٤ اغلاث

Tanta University

Department: Electronics and Communication Engineering
Total Marks: (**90**) Marks

Faculty of Engineering

Course: Mobile Communication Systems	**Course Code:** EEC 4230	**Year:** 2nd Semester 2018-2019
Date: 1/6/2019 (**Final Exam**)	**Time:** 3 hours	**No of Pages:** (4) pages

Remarks:
- Answer **All** of the following Questions.
- It is **allowed** to use Erlang B, Erlang C, and Q-function Tables.

Question # 1: (20) Marks

(a) (**5 Marks**) A cellular service provider decides to use a digital TDMA scheme which can tolerate a signal-to-interference ratio of 18 dB in the worst case. Assume a path loss exponent of $n = 3.5$, find the optimal value of cluster size N that satisfy this SIR requirement for:

i. Omni-directional antennas

ii. 120^0 sectoring

iii. 60^0 sectoring

(b) (**5 Marks**) Does 120^0 sectoring increase or reduce the capacity compared to an omni-directional antennas? If a 120^0 sectoring is used and a total of 28.8 MHz is allocated for the duplex cellular system. Assume each simplex channel has 25 kHz, how many channels are available per sector?

(c) (**5 Marks**) If the channels in each sector are trunked, how many users can be supported thought the 3000 sq. miles coverage area and what is the trunking efficiency for a GoS specification of 2% probability of blocking?, given that each user generates 0.1 Erlangs of traffic for call request rate of 1 call per hour, and assuming hexagonal cells of 100 sq. miles area each

(d) (**5 Marks**) If the system is upgraded to a blocked-calls delayed system with 2% probability of a call being delayed, and infinite buffer memory at the base station. What is the probability that calls are lost in the system, given that the maximum queuing time is 200 milliseconds?.

Question # 2: (20) Marks

(a) (**5 Marks**) Illustrate **briefly** the basic mechanisms impacting both large scale and small scale radio propagations.

(b) (**5 Marks**) Mention **Three** of the empirical models used in outdoor channel modeling illustrating its advantage over log-normal shadowing models.

(c) (**5 Marks**)

Consider seven-cell frequency reuse. Cell B1 is the desired cell and B2 is a co-channel cell as shown in Fig. 1. For a mobile located in cell Bl, find the minimum cell radius R to give a forward link C/I ratio of at least 18 dB at least 99% of the time. Assume the following: Co-channel interference is due to B2 only, $f_c = 890$ MHz, $d_0 = 1$ km. Assume $G_{BS} = 6$ dBi and $G_{MS} = 3$ dBi. The TX power, $P_t = 10$ W (assume equal power for all BSs). Assume $PL[dB]$ between the mobile and base B1 is given as:

$$\bar{PL}[dB] = PL(d_0) + 10(2.5)\log_{10}(\frac{d_1}{d_0}) - X_\sigma \qquad \sigma = 0dB$$

and $PL[dB]$ between the mobile and base B2 is given as

$$\bar{PL}[dB] = PL(d_0) + 10(4.0)\log_{10}(\frac{d_2}{d_0}) - X_\sigma \qquad \sigma = 7dB$$

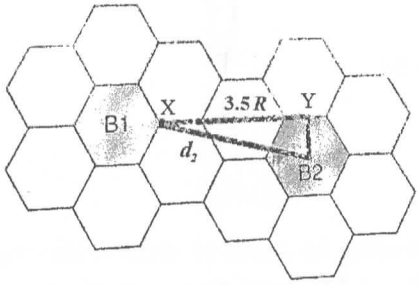

Figure 1: co-channel interference geometry between B1 and B2

(d) (**5 Marks**) Given the following geometry in Fig. 2, determine the loss due to knife edge diffraction, and the hight of the obstacle required to induce $6dB$ diffraction loss. Assume $f = 900MHz$.

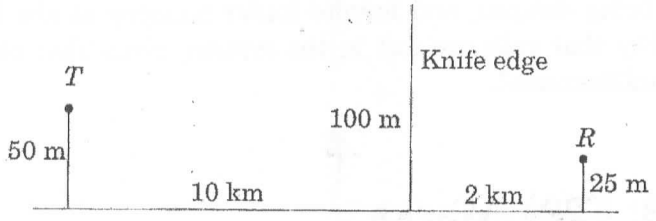

Figure 2

Question # 3: (20) Marks

(a) (5 Marks) Explain Briefly with sketches **two** of the channel sounding techniques for estimating the power delay profiles in wireless systems.

(b) (5 Marks) Given that the received signal amplitude r, over a wireless channel, is a Rayleigh distributed random variable. Compute the following: The mean, variance, and median value of r?

