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00156

The Open University of Sri Lanka

ECX5234 Data Communications
FINAL EXAMINATION– 2009/2010 (CLOSED BOOK)

DATE: 12th March 2010 **0930 hrs – 1230 hrs**

Answer any 5 questions. All questions carry equal marks.

Q1 (a) What are the 5 layers in the internet protocol stack? State the main responsibilities of each of these layers. [05]

(b) For each of the following protocols, briefly explain its significance in networking applications and specify in which layer of the internet protocol it operates:

(i) SMTP (ii) DNS (iii) UDP (iv) IGMP (v) FTP [05]

(c) Briefly explain what delta modulation is and how it affects the sampling rate and the quantization accuracy compared to pulse code modulation. [02]

(d) Consider an audio signal with spectral components in the range 300 to 3000 Hz. Assume that this signal is sampled at a rate 20% above the Nyquist rate and quantized to generate a PCM signal. For SNR = 30dB,

(i) Calculate the number of uniform quantization levels needed.

(ii) What is the required data rate? [08]

Q2 (a) Consider a data frame consisting of two characters of 4 bits each. Assume that the probability of bit error is 10^{-3} and it is independent for each bit.

(i) What is the probability that the received frame contains at least one error?

(ii) Now add a parity bit to each character. What is the probability that the received frame contains at least one error? [04]

(b) What is the purpose of using modulo-2 arithmetic rather than binary arithmetic in computing frame check sequence (FCS) in Cyclic Redundancy Check (CRC)? [02]

(c) (i) In CRC error detection scheme, the polynomial is chosen as

$P(x) = x^4 + x + 1$. Encode the message 10010011011 with this. [04]

(ii) Suppose the channel introduces an error pattern 010010000000000. (i.e. a flip from 0 to 1 or from 1 to 0 in positions 2 and 5 from the left in the transmitted message.) What is the received bit sequence? Can the error be detected? [04]

(iii) Suppose the channel introduces an error pattern 010011000000000. (i.e. a flip from 0 to 1 or from 1 to 0 in positions 2, 5 and 6 from the left in the transmitted message.) What is the received bit sequence? Can the error be detected? [04]

(iv) Comment on your answers in (ii) and (iii) explaining the possibility of error detection in CRC. [02]

Q3 (a) How is access to the shared medium achieved in Ethernet, Token Ring and 802.11 networks respectively? Briefly explain each method. [09]

(b) The Ethernet medium access control (MAC) protocol is often nick-named as both "Listen before talk" and "Listen while talk". Identify how these nick-names relate to the Ethernet MAC protocol. [02]

(c) What is the reason for requiring an Ethernet frame to be at least 64 bytes long? [03]

(d) Suppose the length of a 10BaseT cable is 2500m. The propagation speed in a thick coaxial cable is $2x10^8$ m/s.

(i) How long does it take for a bit to travel from the beginning to the end? (Ignore any propagation delay in the equipment.)

(ii) How long does it take to create the smallest frame? Show your calculation.

[06]

Q4 (a) Stop and Wait Automatic Repeat Request (ARQ) protocol works well on channels that have low propagation delay. Justify this using a suitable example. [03]

(b) Consider a communication channel that uses Go-Back-N ARQ protocol with a 2 bit sequence number. Use timing diagrams to show what happens in the following 3 scenarios. Comment on the possibility of identifying the correct frame at the receiver in each case.

(i) When N = 5 and the acknowledgements of the first set of N frames are lost. [04]

(ii) When N = 4 and the acknowledgements of the first set of N frames are lost. [04]

(iii) When N = 3 and the acknowledgements of the first set of N frames are lost. [04]

(c) Hence determine the most suitable value for N. [02]

(d) Differentiate Go-Back-N ARQ method with Selective Repeat ARQ method and explain the situations where Go-Back-N ARQ is best suited and where Selective Repeat ARQ is best suited. [03]

Q5 (a) Describe the role of the DNS system in e-mail distribution. [03]

(b) Consider an HTTP client who wants to retrieve a Web document at a given URL. The IP address of the HTTP server is initially unknown. The web document at the URL has one embedded GIF image that resides at the same server as the original document. What transport and application layer protocols are needed for this scenario? Explain this process. [06]

(c) Briefly explain the operating principle of ADSL. Clearly describe how ADSL has a higher download speed, compared to upload speed. [05]

(d) State what is meant by broadband communication. Briefly explain 2 commonly used wireless broadband techniques giving their important features. [06]

Q6. (a) Compare Link State routing and Distance Vector routing in terms of convergence time, memory and processing requirements. [06]

(b) Briefly explain two commonly used interior gateway protocols which are used to route internet communications within a local area network stating their main features. [04]

(c) For the network diagram given in Fig. Q6, find out the least cost paths from node B to all other nodes using Distance Vector routing mechanism. Relevant path costs are marked along each link. [10]

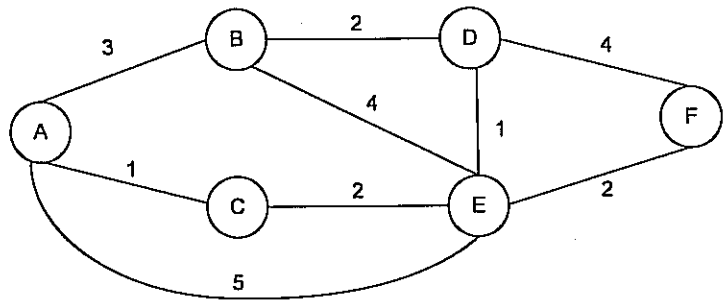

Fig. Q6

You should show clearly how you get the least cost paths by providing suitable table entries or graphs.

Q7. (a) Briefly describe the meaning of supernetting with an example given in CIDR format. [02]

(b) Assume an ISP has an address block 128.20.224.0/19. It has two customer networks of size 2000 nodes each and three customer networks of size 1000 nodes each.

(i) Assuming that the ISP allocates IP addresses sequentially from the beginning of its address space, what are the prefix allocations for these customers? [05]

(ii) The remaining customer networks have a size of 250 nodes each. How many remaining customer networks can be supported? [03]

(iii) For each of the above networks find:

a. Subnet address in CIDR format

b. Subnet mask

c. Broadcast address [10]

Clearly show the steps you follow in getting your results for the above questions.

Q8 (a) Compare and contrast connection oriented communication and connectionless communication. Give an example protocol for each. [04]

(b) Consider a file of 8000 bytes to be sent over a communication path of 5 links. Each link transmits at the rate of 2 Mbytes/sec. The network is lightly loaded so that there are no queuing delays. Propagation delay is also negligible. When packet switching is used the file is broken into packets of size 1000bytes each. Find the time taken to send the file from source to destination for the following cases:

(i) Suppose that the network is a circuit switched network with the total circuit set up time of 10 sec and a header of 20 bytes is appended to the entire file. [04]

(ii) Assume that message switching is used and a header of 40 bytes is appended to the entire message. [04]

(iii) Suppose the network is a packet switched virtual circuit network with the VC set up time of 100 msec and the header size of each packet is 20 bytes. [04]

(iv) Suppose the network is a packet switched datagram network and each packet has a header size of 40 bytes. [04]