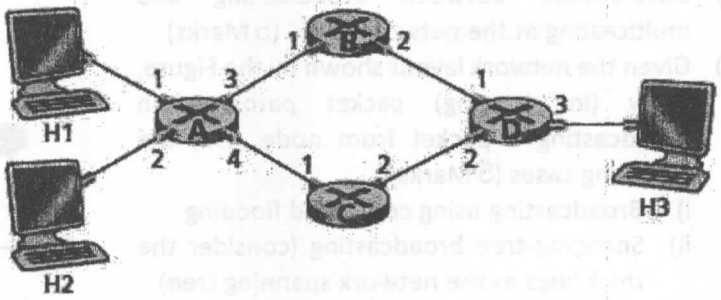
Workout the following questions

1) a) Mention some services that could be provided by the network layer to the transport layer in stressing flow of packets related services. (5 Marks)

b) Consider the network shown below and suppose that this network is a virtual circuit network and that there is one ongoing call between H1 and H3, and another ongoing call between H2 and H3. Write down a forwarding table in router A, B, C and D, such that all traffic from H1 destined to host H3 is forwarded through interface 3, while all traffic from H2 destined to host H3 is forwarded through interface 4. (5 Marks)



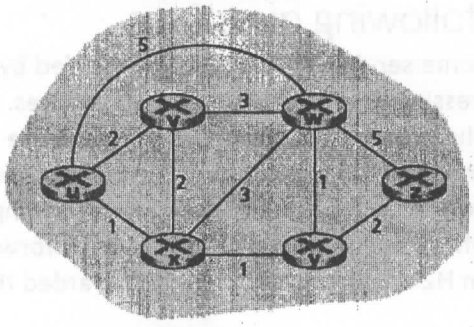
2) a) With the help of schematic diagram, explain some ways in which switching can be accomplished inside a router in giving relative advantages and disadvantages of each. (10 Marks)

b) Consider a router that interconnects three subnets: Subnet 1, Subnet 2, and Subnet 3. Suppose all of the interfaces in each of these three subnets are required to have the prefix 223.1.17/24. Also, suppose that Subnet 1 is required to support at least 60 interfaces, Subnet 2 is to support at least 90 interfaces, and Subnet 3 is to support at least 30 interfaces. Provide three network addresses (of the form a.b.c.d/x) that satisfy these constraints. Detail your solution steps.(5 Marks)

c) Consider sending a 2400-byte datagram into a link that has an MTU of 700 bytes. Suppose the original datagram is stamped with the identification number 422. How many fragments are generated? What are the values in the various fields in the IP datagram(s) generated related to fragmentation? (5 Marks)

3) a) Broadly, we can classify routing algorithms in the network layer according to whether they are *global* or *decentralized* or according to whether they are *static* or *dynamic*. Explain. (5 Marks)

b) For the network shown below, find all shortest path from node A to each of the other nodes then from node z to each of the other nodes. Detail your solution steps. (15 Marks)

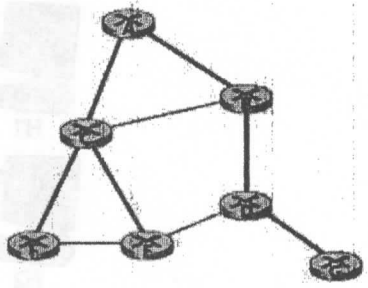


4) a) Differentiate between broadcasting and multicasting at the network layer. (5 Marks)

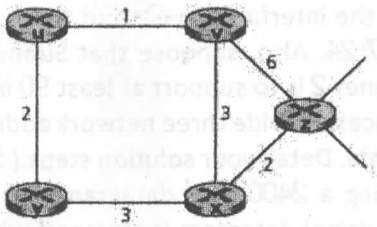
b) Given the network layout shown by the Figure, show (in drawing) packet paths when broadcasting a packet from node A in the following cases (5 Marks):

i) Broadcasting using controlled flooding

ii) Spanning-tree broadcasting (consider the thick lines as the network spanning tree)



c) Consider the network shown below, and assume that each node initially knows the costs to each of its neighbors. Consider the distance-vector algorithm and show the distance table entries at node z. Details your solution steps. (10 Marks)



