making system should be able to provide a value that represents your ranking of the desirability of purchasing each of the cars (you may use a range of 0-1 for this).

b) Provide a test scenario to test your design (i.e. suppose that you are provided with one car with the above characteristics; explain the decision of your fuzzy decision making system).

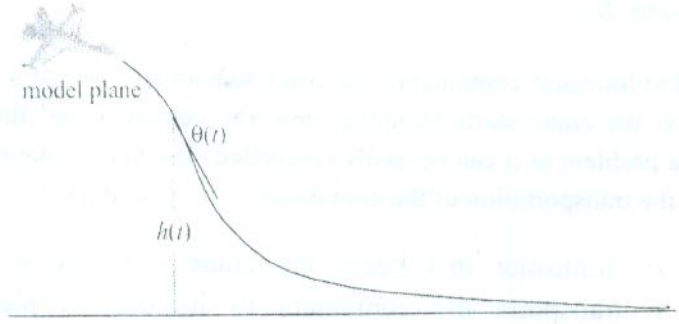
(Question 3) **(18 Marks)**

The objective is to design a fuzzy logic controller to land the plane shown in figure safely, anywhere on the ground on the x-axis. Assume that no mathematical model for the plane is available for the design, but the plane is equipped with sensors that can measure the height $h(t)$ and the angle $\Theta(t)$ of the motion of the plane. Suppose that the model plane is moving forward at a constant speed and the controller is used to steer the angle of the plane (i.e. the fuzzy controller is used to provide an input u, which controls the angle of the plane, so as to guide it to land on the ground safely.

a) Design a fuzzy logic controller to land the plane safely as explained above. Explain your design in details.

b) For the $h(t) = 200$ meters, and $\Theta(t)=30°$ (clockwise direction) Determine:

i- The fired rules.
ii- The output fuzzy set of each rule.
iii- The crisp value of the controller output u.



(Question 4) **(16 Marks)**

a) With the aid of block diagram, explain how the supervisory control system works? (5 Marks)

b) Consider a system defined with first order transfer function, $1/as+b$, with known constants $a>0$ and b.

i- Design PI controller (i.e. find the controller constants) for this system such that the system output $y(t)$ tracks a reference $r(t)$. (7 Marks)

ii- Provide a fuzzy auto tuner for the PI controller you use in (a). Explain your solution.

(4 Marks)

Good Luck ***Dr. Ahmed Elmogy***

Tanta University

Department: Computers and Automatic Control

Faculty of Engineering

Course Title: Fuzzy Control
4th year

Course Code: CCE4128
Allowed time: 3 hrs

Answer the following questions:

(Question 1) **(23 Marks)**

a) Consider the following two discrete fuzzy sets, (5 Marks)

$A = \text{"}Zero\text{"} = \{\frac{0}{-2} + \frac{0.4}{-1} + \frac{1}{0} + \frac{0.4}{1} + \frac{0}{2}\}$ defined on Universe $X = \{-2,2\}$

$B = \text{"}Negative\ Medium\text{"} = \{\frac{1}{-3} + \frac{0.7}{-2} + \frac{0.3}{-1} + \frac{0}{0}\}$ defined on Universe $Y = \{-3,3\}$:

1. Construct the relation for the rule IF A, THEN B. Explain this relation.
2. If we introduce a new antecedent:

$A' = \text{"}Negative\ Small\text{"} = \{\frac{0}{-3} + \frac{0.5}{-2} + \frac{1}{-1} + \frac{0.5}{0}\}$

Find the new consequent $\dot{B}$.

b) A crane system is used to transport containers from place to another place at a specific distance from the picking up position. As soon as the crane starts to move, both the container and the crane itself start to swing. The container swing is not a problem as it can be easily controlled. The main issue is the crane swing which can cause some problems during the transportation of the containers. (18 Marks)

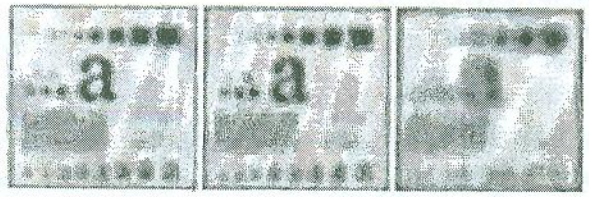
1. Design a fuzzy controller that keeps the crane swing at a minimum level (no swing if possible) as it transports the containers to its desired places. Explain your design in details.
2. Test your design with numeric examples showing:
   - i- The fired rules.
   - ii- The output fuzzy set of each rule.
   - iii- The crisp value of the controller output.

