)

[It is to mention that bandwidth-delay product indicates the maximum possible number of bits on the pipe]

(i) Find bandwidth delay product.
(ii) Find maximum size of send and receive window so that there is no packet loss.
(iii) Find minimum size of sequence number field in bits.
(iv) Find minimum value of timeout timer at sender side to avoid early retransmission.

Question 2

(a) (1+1+7+1=10 Marks)

An ISP is granted the block 80.70.56.0/21. The ISP needs to allocate addresses for two organizations each with 500 addresses, two organizations each with 250 addresses, and three organizations each with 50 addresses.

(i) Find the number of addresses in the ISP block.
(ii) Find the first address and last address in the ISP block.
(iii) Find the range of addresses (first address, last address, and number of addresses) along with corresponding block prefixes for all of the eight organizations to which the ISP is allocating addresses.
(iv) Find the range (first address, last address, and number of addresses) of unallocated addresses from the ISP block.

(b)

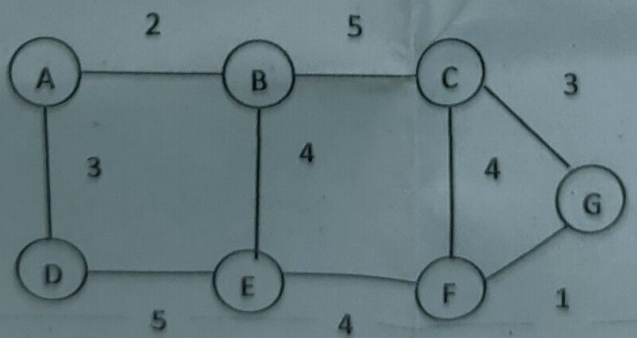
Consider a situation, where a TCP client is communicating with a TCP server and thus following the rules of TCP for error control as well as for all other applicable tasks at transport layer. Properly list down the reactions of the TCP server to the following events along with corresponding justification and diagrams:
(2*2=4 Marks)

(i) Assume that a TCP server expects to receive byte 2001, but it receives a segment with sequence number 2200.
(ii) Assume that a TCP server is expecting to receive byte 6001. It receives a segment with the sequence number 6001 that carries 2000 bytes. Given that at this moment, the server has bytes 4001 to 5000 to send to client.

Question 3

(a) (2+2+2 =6 Marks)

Consider the network shown in the following figure. Answer following questions with reference to link state routing in detail showing all steps using diagrams along with corresponding discussion.



(i) Show link state packets created and sent out by each of the node for above network using a diagram and explain how these are used to create link state database.

(ii) Create least cost tree for node A and node G for the network shown above. Show all the steps of creating these trees.

(iii) Show forwarding tables consisting of information about destination, cost and next hop for the node A and G using the information from (ii) above.

(b)

(i) Draw the graph for the Manchester encoding scheme and Differential Manchester encoding scheme using each of the following data streams. Assume that the last signal level has been positive at 90 degree. (1+1=2 Marks)

A. 00000000 B. 11111111

(ii) With the help of diagrams, explain the principle based on which the light propagate within the fiber-optic cable. (2 Marks)

(iii) A signal can be decomposed into five sine waves with frequencies at 0, 25, 60, 100, and 200 Hz. Draw the signals in the frequency domain and show its bandwidth. (2 Marks)

Question 4

(a)

Consider a CSMA/CD network in bus topology with only two stations A and B. Given that the maximum propagation time for a frame (Tp) is 25 microsecond and the average time required to send out a frame (Tfr) is 40 microsecond. Station A starts sending a frame at time t1=0.0 microsecond and station B starts sending a frame at time t2= 23.0 microsecond. Then, answer following: (2+2+2+2=8 Marks)

(i) If frame from A and frame from B collide at t^{th} microsecond, what is the value of t?

(ii) At which time collision news reaches to A? Does station A detects collision before it finished transmission? Explain.

(iii) At which time collision news reaches to B? Does station B detects collision before it finished transmission? Explain.

(iv) If the value of Tfr cannot be changed, then what should be the value of maximum value of Tp to avoid collision? What is relation between Tfr and Tp in CSMA/CD?

(b) Given that the maximum effect (in the form of error bits) of 4 ms burst of noise on data transmitted at the rate of 1500 bps and 12 kbps is s1 and s2, respectively? Calculate the value of s1 and s2. [2 Marks]

(c) Show the position of the socket interface in the TCP/IP layered architecture. In this context, what the socket is and which layer is responsible for its creation and usage? [2 Marks]

----------End of Paper----------