



Course Title: Information Theory
Date: 6/6/2017 (Second Term)

Course Code: EEC4237
Allowed time: 3 hours

Year: 4th
No. of Pages: (2)

Remarks: (answer the following questions, assume any missing data, answers should be supported by sketches, Neat answers and boxed results are appreciated)

Question (1)

- (a) Find the upper limit of capacity for continuous channel.
- (b) A terminal is used to enter alphanumeric data into a computer through a telephone channel of 3400 Hz. It is found that the obtained channel rate is 14929 bit/sec. Determine:
 - (i) S/N in dB.
 - (ii) If the channel bandwidth is doubled, what will be the required S/N for the same channel rate?
- (c) Construct a convolution encoder with the commutator samples $C_1 = D_1$, $C_2 = D_1 \oplus D_2$, and $C_3 = D_1 \oplus D_2 \oplus D_3$. The data input stream is 1011. Find the message coded by the encoder.

Question (2)

- (a) Show that the mutual information is symmetrical.
- (b) Prove that; $I(X;Y) = H(X) + H(Y) - H(X,Y)$.
- (c) For a binary symmetric channel whose input source is the alphabet $X = \{0, 1\}$ with probabilities $\{0.5, 0.5\}$ and whose output alphabet is $Y = \{0, 1\}$, having the following channel matrix where e is the probability of transmission error:

$$\begin{pmatrix} 1-e & e \\ e & 1-e \end{pmatrix}$$

- i. What is the entropy of the source, $H(X)$?
- ii. What is the probability distribution of the outputs, $p(Y)$, and the entropy of this output distribution, $H(Y)$?
- iii. What is the joint probability distribution for the source and the output, $p(X,Y)$, and what is the joint entropy, $H(X,Y)$?
- iv. What is the mutual information $I(X;Y)$ of this channel?
- v. How much uncertainty is there about the input symbol once an output symbol has been received?
- vi. What value of e maximizes the uncertainty $H(X|Y)$ about the input symbol given an output symbol?
- vii. How many values are there for e for which the mutual information of this channel is maximal? What then is the capacity of such channel?
- viii. For what value of e is the capacity of this channel minimal? What is the channel capacity in that case?

Question (3)

- (a) Check if the following code $C = \{0, 11, 100, 110\}$ is instantaneous or not? If not; find its instantaneous one.
- (b) Compare between GBN ARQ and SR ARQ schemes (answer should be in a table).
- (c) Check whether the received signal "0010111010101100" is error-free or not using Hamming code (16, 11) where the Hamming bits are in positions 1, 2, 4, 8, and 16.
- (d) Using CRC to detect any error in the received message at a channel output when the data message was "1011011010", using the polynomial $P(x) = x^4 + x^3 + 1$.

Question (4)

- (a) Define strong-noise channel and symmetrical one; give an example for each? Write the mathematical expression of each one representing probability and entropy.
- (b) Is it possible that a nonzero error pattern can produce zero syndrome? Justify your answer.
- (c) The parity check matrix is given by the following

$$\begin{bmatrix} 1 & 0 & 1 & 1 & 1 & 0 & 0 \\ 1 & 1 & 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 1 & 1 & 0 & 0 & 1 \end{bmatrix}$$

- (i) Find the P matrix.
- (ii) Find the generator matrix, G.
- (iii) What is the dimension of the code?
- (iv) Check which of the following is a codeword; (1001011), (0101100), and (1101100)?
- (v) What is the information message if the received codeword is "1011110"?
- (vi) Does the parity check matrix allow the presence of the codewords of weight less than 3 (apart from the all zero codeword). Why?
- (vii) Suppose that the code is used for error detection only over a binary symmetric channel with error rate $p = 10^{-3}$. Find the probability of undetected error.

Best Wishes of Success
Dr. Heba A. El-Khobby



Course Title: Multimedia and Image Processing (Elective course 4) Course Code: EEC4235
Date: 11/06/2017 Allowed time: (3) hrs.

Year: 4rd
No. of Pages: (1)

Please answer the following questions

Question No. 1:

- A) Mention the concept of multimedia with addressing the multimedia modalities and its applications.
- B) Draw the block diagrams of the image processing system indicating the three processing levels as well as the key stages in the digital image processing system.
- C) Explain the processes included in capturing a digital image of a real-world scene.
- D) Mention four multimedia software tools.

Question No. 2:

- A) What is the main component in the video? Draw the video sequence with time? Explain is the correlation between the frames in a video better to be high or low?
- B) Compare between the spatial and frequency domain techniques in image enhancement.
- C) Define the histogram and histogram equalization using equations.
- D) Draw the histogram distribution as an example for dark image and bright image.

