



كلية الهندسة بطوان

Dept/Division : Biomedical Engineering

Academic level: 4TH YEAR

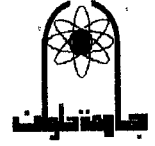
Semester: First 2015/2016

Course code & title: ELC4411 Signal Processing

Instructor: Dr. Shahira Mahmoud, Dr. Marwa Hadhoud

Total marks: 90 marks

Time allowed: 3 hrs



Answer the following questions:

Part 1: (45 Points)

مطابق الاسئلة
ع حبيبه

Question 1: (15 Points)

Consider a system with impulse response

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$$h(n) = \begin{cases} 0.5^n, & 0 \leq n \leq 4 \\ 0 & \text{elsewhere} \end{cases}$$

Determine the input $x(n)$ for $0 \leq n \leq 8$ that will generate the output sequence

$$Y(n) = \{1, 2, 2.5, 3, 3, 3, 2, 1, 0, \dots\}$$

Question 2: (15 Points)

A linear time invariant system is described by the following difference equation:

$$y(n) = x(n-2) + 2x(n-1) + x(n)$$

a- Determine the magnitude and phase of the frequency response $H(\omega)$ of the system.

b- Determine the output of the system to the input signal

$$x(n) = 5 + 12 \sin\left(\frac{\pi}{2}n\right) - 20 \cos\left(\pi n + \frac{\pi}{4}\right)$$

Question 3: (15 Points)

Compute the 8-point FFT of the sequence

$$x(n) = \cos\left(\frac{\pi}{2}n\right), \quad 0 \leq n \leq 7$$

Calculate the saving in the computation using FFT.

Part 2: (45 Points)

Question 4: (15 Points)

The normalized lowpass filter with a cutoff frequency 1 rad/sec is given as

$$H_p(s) = \frac{1}{s+1}$$

Use the given $H_p(s)$ and the BLT to design a corresponding digital IIR bandpass filter with a lower cutoff frequency of 15 Hz, an upper cutoff frequency of 25 Hz, and a sampling rate of 120 Hz.

Question 5: (15 Points)

Given the difference equation

$$y(n) = 0.5x(n) + 0.5x(n-1)$$

- find the $H(z)$;
- Determine the impulse response $y(n)$ if the input $x(n)=4\delta(n)$;
- Determine the step response $y(n)$ if the input $x(n)=10u(n)$.



Question 6: (15 Points)

Design a 5-tap FIR highpass filter with a cutoff frequency of 250 Hz and a sampling rate of 1,000 Hz using a rectangular window function. Determine the transfer function and difference equation of the designed FIR system, and compute and plot the magnitude frequency response for $\Omega = 0, \pi/4, \pi/2, 3\pi/4,$ and π radians.

Best Wishes .

Dr. Shakira Mahmoud & Dr. Marwa Hadhoud

١١/١٤ - ٢٠١٦ - امتحان - من اختيار في امتحان استوائيا

 <p>كلية الهندسة بحلوان</p>	<p>Dept: Biomedical Eng. Academic level: Fourth Semester: First 2015/16 Course code & title: (BME 4414) & Random Processes Instructors: Dr. Fatty M. Salem Total mark: 100 Marks Time allowed: 3 hrs</p>	 <p>جامعة أسيوط</p>
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Answer the following questions

Question (1):

a) A factory production line is manufacturing bolts using three machines, A, B and C. Of the total output, machine A is responsible for 25%, machine B for 35% and machine C for the rest. It is known from previous experience with the machines that 5% of the output from machine A is defective, 4% from machine B and 2% from machine C. A bolt is chosen at random from the production line and found to be defective. What is the probability that it came from:

- Machine A.
- Machine A or machine C.

b) An instructor who taught two sections of engineering statistics last term, the first with 20 students and the second with 30, decided to assign a term project. After all projects had been turned in, the instructor randomly ordered them before grading. Consider the first 10 graded projects.

- What is the probability that exactly 5 of these are from the second section?
- What is the probability that at least 8 of these are from the second section?
- What is the probability that at least 8 of these are from the same section?