(c) (7 Marks) The local average dely profile in a particular enviroment is found to be

$$p(\tau) = \sum_{n=0}^{2} \frac{10^{-6}}{n^2+1} \delta(\tau - n10^{-6})$$

(i) Sketch the power delay profile of the channel in dBm.
(ii) What is the local average power in dBm?
(iii) What is the rms delay spreed of the channel?
(iv) If 256 QAM modulation having a bit rate of 2 Mbps is applied to the channel, will the modulation undergo flat or frequency selective fading? explain your answer.
(v) Over what BW will the channel appear to have constant gain?

(d) (3 Marks) For a mobile RX operating at frequency of 860 MHz moving at 100 km/hr. Calculate the level crossing rate and average fade duration if $\rho = -20dB$.

Question # 4: (15) Marks

(a) (4 Marks) Capacity in AWGN is given by $C = B\log_2(1 + \frac{S}{N_0 B})$. Find the capacity in the limit of infinite bandwidth as a function of S.

(b) (7 Marks) Consider a flat fading channel of BW 20MHz where for a fixed transmit power, the received SNR is one of six values: $\gamma_1 = 20dB, \gamma_2 = 15dB, \gamma_3 = 10dB, \gamma_4 = 5dB, \gamma_5 = 0dB, \gamma_6 = -5dB$. The probability associated with each state is $p_1 = p_6 = 0.1, p_2 = p_4 = 0.15, p_3 = p_5 = 0.25$. Assume only the RX has CSI.
(i) Find the shannon capacity of this channel.
(ii) Plot the capacity versus outage for $0 \leq P_{out} < 1$ and find the maximum average rate that can be correctly received.

(c) (4 Marks) What are the benefits of the following digital modulation schemes over their legacy systems: (i) $\pi/4$QPSK (legacy: QPSK), (ii) GMSK (legacy: MSK; FSK), and mention one example of cellular system employing each of them.

Question # 5: (15) Marks

(a) (**7 Marks**) Differential BPSK and GMSK signals have the following Bit error probability over AWGN channels:

$$P_e = 0.5e^{-\frac{E_b}{N_0}} \qquad (DPSK)$$

$$P_e = Q(\sqrt{\frac{2 \times 0.68 \times Eb}{N_0}}) \qquad (0.25GMSK)$$

where $Q(x) \approx \frac{1}{12}e^{-\frac{1}{2}x^2} + \frac{1}{4}e^{-\frac{4}{6}x^2}$

(i) Derive an expression for the bit error probability fo DPSK and 0.25GMSK over Rayleigh fading channel.

(ii) Using your expression over Rayleigh fading channel, compare the performance of two mobile devices at 10 dB SNR, if one of them employs DPSK modulation while the other employs 0.25GMSK.

(b) (**4 Marks**) Explain briefly how equalizers are needed to reduce the channel inter-symbol interference (ISI), then sketch a block diagram for adaptive equalizer.

(c) (**4 Marks**) Compute the SNR improvment of 2 branch and 6 branch with maximum ratio combining (MRC) over the case of no-diversity.

Good Luck

Dr. Hussein E. Seleem (Course Coordinator)

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٣ - اتصالات

٢٠١٩/٦/٢

Tanta University | Department of Electronics and Electrical Communication Engineering | Faculty of Engineering

Course: **Computer Networks**	Course Code: **EEC4231,**	Students: **4th year**
Date: **Mon., 03-June-2019,**	Time Allowed: **3 hours,**	No. of Pages: **2,**
Final Exam	**(Total Marks: 75 marks)**	

Question No. 1 *[15 points]*

Complete the following sentences:

1. The layer 1 devices like hubs are ....as they have no decision-making abilities.
2. ..... can divide a large network into smaller segments.
3. ..... address identifies a process on a host.
4. ..... layer provides the services to user.
5. Transmission data rate is decided by.....
6. TDMA and FDMA are better than random access scheme when .....
7. .....layer provides reliable delivery and flow control.
8. .....layer is both software and hardware.
9. In the polling access method (centralized polling) the select function is used when.....
10. .....is defined as a network segment that shares bandwidth with all other devices on the same network segment.
11. ..... can accept a packet formatted for one protocol (Appletalk) and convert it to a packet formatted for another protocol (TCP/IP) before forwarding it.
12. The last 24 bits of MAC address define.....
13. Examples of single segment networks: .....
14. The higher portion of the data link layer is often called .....and it is responsible for.....
15. ARP table is.....