Question No. 3:

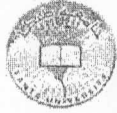
- A) Derive using equations the Laplacian filter and the Sobel operator for image enhancement.
- B) Mention the approaches that can be used to deal with the missing edge pixels.
- C) Illustrate with drawing the discrete Fourier transform (DFT) and the transfer function of the Butterworth for image processing.
- D) Describe with equations the concept of adaptive median filter and its uses.

Question No. 4:

- A) Define the segmentation process. Give an example the design of an edge detection filter.
- B) Address the different segmentation techniques with detailed description using their algorithms. Compare between the local and global thresholding.
- C) Define the data compression process, its goals and its basic methods. What are the different types of redundancy? Compare between the audio and image compression. Write the steps of the Huffman-coding.
- D) Compare between the lossless and lossy compression. What are the different frame types in the Moving Pictures Expert Group (MPEG) technique? What are the benefits of using real time video encoding?

End of Questions

Good luck
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Course: Computer Networks

Date: Thu., 08-June-2017,

Course Code: EEC4231,

Time Allowed: 3 hours,

Students: 4th year

No. of Pages: 2,

Final Exam

(Total Marks: 75 marks)

Answer the following questions:

Question 1: [20 Marks]

a) Find the OSI layer that perform the following functions:

- | | | | |
|-----------------------|-------------------|-----------------------|----------------|
| 1- Data rate | 2- Access control | 3- Connection control | 4- Grouping |
| 5- Line configuration | 6- addressing | 7- Flow control | 8- Compression |

b) A 24 bit data stream, 101100101011100110110101. If the word size is 8 bits (i.e. the stream represents 3 bytes). Find the VLRC. If errors occurred at the bits 3,9,10 counted from the MSB side. Does VLRC capable for error detection and correction for these errors?

c) Compare between the networking devices: routers and gateways.

Question 2: [20 Marks]

a) With the aid of diagrams, describe the different Automatic Repeat Request (ARQ) mechanisms. Deduce the advantages and disadvantages of each technique.

b) Use charts to clarify the types and categories of the multiple access protocols.

c) Compare Pooling to Reservation media access protocols. Use diagrams and flow charts when possible.

d) With the aid of flow charts and performance curves show the differences between the common types of random access techniques. Deduce the suitable network topology for each access protocol stated.

Question 3: [15 Marks]

- a) In Fig.1, you have a subnetwork, 192.168.214.0/24. It is divided into subnet A and subnet B. You want to add a third subnet, C, with 10 hosts. Is this possible? If yes, provide the network address (i.e. Subnet ID) of the new subnet you will be adding (i.e. 192.168.2.14).

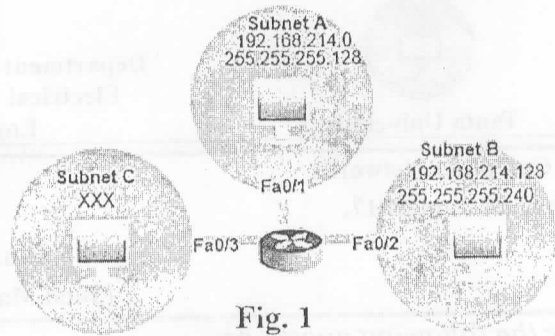


Fig. 1

- b) What is the valid host range of the subnet that host 192.168.28.67, 255.255.255.224 is a part of?

- c) Based on the information in Fig.2, using the address space 172.16.0.0, design a network addressing scheme that will supply the minimum number of hosts per subnet with the most efficient use of the given addressing space.

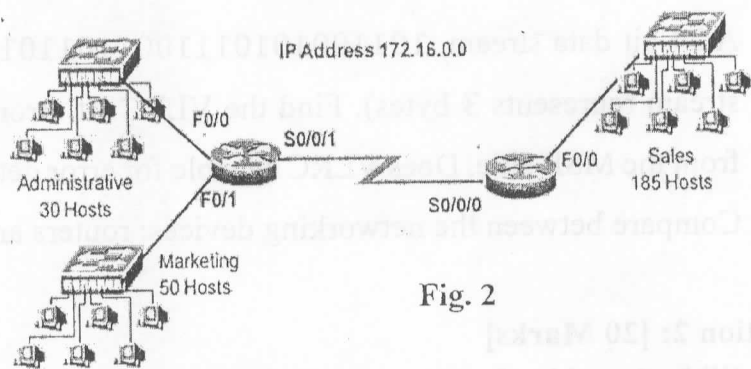


Fig. 2

Question 4: [20 Marks]

- a) Compare between the different WLAN's MAC layer management frames in terms of: their purpose, content and the entity (APs or STAs) that is responsible for transmitting each one?
- b) Using diagrams, compare the architectures of WiFi access points (AP) and stations (STA).
- c) Classify wireless sensor network routing protocol according to: Network organization, Protocol operation.
- d) Write short notes on: stages of handshaking phase in SPIN protocol, SPIN's metadata, SPIN protocol families.

With best wishes of success

Dr. Sameh A. Napoleon

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