5) a) Using space-time diagram, show how collision can occur then detected between two stations operated by the carrier sense multiple access with collision detection protocol (CSMA/CD). (5 Marks)

b) Explain the self-learning operation of link layer switches. (5 Marks)

c) Suppose nodes A and B are on the same 10 Mbps broadcast channel, and the propagation delay between the two nodes is 325 bit times. Suppose CSMA/CD and Ethernet packets are used for this broadcast channel. Suppose node A begins transmitting a frame and, before it finishes, node B begins transmitting a frame. Can A finish transmitting before it detects that B has transmitted? Why or why not. Hint: the minimum-sized frame is of 512 + 64 bits. (10 Marks)

Best wishes.... The examination committee

Tanta University | **Fourth Year Students**
Faculty of Engineering | **Second Term Exam**
Computers and Control Department | **June 2014**

INFORMATION SYSTEM DESIGN

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

Question 1

(a) Discuss the life cycle of an information system. Why is it called a ' cycle ' ?

(b) It is database design that plays the pivotal role in information system design. Give reasons.

(c) With reference to database modeling, explain how the top-down and bottom-up design strategies can be employed. Is a 'mixed' strategy advantageous in this respect? Justify.

Question 2

(a) Give a formal definition for the Entity-Relationship (E-R) model. What is it used for in database design?

(b) Through practical examples and brief description, show how an E-R model illustrates the concepts of:

- Recursive relationship
- One-to-many relationship
- External identifier
- Ternary relationship
- Composite attribute
- Partial generalization

(c) Construct an E-R model that simply, but adequately, describes the E-R model itself.

Question 3

(a) Why is the E-R model often restructured before the logical design phase begins?

(b) Clarify how generalizations are treated in restructuring an E-R model, via :

- Collapsing the child entities into the parent entity.
- Collapsing the parent entity into the child entities.
- Representing the generalization by relationships.

(c) An E-R model consists of two entities E1 and E2 connected by means of a single relationship R. The cardinalities of R for E1 and E2 are (X, Y) and (U, V), respectively. E1 has two attributes A11 (identifier) and A12, and E2 has two attributes A21 and A22 (identifier). Translate this E-R model into a relational data model in each of the cases:

- $X = Y = 1 ; U = V = 1$
- $X = Y = 1 ; U = 0, V = 1$
- $X = 0, Y = 1 ; U = 0, V = 1$

Determine the keys of the relations and the attributes that may have null values.

Question 4

Consider a company with several branches. Each branch is situated in a city and has its address. It is organized into departments, and each department has a name and a telephone number. The employees of the company are affiliated to these departments, starting on a specific date. The departments are managed by certain employees. Each employee has his or her surname, salary, age, and SSN (social security number). Some of the employees work on industrial projects, starting on a specific date, and each project has a name, budget, and release date.

(a) Construct an E-R model for the company. Assume reasonably the cardinalities of the relationships and attributes, and choose appropriate identifiers for the entities.

(b) Translate the E-R model obtained in part (a) into a relational data model. Specify, in particular, the referential constraints involved.

Prof. Dr. Mahmoud M. Fahmy

Course Title: Control and Instrumentation in Industrial Processes Course Code: CCE4237 Year: 4th
Date: 14/6 /2014 (Second term) Allowed time: 3hrs No. of Pages: (2)

Answer the following questions

Question (1) (25 Marks)

a) Explain what is meant by the learning process? State the different types of learning algorithms?

b) Implement the error correction rule for training the neural network to make it gives the desired output d(1), d(2) for input vectors X(1), X(2) respectively, where the activation function is threshold function and unity learning rate. Also given the initial weight vector is $W(0) = [0 \quad 1 \quad 0]^T$.

n Sample	x_1	x_2	x_3	*d*
1	2	1	-1	0
2	0	-1	-1	1

Question (2) (30 Marks)

a) Does the back propagation learning algorithm guarantee to find the global optimum solution? Explain how to speed up the convergence speed of the back propagation learning algorithm?