(Question 2) **(18 Marks)**

Suppose that you wish to buy a used car. You have various priorities with regard to price, safety features, and the year the car was made.

a) Implement each of these characteristics with fuzzy sets and then design a fuzzy decision – making system that represents your own priorities in purchasing a used car using these characteristics. For instance, when presented with N cars, the designed fuzzy decision

III. The three images shown below were blurred using square averaging masks of sizes n = 23, 25, and 45, respectively. The vertical bars on the left lower part of (a) and (c) are blurred, but a clear separation exists between them. However, the bars have merged in image (b), in spite of the fact that the mask that produced this image is significantly smaller than the mask that produced image (c). If you know that the vertical bars are 5 pixels wide, 100 pixels high, and their separation is 20 pixels. Explain bar merging in image b.



(a) (b) (c)

Question 3 (20 Marks: 5 for each item)

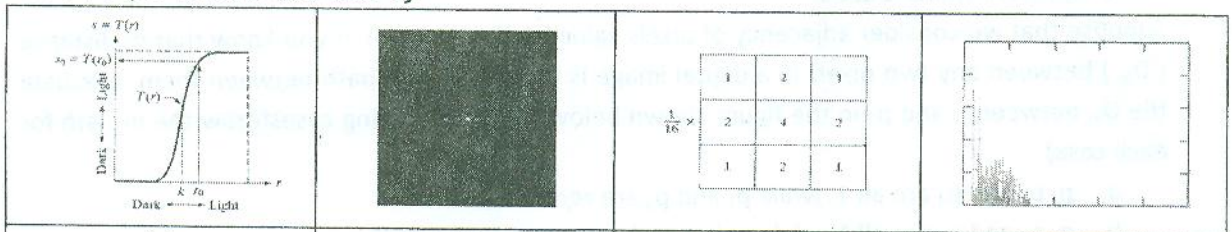
I. Image filtering using the median of the pixel neighborhood is useful in removing certain kind of noise. The median, ζ, of a set of numbers is such that half the values in the set are below ζ and the other half are above it. For example, the median of the set of values {2, 3, 8, 20, 21, 25, 31} is 20. Show that an operator that computes the median of a sub-image area, S, is nonlinear.

II. Write MATLAB statements to read and image, display the image, display the histogram of the image, apply histogram equalization on the image and finally display the equalized histogram image.

III. Geometric transformation is the mapping of the coordinates of each pixel in an input image to another (displaced/rotated,..) pixel in the output image. This mapping can be done in two different ways: Forward-mapping and inverse-mapping. Explain the two ways in contrasting the difference between them. Which way you prefer? Why?

IV. Explain how an image could be sharpened using spatial filtering.

Question 4 (15 Marks: 8, 3 and 4)



(a) (b) (c) (d)

I. Answer the following in referring to the above figure

a. When the intensity mapping function shown in the figure (a) is applied to a digital image,

i. It stretches its contrast

ii. It compresses its contrast

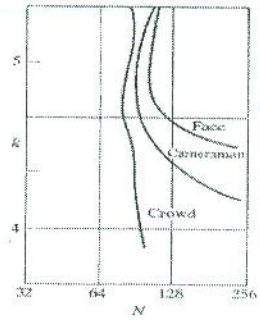
iii. It Smoothes the image

b. The image shown in figure (b) is the Fourier transform of an image. As shown, we see few details. What kind of intensity transformation you suggest to get more details from this image?
   i. Power law transformation
   ii. Logarithmic transformation
   iii. Inverse logarithmic transformation

c. The mask shown in figure (c) is used with correlation to
   i. Differentiate a digital image
   ii. Equalize the histogram of a digital image
   iii. Get a weighted average of a digital image

d. The histogram shown in figure (d) is for
   i. A dark image
   ii. Lighted image
   iii. Washed out image

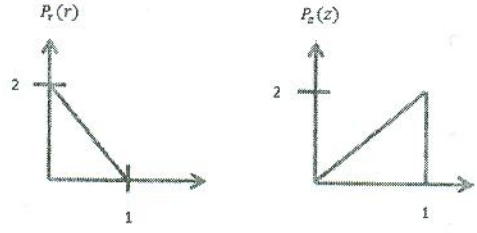
II. What do you understand from the following *isopreference* curves (shown below) for three types of images: Low details images represented by a face image, Medium details images represented by a camera-man image and high detail images represented by a crowd image.