Question No. 2: *[25 points]*

A. (i) Compare and contrast a random-access protocol with a controlled access protocol.
(ii) Do we need a multiple access protocol when we use the local loop of the telephone company to access the Internet? Why? **(6 points)**

B. What is the window size in stop-and-wait ARQ? How many unique sequence numbers does Stop-and-Wait need? How many bits are needed to represent Stop-and Wait's unique sequence numbers? Explain. **(5 points)**

C. Suppose that a sender and a receiver are using ARQ to perform reliable data delivery:
(i) In a Go-Back-N ARQ protocol, the window size is 6. Frames with sequence numbers 1, 2, 3, 4 and 5 have been sent. The sender just received an ACK for frame 1. Frames 6, 7, 8, 9 and 10 are waiting to be sent. Draw the time diagram showing this scenario.
(ii) Which frame(s) can the sender send before it must wait for the next ACK from the receiver? Explain. **(8 points)**

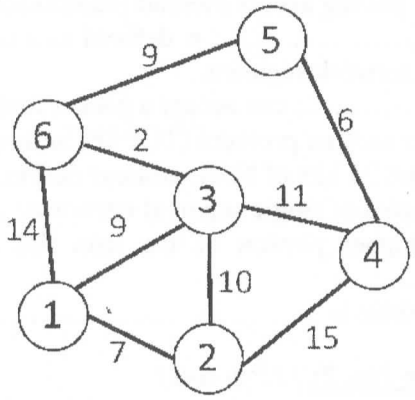
D. (i) A B ESC C ESC FLAG FLAG is given. This data fragment occurs in the middle of a data stream for which the byte-stuffing algorithm is used. What is the output after stuffing?
(ii) A bit string 0111101111101111110, needs to be transmitted at the data link layer. What is the string actually transmitted after bit stuffing? **(6 points)**

Question No. 3: *[15 points]*

A. Using diagrams, compare the architectures of Wi-Fi access points (AP) and stations (STA).
B. Define the following WLAN terminology abbreviations: SSID, BSSID, DS, ESS, BSS, and IBSS.
C. Define the different MAC layer management frames. Estimate the purpose for each one, and deduce if the APs or the STAs are responsible for transmitting each one.
D. Draw the block diagram for the IEEE 802.11a transceiver and briefly describe the function of each block.
E. Compare between passive scanning and active scanning in IEEE802.11.

Question No. 4: *[20 points]*

A. What are the different SPIN families of protocols? Deduce the purpose of each one.
B. Explain the handshaking mechanism in a WSN when the SPIN protocol is used for routing.
C. Categorize the sensor networks routing protocols according to: i) Network organization, (ii) Protocol operation, and (iii) Network structure.
D. Write the algorithm for the Dijkstra routing technique.
E. For the network's routing nodes shown in the figure, use the Dijkstra routing algorithm and the line costs described beside each link to construct the routing table at node "2" and then find the best path between network node "2" and network node "5" .



The end of questions

Use only black or blue pens or pencils in your answer
Do not make any mark in your booklet

Good luck

Dr. Roayat Ismail *Dr. Sameh A. Napoleon*

٤ - الاتصالات ٢٠١٩/٦/١٠

Tanta University

Department: Electronics and Electrical Communications Engineering

Faculty of Engineering

Total Marks: (85) Marks

Final Exam

Course Title: Multimedia and Image Processing (Elective course 4) Course Code: EEC4235 Year: 4rd
Date: 10/06/2019 Allowed time: (3) hr. No. of pages:2

Please answer the following questions

Question No. 1: **[20 Marks, 5 marks each]**

A) What are the main components of the multimedia system? Then, mention five applications of multimedia systems.

B) Explain the concept of the stereo images and disparity with clarifying how the image is formed? Then, define the disparity map.

C) How the kinect images are formed using a kinect camera? Then, explain how a video is formed with clarifying is the correlation between the frames in a video better to be high or low?

D) Define the histogram, then compute the gray- level histogram, and perform histogram stretching from [06:15] to [0:19], for the following intensity values of a gray-scale image.

12	06	05	13	14	14	16	15
11	10	08	05	08	11	14	14
09	08	03	04	07	12	18	19
10	07	04	02	10	12	13	17
16	09	13	13	16	19	19	17
12	10	14	15	18	18	16	14
11	08	10	12	14	13	14	15
08	06	03	07	09	11	12	12

Question No. 2 : **[20 Marks, 5 marks each]**

A) During the image enhancement process, what are the approaches that can be used to deal with the missing edge pixels?

B) For image enhancement, compare between the spatial and frequency domain techniques.

C) For image enhancement, compare between Sobel and Laplacian operators with deriving their equations.

D) Compare between the point and neighborhood processes.

Question No. 3: **[20 Marks, 5 marks each]**

A) Write the mathematical expression of the logarithmic transformation and power law transformations with explaining their concept.

B) Write with explanation the transfer function of the Butterworth with drawing the discrete Fourier transform (DFT) for image processing.