b) Consider the two-layer NN shown in Fig. (1). Assume that the neurons have a Sigmoid activation function and the learning rate is **0.8**

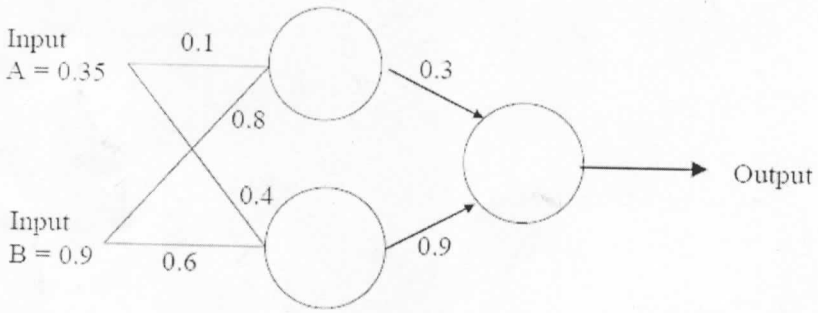


Fig. (1) Two-layer NN

i. Perform a forward pass on the network.

ii. Perform a reverse pass (training) once (target = 0.5).

Question (3) (35 Marks)

a) Prove that the PID controller can be implemented using recurrent (feedback) neural network? Draw the detailed architecture of the neural network based PID system and explain how the PID parameters can be learned

b) neural network based PID in comparison with traditional PID?

c) What are the advantages of genetic algorisms (GAs) with respect to the conventional optimization techniques?

d) Explain each of the following terms:

i. Chromosome

ii. Search space

iii. Fitness function

iv. Roulette wheel selection

v. Crossover and mutation operations (give example)

Good Luck

Dr. Eng. W. M. Elawady

Tanta University — 4th year
Faculty of Engineering — June, 2014
Computers and control Dept. — ***Robotics*** — **Time:** 3 hours

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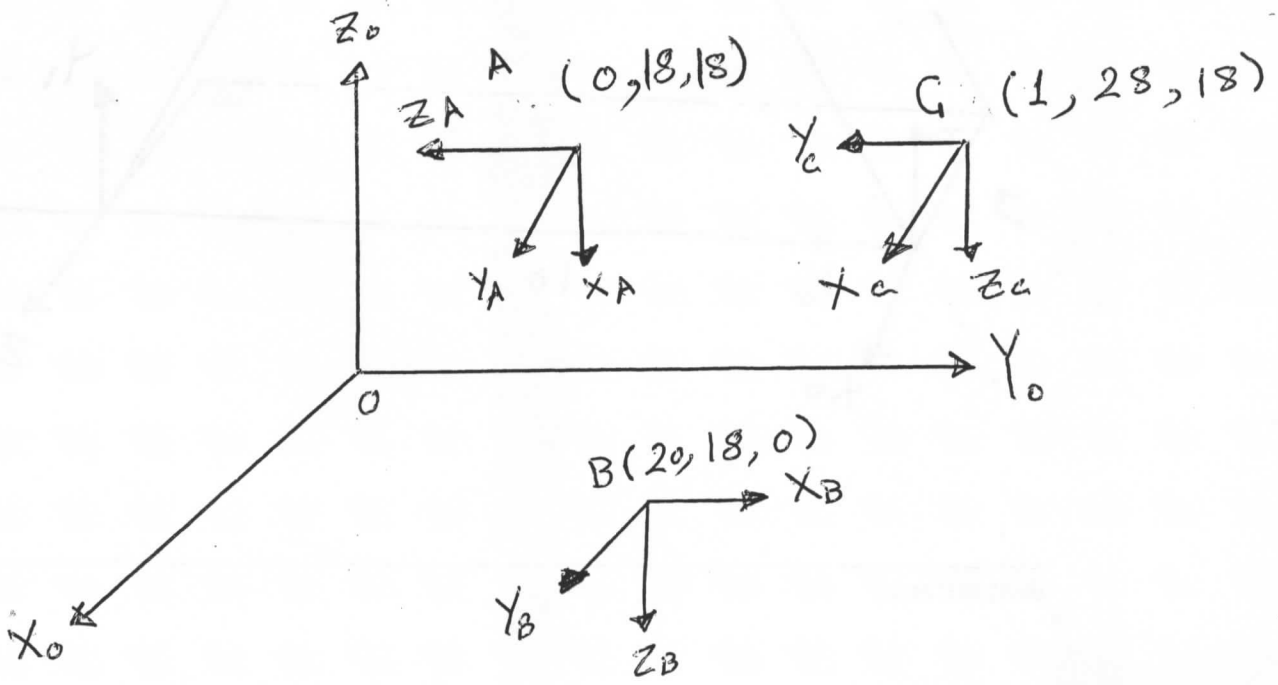
QUESTION 1: (25 MARKS)

