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Paper Code: TCS 505 / TIT 505

End Semester Examination, 2018
B.Tech. (CS/IT)

Paper Name: Computer Network -II

Time: Three Hours

MM: 100

Note:

(i) This question paper contains five questions.
(ii) All questions are compulsory.
(iii) Each question contains three parts a, b, c. Attempt any two out of three parts.
(iv) Each part carries *ten* marks. Total marks assigned to each question are twenty.

Q1a). Suppose nodes A, B, and C each attach to the same broadcast LAN (through their adapters). If A sends thousands of IP datagrams to B with each encapsulating frame addressed to the MAC address of B, will C's adapter process these frames? If so, will C's adapter pass the IP datagrams in these frames to the network layer C? How would your answers change if A sends frames with the MAC broadcast address? [2+8]

b). A bit stream 110011101 is transmitted using the standard CRC method described in the text. The generator polynomial is $x^4 + x + 1$. Show the actual bit string transmitted. Suppose that the third bit from the left is inverted during transmission. Show that this error is detected at the receiver's end. Give an example of bit errors in the bit string transmitted that will not be detected by the receiver. [5+3+2]

c). Suppose nodes A and B are on the same 10 Mbps broadcast channel, and the propagation delay between the two nodes is 245 bit times. Suppose A and B send Ethernet frames at the same time, the frames collide, and then A and B choose different values of K in the CSMA/CD algorithm. Assuming no other nodes are active, can the retransmissions from A and B collide? Suppose A and B begin transmission at t = 0 bit times. They both detect collisions at t = 245 bit times. Suppose $K_A = 0$ and $K_B = 1$. At what time does B schedule its retransmission? At what time does A begin transmission? At what time does A's signal reach B? Does B refrain from transmitting at its scheduled time? [2+2+2+2+2]

Q2a). i). Show that two-dimensional parity checks can correct and detect a single bit error. Show (give an example of) a double-bit error that can be detected but not corrected.

ii). Explain the Point-to-Point Protocol (PPP) frame format. [5 + 5]

b). i). We have sampled a low-pass signal with a bandwidth of 200 KHz using 1024 levels of quantization. Calculate the bit rate of the digitized signal and the PCM bandwidth of this signal.

ii). Ten signals, each requiring 4000 Hz, are multiplexed onto a single channel using FDM. What is the minimum bandwidth required for the multiplexed channel? Assume that the guard bands are 400 Hz wide. [5 + 5]

c). Draw the graph of the Manchester and Differential Manchester schemes for the following data streams, assuming that the last signal level has been positive. From the graphs, guess the bandwidth for this scheme using the average number of changes in the signal level. [5 + 5]

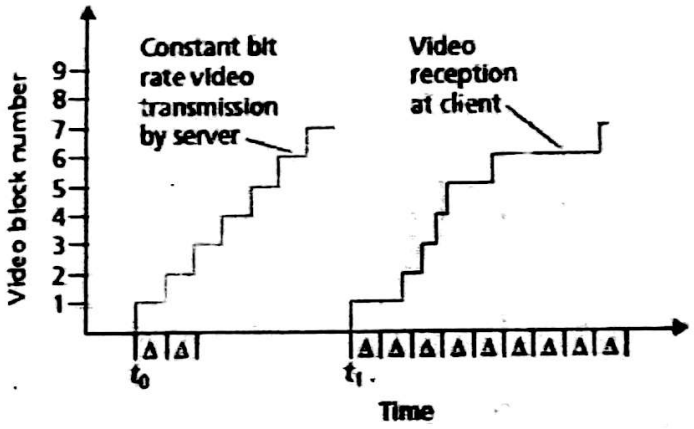
1001011000101

Q3a).i). The telephone line has 4 KHz bandwidth. What is the maximum number of bits we can send using each of the following techniques? Let d = O.

(i) ASK
(ii) FSK
(iii) QPSK
(iv) 16-QAM
(v) 64-QAM

ii). Explain the term Transmission impairment. Explain the various causes of impairment in media. [5 + 5]