III. Explain under what conditions(s) a camera of 1200x1200 pixels resolution gives more detailed image than a camera has 1600x1600 pixels resolution. Assume the size of sensors and their in-between distances are the same in the two camera sensor arrays.

Question 5 (25 Marks: 10 and 15)

I. An image with intensities in the range [0, 1] has the PDF $P_r(r)$ shown in the figure below. It's desired to transform the intensity levels of this image so that they will have the specified $P_z(z)$ shown also in the figure below. Assume continuous quantities and find the transformation (in term of r and z) that will accomplish the mapping.



II. A 3 bit image (L=8) of size 64x64 pixels (MxN=4096) has the intensity distribution shown in the table below, where the intensity levels are integers in the range [0-(L-1)]=[0-7].

a. Calculate and sketch the histogram components for the image
b. Calculate and sketch the histogram components of the image after the application of histogram equalization. Hint: histogram equalization intensity transformation is specified by: $s_k = T(r_k) = \frac{(L-1)}{MN}\sum_{j=0}^{k} n_j$

r_k	n_k
r_0	790
r_1	1023
r_2	850
r_3	656
r_4	329
r_5	245
r_6	122
r_7	81

Good Luck

Course examination committee:

Course Coordinator: Dr. Hamed M. Hemeda

Title: Pattern recognition and digital image processing **Course code:** CCE4130 **Year:** Fourth year
Final exam, Date: 16/1/2012, **Total marks:** 85 **Allowed time:** 3 hours **Number of pages:** 3

Workout the following questions

Question 1 (10 marks: one for each item)

Determine if each of the following statements is true or not. If it is not, modify it to become true.

a) Correlation could be used to apply median filtering
b) It's possible to apply the median on images using a mask and the correlation
c) In human eye, the rods are responsible for global vision while the cones are responsible for investigation and color vision
d) In human eye, cones require high amount of illumination to give a response while rods work in low-level illumination.
e) The human visual system operates over a large range of illumination levels with the same settings and adaptation.
f) The wavelength of an EM wave required to see an object must be of the same size as or smaller than the object
g) In digital images, high dynamic range means high contrast and the reverse is true.
h) In digital images that contain a high amount of details, increasing the vertical resolution (number of bits per pixel) usually achieves better enhancement than increasing the image spatial resolution.
i) In digital image processing, nearest-neighbor interpolation gives better results than bilinear interpolation
j) One application for digital image subtraction is the reduction of noise effects on an image

Question 2 (15 Marks: 5 for each item)

I. Discuss three different representations of digital images. Show the context in which each of the three representations is used.
II. Suppose that we consider adjacency of pixels valued 1 (i.e., V = {1}). If you know that m-distance (D_m) between any two pixels in a digital image is the shortest m-path between them, calculate the D_m between p and p_4 in the figure shown below for the following cases(draw the m-path for each case):
    a. p, p_2 and p_4 are all 1_s while p_1 and p_3 are zeros.
    b. p, p_2 and p_4 are all 1_s while p_1 is 1 and p_3 is 0.
    c. p, p_2 and p_4 are all 1_s while p_1 is 0 and p3 is 1.
    d. p, p_2 and p_4 are all 1s while p_1 is 1 and p_3 is 1.

	p_3	p_4
p_1	p_2	
p		

Tanta University
Faculty of Engineering
Computers and Control Department

Fourth Year Students
First Term Exam
January 12, 2012

NEURAL NETWORKS ***Code : CCE 4129***

Answer the following *four* questions. Time allowed : 3 hours.

Question 1 (21 Marks)

A logic XNOR operation $f = x_1 \odot x_2$ is to be implemented by a neural network. To this end, an output neuron in the network receives three inputs x_1 , x_2, and $x_3 = x_1 + x_2$ (logic OR), and generates the required signal f according to a binary threshold activation function.

(a) Construct the neural network and determine all its weights.