1. Define a **Robot**. (5 marks)
2. Compare the **advantage** and **disadvantage** of using **robots** in **industry**. **(5 marks)**
3. Determine the **homogenous transformation matrix** to represent a rotation of **60°** about **OX**-axis and a translation of **10 units** a long the **OA**-axis of the mobile frame. **(5 marks)**
4. Determine the **homogenous transformation matrix** to represent the following sequence of operations: **(10 marks)**
   i. Rotation of **30° OX**-axis.
   ii. Translation of **5 units** along **OX**-axis.
   iii. Translation of **-8 units** along **OB**-axis.
   iv. Rotation of **60°** about **OA**-axis.

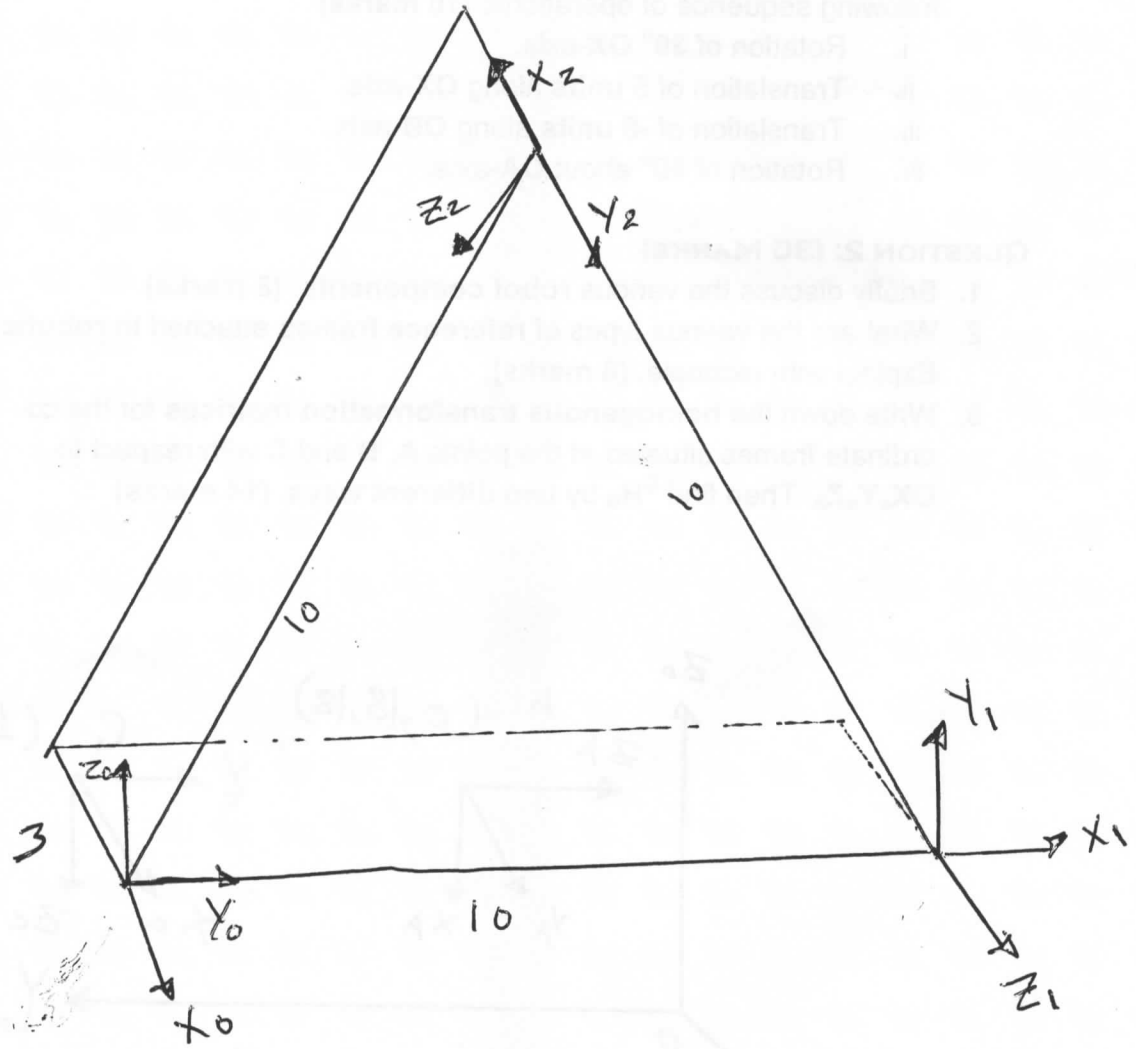
QUESTION 2: (30 MARKS)

1. Briefly discuss the various **robot components**. **(8 marks)**
2. What are the various types of **reference frames** attached to **robotic**? Explain with example. **(8 marks)**
3. Write down the **homogenous transformation matrices** for the co-ordinate frames situated at the points **A**, **B** and **C** with respect to **$OX_oY_oZ_o$**. Then find **${}^{C}H_B$** by **two different ways**. **(14 marks)**



QUESTION 3: (30 MARKS)

1. **Compare hard** automation with **soft** automation. **(5 marks)**
2. Briefly discuss **one** type of the **robot classification**. **(5 marks)**
3. The co-ordinates of a point $\mathbf{P_{abc}}$ in the mobile reference frame **OABC** is given by $[1,2,3]^T$. If the frame **OABC** is rotated **45°** with respect to **OY** of the **OXYZ** frame, find the co-ordinates of $\mathbf{P_{xyz}}$ with respect to the **base frame**. (**5 marks**)
4. For the object shown in the figure, find the **4x4 homogenous transformation matrices** ${}^0H_1$, ${}^0H_2$ and thus find the transformation of frame at **point 2** with respect to the frame at **point 1** with different ways. **(15 marks)**



Best wishes

Tanta University
Faculty of Engineering
Department of Computer & Control Eng.
Subject: مقرر اختياري Computer Vision (4th year)

Date: 18/6/2014
Time allowed: 30 Min.
Full Mark: 70 Marks
Final Term Exam (Second Semester)

Answer All the Following Questions

The First Question (20 Marks)

State whether each of the following statements is true or false.

1. The orthographic projection of two parallel lines in the world must be parallel in the image.
2. In binary images, every 8-path is also a 4-path.
3. Saturation is a measure of the overall amount of light within the visible spectrum.
4. Edge relaxation is an iterative process used for determining contours in edge images.
5. The Sobel convolution filter is actually a pair of filters.
6. If we apply a Gaussian filter to an image and apply it again to the output, typically the image is smoothed more strongly than for a single application of the same filter.
7. When we apply the shrinking algorithm to some image containing black and white pixels, it could happen that all black pixels disappear.
8. The numbers in an averaging filter should always add up to zero.
9. For any two given points in an image, the Euclidean distance between the points is always less than or equal to the city-block distance.
10. We can perform median filtering through convolution.
11. The Laplacian convolution filter computes the second derivative of the input image.
12. When we move backward, the direction of optical flow throughout our visual field is perpendicular to the gradient of its magnitude.
13. Pyramid is built by using multiple copies of image.
14. Each level in the pyramid is 1/4 of the size of previous level.
15. The lowest level is of the highest resolution and The highest level is of the lowest resolution.
16. In pyramid, the sum of mask should be 1, and all nodes at a given level must contribute the
17. same total weight to the nodes at the next higher level.
18. In Laplacian Pyramids, most pixels are zero and can be used for image compression.
19. Motion vector (u,v) is the image displacement in x and y directions between two consecutive frames.
20. Optical Flow has many applications such as motion based segmentation and structure from motion.

The Second Question (10 Marks)

(a) A camera with focal length f = 250 pixels has horizontal pixel rows and is pointing down at 45 degrees toward a horizontal plane. Where does the camera see the horizon of that plane? (in other words, where is the vanishing line for that plane located in the image plane of the camera?). Explain your conclusion.

(b) The relationship between a 3D point at world coordinates (X,Y,Z) and its corresponding 2D pixel at image coordinates (u,v) can be defined as a projective transformation using a 3 x 4 camera projection matrix P.

1. Can the matrix P incorporate any lens distortions that might be in the camera? Briefly explain.
2. Give two lists, one specifying the intrinsic camera parameters and the other giving the extrinsic camera parameters.
3. Show how P can be decomposed into a product of matrices that contain elements expressed in terms of the intrinsic and extrinsic camera parameters.
4. Give the main steps of an algorithm for computing the matrix P from a single image of a known 3D "calibration object."

5. Under what conditions will a line viewed with a pinhole camera have its vanishing point at infinity?

(c) A scene point at coordinates (400,600,1200) is perspectively projected into an image at coordinates (24,36), where both coordinates are given in millimeters in the camera coordinate frame and the camera's principal point is at coordinates (0,0,f) (i.e., $u_0 = 0$ and $v_0 = 0$). Assuming the aspect ratio of the pixels in the camera is 1, what is the focal length of the camera?

The Third Question (10 Marks)

(a) Show how an approximation to the first derivative of an image can be obtained by convolving the image with the kernel [1 −1] where the image is defined as [56 64 79 98 115 126 132 133]. Ignore computing a value for the first and last image pixels (in other words, your result will be 6 values). In addition to showing the result of the convolution, indicate where edges would be detected and why.

(b) The image below is an image of a 3 pixel thick vertical line. Show the resulting image obtained after convolution of the original with the following approximation of the derivative filter [−1, 0, 1] in the horizontal direction. How many local maxima of the filter response do you obtain ?

0 0 0 1 1 1 0 0 0
0 0 0 1 1 1 0 0 0
0 0 0 1 1 1 0 0 0
0 0 0 1 1 1 0 0 0
0 0 0 1 1 1 0 0 0
0 0 0 1 1 1 0 0 0
0 0 0 1 1 1 0 0 0
0 0 0 1 1 1 0 0 0
0 0 0 1 1 1 0 0 0

(c) Suggest a filter which when convolved with the same image would yield a single maximum in the middle of the line. Demonstrate the result of the convolution on the original image.

The Fourth Question (10 Marks)

(a) Consider the subimage shown below. Find the gradient magnitude and gradient direction at the center entry using (i) the Prewitt operator, (ii) the Sobel operator.

4 1 6 1 3
3 2 7 7 2
2 5 7 3 7
1 4 7 1 3
0 1 6 4 4

(b) What property of the coefficients of a kernel ensures that an appropriate output is obtained for regions of constant intensity in an image when

1. The kernel is approximating a first derivative.
2. The kernel is approximating a second derivative.
3. The kernel is approximating a Gaussian.

(c) List the sequence of steps involved in Canny edge detection, including image preprocessing. Describe the function of each step in one or two sentences.

The Fifth Question (20 Marks)

(a) For each of the following properties of edge detectors, indicate whether the Canny edge detector or the Marr-Hildreth (also known as 2G or Laplacian-of-Gaussian) detector is better with respect to this property, and explain briefly why.