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Uva Wellassa University of Sri Lanka
Faculty of Science and Technology
Science and Technology Degree Program
3rd Year 2nd Semester Examination August / September 2014
SCT 377-3 Data Communications & Networking

Uva Wellassa University

Mark allocation: Part-B: 400 mark
Time allocation: Two (2) hours
Number of questions: Four (4)
Answer all questions.

Part – B

1.

a. A person needs to send four data items: Ox3456, OxABCC, Ox02BC, and OxEEEE. Answer the following questions considering above mentioned data units.

i. Find the checksum at the sender site. (10 mark)
ii. Find the checksum at the receiver site if there is no error. (10 mark)
iii. Find the checksum at the receiver site if the second data item is changed to OxABCE. (10 mark)

b. Answer the following questions assuming a Simple Even Parity Check code only four bit are used in the dataword.

i. Consider all the combinations that can be produced using four bits and then generate codewords belong to each dataword. (10 mark)
ii. Illustrate whether the generated code in part (i) is linear and Cyclic Redundancy Check code. (10 mark)
iii. Identify the minimum hamming distance. (10 mark)
iv. Prove that the above coding scheme can be used to detect single bit errors. (10 mark)
v. Assuming that the sender consult the dataword 1011 and then send the corresponding codeword to the receiver. Consider the following cases and then identify related syndrome and dataword at the receiver's side.
    1. No error occurs
    2. One bit corrupted
    3. Two bits corrupted
    4. Three bits corrupted (20 mark)
vi. Show that odd number of errors can be detected using this coding scheme. (10 mark)

2.

a. Describe and illustrate the physical construction characteristics of the following transmission media.
   i. Twisted pair
   ii. Coaxial cable
   iii. Optical fiber cable (30 mark)

b. Discuss advantages and disadvantages of microwave, optical fiber and radio transmission in terms of cost, ease of installation, adapting and providing range of services to the consumers and applications. (20 mark)

c. Compare and contrast different generations in mobile telephone systems. (20 mark)

d. Choose only three (3) topics and write short notes from the followings.
   i. Multipath fading
   ii. Path diversity
   iii. Mobility
   iv. VSAT network
   v. Geo-Stationary earth orbit (30 mark)

3.

a. Briefly explain the causes of transmission impairments. (30 mark)

b. What is the phase shift for the following?
   i. A sine wave with the maximum amplitude at time zero
   ii. A sine wave with maximum amplitude after 1/4 cycle
   iii. A sine wave with zero amplitude after 3/4 cycle and increasing (15 mark)

c. A non-periodic composite signal contains frequencies from 10 to 30 KHz. The peak amplitude is 10 V for the lowest and the highest signals and is 30 V for the 20KHz signal. Assuming that the amplitudes change gradually from the minimum to the maximum, draw the frequency spectrum and calculate the bandwidth of the signal. (20 mark)

d. There is a channel with 4 KHz bandwidth. If it is required send data at 100 Kbps, what is the minimum SNR_{dB}? What is SNR? (10 mark)

e. What is the total delay (latency) for a frame of size 5 million bits that is being sent on a link with 10 routers each of them has a queuing time of 2 μs and a processing time of 1 μs. The length of the link is 2000 Km. The speed of light inside the link is 2×10^8 ms^{-1}. The link has a bandwidth of 5 Mbps. Which component of the total delay is dominant? Which one is negligible? (25 mark)

4.

a. A path in a digital circuit-switched network has a data rate of I Mbps. The exchange of 1000 bits is required for the setup and teardown phases. The distance between two parties is 5000 km. Answer the following questions if the propagation speed is 2 X 10^8 ms^{-1}.

   i. What is the total delay if 1000 bits of data are exchanged during the data transfer phase?
   ii. What is the total delay if 1,000,000 bits of data are exchanged during the data transfer phase? (20 mark)

b. Five equal-size datagrams belonging to the same message leave for the destination one after another. However, they travel through different paths as shown in following table.

Datagram	*Path Length in km*	*Visited Switches*
1	3200	1,3,5
2	11 700	1,2,5
3	12 200	1,2,3,5
4	10 200	1,4,5
5	10 700	1,4,3,5

We assume that the delay for each switch (including waiting and processing) is 3, 10, 20, 7, and 20 ms respectively. Assuming that the propagation speed is 2 x 10^8 ms^{-1} find the order the datagrams arrive at the destination and the delay for each. Ignore any other delays in transmission. Assume that all datagrams starts at time 0.
(50 mark)

c. We need a three-stage space-division switch with N =100. We use 10 crossbars at the first and third stages and 4 crossbars at the middle stage.

   i. Draw the configuration diagram.
   ii. Calculate the total number of cross points.
   iii. Find the possible number of simultaneous connections.
   iv. Find the possible number of simultaneous connections if we use one single crossbar (100 x 100).
   v. Find the blocking factor, the ratio of the number of connections in c and in d.
(30 mark)