(b) What is the role played by the third input x_3 ?

(c) On the x_1-x_2 plane, specify the regions for which $f = 0$ and those for which $f = 1$.

Question 2 (20 Marks)

A neuron receives two inputs $x_1 = 1.5$ and $x_2 = 1.25$ with weights $w_1 = -1$ and $w_2 = 2$, respectively. The output signal s obeys a sigmoidal function of the form $1/(1 + \exp(-\alpha y))$, where y is the activation and α is a positive parameter. The maximum value of the derivative of s with respect to y, ds/dy, is 0.4. Find the neuronal bias weight w_0 when ds/dy = 0.2. What is the corresponding value of s ?

Question 3 (21 Marks)

Design a neural network that behaves as a two-class data classifier for two-dimensional input patterns (x_1, x_2). The numerical value of any weight in the network should not exceed 2.5. From the classification viewpoint, the x_1–x_2 plane is divided into two regions R_1 and R_2, where R_1 accommodates all points inside a trapezoid with vertices (4,4), (0,4), (-4, -1), and (5, -1), and R_2 accommodates all points outside this trapezoid. Show, through calculations, how your network will classify the input patterns (1,1), (5,5), and (-3.2, 0).

Question 4 (23 Marks)

In a two-layer, back-propagation neural network, the input layer has two neurons N1 and N2 receiving inputs x_1 and x_2, respectively, and the output layer has two neurons N3 and N4 producing bipolar sigmoidal signals g and h, respectively. The weights of the network are :

$w_{13} = -1.21$ $w_{23} = 0.88$ $w_{03} = -0.4$

$w_{14} = 1.44$ $w_{24} = -0.75$ $w_{04} = -0.4$

Under certain operating conditions, the errors in the values of g and h are -0.8 and -0.9, respectively, and the gradients of the half summed square error E with respect to w_{03} and w_{04} are $\partial E/\partial w_{03} = 0.3$ and $\partial E/\partial w_{04} = 0.288$. Calculate the gradients of E with respect to the remaining weights, respectively. What are the values of x_1 and x_2 ?

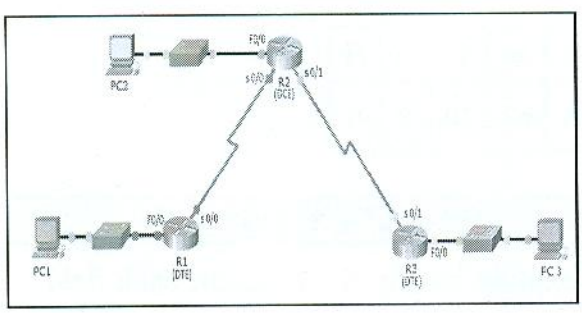
Prof. Dr. Mahmoud M. Fahmy

Question 3: $18^{o} = (6^{o} + 6^{o} + 6^{o})$

1) Write the commands used to:
   a. Turn RIP routing on in a router and advertise network 10.0.0.0
   b. Configure a default route on a router to go to 172.16.0.0
   c. Enable EIGRP with an autonomous system number 300
2) What is the routing loops problem in the Distance-Vector Routing protocols? Explain two different techniques that can solve this problem.
3) Define the following:
   a. Administrative distance in the routing protocols.
   b. The feasible successor in EIGRP
   c. Adjacency in OSPF

Question 4: $22^{o} = (12^{o} + 5^{o} + 5^{o})$

1) For the following figure:



Device (Name)	Interface	IP address	Mask
R2	S0/0	192.168.4.1	255.255.255.0
R2	S0/1	192.168.5.1	255.255.255.0
R2	F0/0	192.168.2.1	255.255.255.0
R1	F0/0	192.168.1.1	255.255.255.0
R1	S0/0	192.168.4.2	255.255.255.0
R3	S0/1	192.168.5.2	255.255.255.0
R3	F0/0	192.168.3.1	255.255.255.0
PC1	NIC	192.168.1.10	255.255.255.0
PC2	NIC	192.168.2.10	255.255.255.0
PC3	NIC	192.168.3.10	255.255.255.0

Write down the necessary commands and the exact configuration mode for configuring the following:

I. Configure a hostname for R2.
II. Configure a telnet password on R2 to allow access for 6 connections at a time.
III. Configure a strong secret password for R2 to be used between user mode and privilege exec mode.
IV. Configure the serial interface (s 0/0) to have an up and running interface.
V. Write the necessary RIP routing commands to be applied on R2.
VI. Save your Running-configuration.