(20 Marks)

Question (2):

a) If the probability density function for a continuous random variable x is :

$$f(x) = \begin{cases} cx, & 0 < x < \sqrt{2} \\ 0, & \text{otherwise} \end{cases}$$

Find:

- The constant c , so that the function $f(x)$ satisfies the conditions of being a probability density function.
- $P(x < 1)$
- The expected value $E(x)$
- The variance σ^2 and the standard deviation σ .

b) Prove that:

$$\text{Cov}(x, y) = E(xy) - \mu_x \mu_y$$

(من فضلك اقلب الصفحة)

c) Let x and y be continuous random variables with joint pdf:

$$f(x, y) = \begin{cases} x + y, & 0 < x, y < \sqrt{2} \\ 0, & \text{otherwise} \end{cases},$$

- i) Find $\text{Cov}(x, y)$
- ii) Find the autocorrelation coefficient ρ .

(30 Marks)

Question (3):

a) Derive the expected value and variance of the binomial distribution.

b) A multiple-choice test contains 10 questions with 4 choices for each answer. If a student guesses the answers, find:

- i) The probability that he will get 3 correct answers.
- ii) The expected value for the correct answers.
- iii) The expected value for the wrong answers.
- iv) The variance and the standard deviation.

c) Vehicles pass through a junction on a busy road at an average rate of 300 vehicles per hour.

- i) Find the probability that none passes in a 1-minute interval.
- ii) What is the expected number passing in 2-minute interval?
- iii) Find the probability that this expected number actually pass through in 2-minute interval.

(30 Marks)

Question (4):

a) A fair die is rolled twice. Let E be the event that a 1 comes up on the first roll. Let F be the event that the sum of the two scores is 5. Are E and F independent?. Justify your answer.

b) The length of similar components produced by a company are approximated by a normal distribution model with a mean of 5 cm and a standard deviation of 0.02 cm. If a component is chosen at random.



- i) what is the probability that the length of this component is more than 5.03 cm?
- ii) what is the probability that the length of this component is between 4.98 and 5.02 cm?
- iii) what is the probability that the length of this component is between 4.97 and 5.04 cm?

(20 Marks)

The areas under the standard normal distribution curve (From 0 to z)

z	0	0.25	0.5	0.75	1	1.25	1.5	1.75	2
Area	0	0.0987	0.1915	0.235	0.3413	0.3944	0.4332	0.4599	0.4773

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 كلية الهندسة بحلوان	Dept/Division: Biomedical Eng. Dept Academic level: B.Sc Semester: I-2014/2015 Course code & title: Biomedical systems (1) Total mark: 100 Time allowed: 3 hrs Instructor: Assoc.Prof: Mohamed Eldosoky	 جامعة أسيوط
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Answer the following questions:


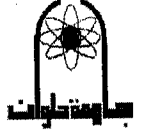
- Q1: For the tissue tek device (15 marks)**
a) Block diagram of tissue tek devices. (10 marks)
b) Depending on this block diagram if 1mm as tissue specimen is required. Suggest the steps for this process. (5 marks)

- Q2: (30 marks equally distributed)**
What are the requirements for each circuit (give reasons):
a) The lead failure detector circuit.
b) The pulse oximeter circuit.
c) The DC-shock (the output shape).
d) The pacemaker.

- Q3: For the Automated blood cell, explain: (30 marks, a and f:10 marks))**
a) The principle of counting the cells with resistance change circuit (DC).
b) The output wave.
c) The function of the variable resistances in this circuit.
d) The disadvantages of this circuit.
e) The wave shape as using RF circuit.
f) The equations of the pulse oximeter.

- Q4: For the sleep lab device: (20 marks equally distributed)**
a) Compare between the wave diagrams of the thoracic and abdominal circuits.
b) The circuits of them.
c) Suggest the difference between these circuits.
d) Explain with drawing the cycle of sleeping and its relation with the diseases.

- Q5: For the ABR device (5 marks)**
Draw the Block diagram of components (modules) contained within the stimulus Generator.

 كلية الهندسة ببحوان	Dept/Division : Biomedical Engineering Academic level: 4 TH YEAR Course code & title: ELC4413 Expert Systems Instructor: Dr. Marwa Hadhoud & Dr. Vidan Ghoniem Total marks: 70 marks	 جامعة أسيوط
Semester: First 2015/2016 Time allowed: 3 hrs		

Answer the following questions:

Question 1: (15 Points)

Consider the two-player game described below (Figure 1).

Figure 1:

A			B
1	2	3	4

This is the starting position of a simple game. Player *A* moves first. The two players take turns moving, and each player must move his token to an open adjacent space in either direction. If the opponent occupies an adjacent space, then a player may jump over the opponent to the next open space if any (for example, if *A* is on 3 and *B* is on 2, then *A* may move back to 1). The game ends when one player reaches the opposite end of the board. If player *A* reaches space 4 first, then the value of the game to *A* is +1; if player *B* reaches space 1 first, then the value of the game to *A* is -1.

Draw the complete game tree, using the following conventions:

- Write each state as (S_A, S_B) where S_A and S_B denote the token locations.
- Put each terminal state in a square boxes.
- Put loop states (states that already appear on the path to the root) in double square boxes.

Question 2: (10 Points)

1- Translate the following sentences into a set of propositional formulas:

- a. Chose one of three roads: short, medium, or long.
- b. The short road is always crowded.
- c. The medium road is not comfortable, but fast.
- d. The long road is comfortable.
- e. The chosen road should be comfortable.

2- Assuming that fast roads are not crowded and crowded roads are not comfortable, hypothesize what roads can be chosen explain your reasoning informally.

Question 3: (15 Points)

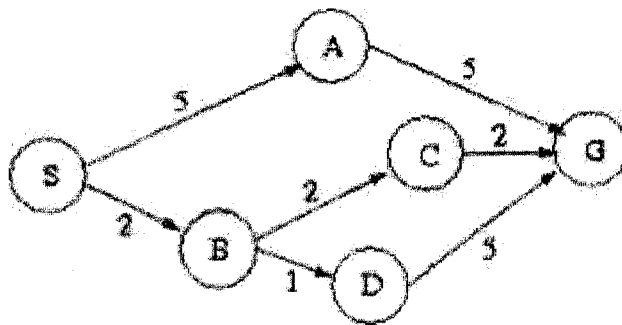
Suppose we have the following predicates and a universe where all of the objects are people.

sat(X) --- X is satisfied with life
 doc(X) --- X is a doctor
 psy(X) --- X is a psychiatrist
 child(X,Y) --- X is a child of Y
 Bob --- an individual person

- (a) Express the following statements in FOL using the predicates and objects above
- A person is satisfied with life if all his/her children are doctors.
 - All of Bob's children are psychiatrists.
 - Psychiatrists are doctors.
- (b) Convert your expressions to a set of clauses in CNF.
- (c) Give a resolution proof that Bob is satisfied with life.

Question 4: (15 Points)

Consider the following search space where we want to find a path from the start state S to the goal state G. The table shows three different heuristic functions h1, h2, and h3.



Node	h1	h2	h3
S	0	5	6
A	0	3	5
B	0	4	2
C	0	2	5
D	0	5	3
G	0	0	0

- (a) What solution path is found by Greedy Best-first search using h2? Break ties alphabetically.
- (b) What solution path is found by Uniform-Cost search? Break ties alphabetically.
- (c) Give the three solution paths found by A* algorithm using each of the three heuristic functions, respectively. Break ties alphabetically.

Question 5: (15 Points)

Consider the following text.

Anyone who does not sink and weights the same as a duck is a witch. Everyone who is made of wood weights the same as a duck. Everyone who is a witch is burned. Bob is made of wood, and does not sink.

- (a) Represent the text in First-Order Logic.

NOTE: use the functions and predicates Sink(x), WeightSameAs(x,y), Witch(x), MadeOf(x,y), Burn(x), and the constants Duck, Wood and Bob

- (b) Convert your FOL sentences to Conjunctive Normal Form. Show all steps of the conversion.
- (c) Answer the following query using Resolution: Will we burn Bob?

Best Wishes .