C) Mention the different noise models. Then, express mathematically and mention the name of the filter that can handle the following noise types:

1- **Salt noise and Gaussian noise, but fails with pepper noise.**
2- **Salt-and-pepper noise**

D) Compare between the image enhancement and restoration processes. Then, give the formula of the PDF for modelling the exponential noise, impulse noise, and Erlang noise.

Question No. 4: [20 Marks, 5 marks each]

A)What are the main techniques for the image segmentation process? Then, write the steps of the global thresholding technique.

B)Define the clustering process, then, compare between the hierarchical and partitional clustering methods. Finally, write the steps of the K-means algorithm.

C) In features extraction:

1- **What are the main characteristics that should be considered for features extraction?**
2- **Give examples for the texture features.**
3- **Write the mathematical expression of the histogram features.**

D) In image compression:

1- **Define the data compression process.**
2- **What are the different types of redundancy?**
3- **Compare between the lossless and lossy compression.**
4- **Draw the image compression model with explaining the function of each block.**

E)Mention the advantages and disadvantages of the neural network. Then compare between the OVA and AVA methods in the multi-classification process.

End of Questions

Good luck
Assistant Prof. Amira Ashour

Tanta University

Department: Electronics and Electrical Communication Eng.
Total Marks: 85 Marks

Faculty of Engineering

Course Title: Information theory	Course Code: EEC4237	Year: 4th year
Date: 12/6/2019	Allowed time: 3h	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) Prove $I(X;Y) = H(X) + H(Y) - H(X,Y)$

b) Check if the following code C = {0, 11, 100, 110} is instantaneous or not? If not; find its instantaneous one.

c) Design a compact code (where, $r=4$) using dummy symbol for a source with 11 symbols, with the following probabilities $p(s_1) = 0.16$, $p(s_2) = 0.14$, $p(s_3) = 0.13$, $p(s_4) = 0.12$, $p(s_5) = p(s_6) = 0.1$, $p(s_7) = p(s_8) = 0.06$, $p(s_9) = 0.05$, $p(s_{10}) = p(s_{11}) = 0.04$.

Question (2)

a) A first-order Markov memory source whose source alphabet is $\{S_1, S_2, S_3, S_4\}$ has the following matrix:

$$\Pi = \begin{bmatrix} 0 & 0.7 & 0.3 & 0 \\ 0 & 0 & 0.7 & 0.3 \\ 0.1 & 0 & 0 & 0.9 \\ 0.7 & 0.3 & 0 & 0 \end{bmatrix}$$

i) Draw the state diagram.

ii) Find the states probabilities and the symbol probabilities, where the source is homogenous stationary one.

iii) If the probabilities in the matrix are changed as follows: $P(S_1/S_3)=0.3$, $P(S_4/S_3)=0.7$. Find the stationary probabilities of the source.

iv) Repeat (i), (ii) for $P(S_1/S_3)=0, P(S_4/S_3)=1$, and other probabilities being unchanged.

v) How the state diagram changes for $P(S_1/S_3) = P(S_4/S_3) = 0$, $P(S_3/S_3) = 1$.

vi) Find the entropies of the source defined. For which transition matrix the entropy would achieve the maximum? What are the symbol probabilities in this case?

Question (3)

a) Find the upper limit of the capacity for continuous channel.

b) For channel in Figure 1, define channel type. Calculate the channel capacity.

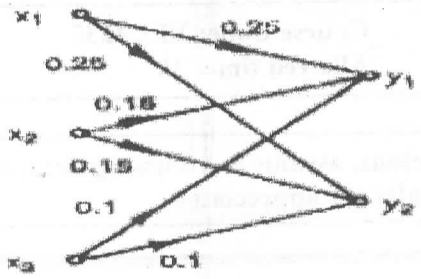


Figure 1

c) For channel in Figure 2, define channel type. Find $H(X/Y)$, $H(X)$. Comment on your results.

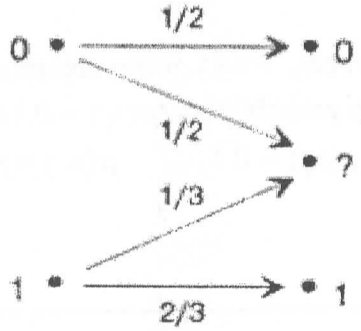


Figure 2

Question (4)

a) For a (7,4) linear block code, the generator polynomial $g(x)$ is given by $1+x^3$. Find the generator matrix and the parity check matrix for this code.

b) 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.

c) Show how CRC is using to detect and correct any error in the received message at a channel output when the data message was "1011011010", using the polynomial $P(x)=x^4+x^3+1$.

d) Construct a convolution encoder with the commutator samples $C_1=D_1$, $C_2=D_1\oplus D_2$, and $C_3=D_1\oplus D_2\oplus D_3$. Find the message coded by the encoder.

Best Wishes of Success
Dr. Heba El-Khobby