2) In the routing protocols, define the Route Invalid Timer, Hold down timer, and the Route Flush Timer.
3) Discuss the main reasons of the fast convergence in OSPF.

Good Luck

Dr. Tarek El.Ahmady El.Tobely

Tanta University
Faculty of Engineering
Computer and Aut. Control Eng. Dep.
Forth Year

Second Term – Final Exam
Subject: Computer Networks
Allowed Time: 3 Hours
Date: Monday, 09/01/2012

Answer the Following (4) Questions and Assume any Missing Data

Question 1: $25^{o} = (4^{o} + 4^{o} + 5^{o} + 12^{o})$

1) What is the principal difference between connectionless communication and connection-oriented communication?
2) Explain the difference between straight-through and cross-over cable connections. Give three examples for connecting different network elements with each of these connection types.
3) Explain the type and maximum length of the cable segment in the 100BaseFX and 1000BaseLX Ethernet standards.
4) Use VLSM technique to design a class C network (192.22.10.0) with 8 subnets as follows:

Network ID	A	B	C	D	E	F	G	H
Number of Hosts	5	11	3	31	62	10	2	6

Question 2: $25^{o} = (6^{o} + 8^{o} + 5^{o} + 6^{o})$

1) Draw the first 12 bytes in the IP header, then explain briefly the function each field.
2) An organization is granted the following class-full IP address 192.168.10.0 with mask 255.255.255.192, for this network find the following:
   a. The number of subnets.
   b. The number of hosts per subnet
   c. Find the first and last addresses in each subnet.
   d. The broadcast address of each subnet.
3) Describe three events or states that initiate ICMP messages in IP networks.
4) In the class-full IP address, state the meaning of the IP address in the following cases:
   a. The Network Address of all 1s
   b. IP Address 127.0.0.1
   c. Entire IP address set to all 1s

Question Four

1- Draw two examples of distributed systems dynamic inter connection?

2- Define the following terms: Ubiquitous computing, Intranet and extranet

3-Assume the following distributed database of suppliers and parts of a car fabrication company which consists of the following tables:

- Supplier table with attributes (Supplier number and city) contains of 10000 records at site A
- Parts table with attributes (Part number, color) contains 100000 records at site B
- Supplier-parts table with attributes (supplier number and part number) contains of 1000000 records at site A

Also assume the data rate is 50000 bits per second , access delay= 0.1 second, Number of red parts is 10, Number of red shipments by London suppliers=100 000 and every record is stored in 25 Byte long .

- If a user wants to execute the following query **"Get supplier numbers for London suppliers of red parts"** Give 3 possible communication scenarios and calculate the communication time for each scenario.

Question Five

1-What are the main types distributed systems architectures models?

2- Quick sort is an example of recursive decomposing based on using on divide –Conquer algorithm which can be suitable for parallel computing. Use the previous quick sort to arrange the following:

5 12 11 1 10 6 8 3 7 4 9 2

Then explain which tasks can be processed in parallel in your solution.

3-Assume you have four processors. You want to execute ten programs where each programs needs to perform four tasks to complete. Assume each task consumes one second in the processing (Neglect all required dispatching over head time) Find the following:

- The time if one processer only execute all programs
- The time if all processors cooperate together to execute the programs at two different parallel scenarios you propose.
- The speed up at the proposed parallel scenarios

With my best wishes Dr. Hatem January 2012

Tanta University

Faculty of Engineering. **Computers and Automatic Control Dep.**
Fourth Year **January 2012, Time: 3 Hours**

Distributed Systems

Answer all Questions

Question One

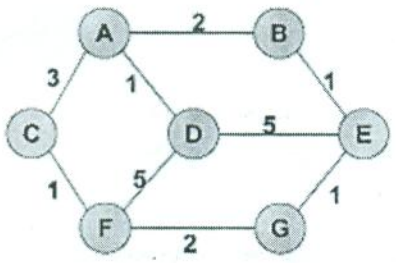
1- Classify the distributed systems according to:
- Memory distribution?
- Processes and Granularity
- Connection topology?