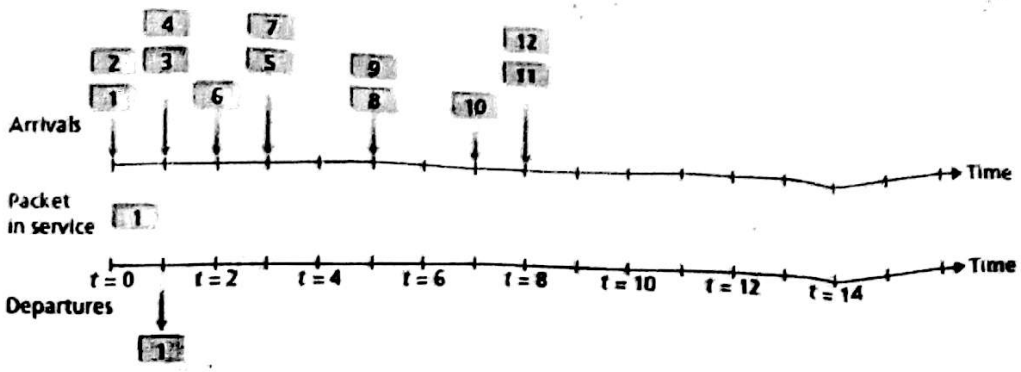
b). Consider the figure below. Suppose that video is encoded at a fixed bit rate, and thus each video block contains video frames that are to be played out over the same fixed amount of time, Δ. The server transmits the first video block at Δ, the second block at $t_0 + \Delta$, the third block at $t_0 + 2\Delta$, and so on. Once the client begins playout, each block should be played out Δ time units after the previous block.



i) Suppose that the client begins playout as soon as the first block arrives at t_1. In the figure below, how many blocks of video (including the first block) will have arrived at the client in time for their playout? Explain how you arrived at your answer.

ii) Suppose that the client begins playout now at $t_0 + \Delta$. How many blocks of video (including the first block) will have arrived at the client in time for their playout? Explain how you arrived at your answer. [5 + 5]

c). Consider the figure below. Answer the following questions:



i. Assuming priority service, and assume that odd-numbered packets are high priority, and even-numbered packets are low priority. Indicate the time at which packets 2 through 12 each leave the queue. For each packet, what is the delay between its arrival and the beginning of the slot in which it is transmitted? What is the average of this delay over all 12 packets? [5]

ii. Now assume round robin service. Assume that packets 1, 2, 3, 6, 11, and 12 are from class 1, and packets 4, 5, 7, 8, 9, and 10 are from class 2. Indicate the time at which packets 2 through 12 each leave the queue. For each packet, what is the delay between its arrival and its departure? What is the average delay over all 12 packets? [5]

Q4a).i). Suppose Alice has a message that she is ready to send to anyone who asks. Thousands of people want to obtain Alice's message, but each wants to be sure of the integrity of the message. In this context, do you think a MAC-based or a digital-signature-based integrity scheme is more suitable? Why? [5]

ii). Suppose that Bob receives a PGP message from Alice. How does Bob know for sure that Alice created the message (rather than, say, Trudy)? Does PGP use a MAC for message integrity? [5]

b). Explain the RSA key generation algorithm. Consider RSA with p = 11 and q = 17 than find the following:

i). What are n and z or $\phi(n)$?

ii). Let e be 3. Why is this an acceptable choice for e?

iii). Find d such that $de = 1 \pmod{z}$ and $d < 160$. [3+3+4]

c). Consider the 3-bit block cipher in Table below. Suppose the plaintext is 100100100. (i) Initially assume that CBC is not used. What is the resulting ciphertext? (ii) Suppose Trudy sniffs the ciphertext. Assuming she knows that a 3-bit block cipher without CBC is being employed (but doesn't know the specific cipher), what can she surmise? (iii) Now suppose that CBC is used with IV = 111. What is the resulting ciphertext? [2+3+3]

input	output	input	output
000	110	100	011
001	111	101	010
010	101	110	000
011	100	111	001

Q5 a). Describe the format of the 802.15.1 Bluetooth frame. You will have to do some reading outside of the text to find this information. Is there anything in the frame format that inherently limits the number of active nodes in an 802.15.1 network to eight active nodes? Explain. [5 + 5]

b).i). Suppose that A, B, C and D are simultaneously transmitting 0 bits, using a CDMA system with the chip sequences of station A, B, C and D are defined as, A = (–1 –1 –1 +1 +1 –1 +1 +1), B = (–1 –1 +1 –1 +1 +1 +1 –1), C = (–1 +1 –1 +1 +1 +1 –1 –1) and D = (–1 +1 –1 –1 –1 –1 +1 –1) respectively. What is the resulting chip sequence?

ii). Explain the various steps involve in routing / communication between Mobile Host (MH)/ Mobile Node (MN) and Remote Host (RH). [5 + 5]

c).i) Consider two mobile nodes in a foreign network having a foreign agent. Is it possible for the two mobile nodes to use the same care-of address in mobile IP? Explain your answer.

ii). If a node has a wireless connection to the Internet, does that node have to be mobile? Explain. Suppose that a user with a laptop walks around her house with her laptop, and always accesses the Internet through the same access point. Is this user mobile from a network standpoint? Explain. [5 + 5]

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