2- Draw a schematic diagram for the following static interconnection (with 4 dimension)
- Fat tree (4 levels)
- Line/ Ring
- Tours

3- Draw a flow chart or write Pseudo code to implement the odd-even algorithm at both serial computer and parallel forms?

Question Two

1- What is middleware? How does it contribute to transparency (single system image) in distributed systems?
2- What are the type of faults in distributed systems
3- Given the network topology in the figure below, Using RIP (routing information protocol) find the final routing tables at router A.



- If router G is shutdown find the same router final table at router A

Question Three

1- What are the twelve objectives of distributed database systems?
2- What are the design requirements of distributed architectures?
3-Consider the following Schedule and then answer the questions:
T3Rf T2Re T2We T2Ra T2Wa T3Wf T1Ra T2Rb T2Wb T1Wa T1Rb T1Wb T3Rb T1Rc T1Wc T2Rh T1Rd T3Wb T1Wd T1Re T2Wh T1We .
Where T3Rf means that transaction 3 reads item f, T2Wa means transaction 2 writes item a
Sketch the Serialization Graph of S and determine if S is conflict serializable or not.

(6 Marks)

```
# include <reg51.h>
sbit b0= P0^0;
sbit A= ACC^7;
void main(void)
{
unsigned char con=0x24;
unsigned char y;
P1=0x04 & 0x68;
ACC=con ^ 0x56;
For (y=0;y<=7;y++)
{
b0= A;
ACC=ACC <<1;
}
}
```

(Question 4) **(16 Marks)**

a) Write a C program using interrupts to do the following: (10 Marks)

- Receive data serially and send it to P1
- Generate a 25 kHz frequency on P2.4 using Timer 0 8-bit auto reload
- Use Timer 1 as an event counter to count up a 3 Hz pulse and display it on P0. The pulse is connected to EX0.

Explain your solution assuming XTAL= 11.0592 MHz and 4800 baud rate.

b) Assume that Timer 1 is programmed for mode 1, TH0=FFH, TL0= F8H, and the IE for Timer 1 is enabled. Explain how the interrupt is activated? Explain what will change if timer is programmed in mode 2? (6 Marks)

(Question 5) **(13 Marks)**

a) Explain the importance of port 3 when Interfacing I/O devices to 8051 microcontroller such as LEDs, Stepper motors, relay, LCDs and keyboard interfacing? (4 Marks)

b) Write an 8051 C program to read the P2.1 and P2.2 bits and issue an action on port 1 according to the following: (9 Marks)

P2.1	P2.2	P1
0	0	Invert bit 2
0	1	Output '2'
1	0	reset bit 3
1	1	Turn on DC- motor connected to P3.1 if bit 4 of P1 is 1

Good Luck ***Dr. Ahmed Elmogy***

Tanta University

Department: Computers and Automatic Control

Faculty of Engineering

Course Title: Microcontrollers **Course Code: CCE4127**
4th year **Allowed time: 3 hrs**

Answer the following questions:

(Question 1) **(15 Marks)**

a) With the help of block diagram, explain the structure of 8051 microcontroller? Explain the memory structure? (6 Marks)

b) What is the function of the following registers? (9 Marks)

SBUF register, SP register, TMOD register, TCON register, SCON register.

(Question 2) **(12 Marks)**

a) Show the stack for the following code? Calculate the delay time of the DEALY subroutine for 8051 system of 11.592 MHz? (6 Marks)

```
000B    120300          LCALL DELAY
000E    80F0            SJMP BACK
.....
0300                    ORG 300H
0300            DEALY:
0302    7CEE            MOV R4, # EEH
0304    7DEE    SSS:    MOV R5, #EEH
0306    DDFE    AGAIN:  DJNZ R5, AGAIN
0308    DCFA            DJNZ R4, SSS
030A    22              RET
```

b) Compare in details between interrupt and polling techniques? Explain the steps of executing an interrupt? (6 Marks)

(Question 3) **(14 Marks)**

a) Write an assembly program to continuously get the status of 8 relays connected to port 1 of 8051 microcontroller and logically OR with 6DH then output on 8 servo motors connected to port 2. Wait 0.2 sec before sending the data to the servo motors (assume that XTAL= 11.592 MHz). Explain your solution? (8 Marks)

b) Explain what will happen if the following code is executed: