THE OPEN UNIVERSITY OF SRI LANKA
FACULTY OF ENGINEERING TECHNOLOGY
BACHELOR OF TECHNOLOGY-LEVEL 06
FINAL EXAMINATION 2009/2010

MEX6272 – Intelligent control

DATE: 12TH MARCH 2010
TIME: 0930-1230 HRS
DURATION: THREE HOURS

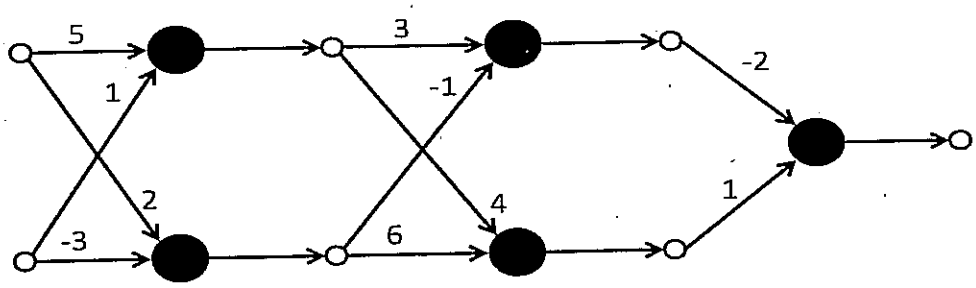
READ THE FOLLOWING INSTRUCTIONS CAREFULLY BEFORE ANSWERING THE QUESTION PAPER

The question paper has **seven** questions
Answer **five** questions only.

1)

a) What is Transfer Function?
b) State three types of transfer functions used in ANN.
c) Figure shows the signal flow of a 2-2-1 feed forward network. The function denotes a logistic function.

$$\phi(v)=\frac{1}{1+e^{-\beta t}}$$



i. State the type of the function.
ii. Define the limits of the function.
iii. Write the input – output mapping defined by this network.

2)

a) What is the difference between a neural network designed as an approximator and one designed as a classifier?
b) Select the appropriate network parameters (number of input, number of output, use of hidden layers, activation functions) for the following applications. Additionally for

each application, describe an example data set that could be used for training the network.

i. A classifier identifying adults based on their age.
ii. A cheese factory is starting a new cheese production. They have customers for strong mouldy cheese and light clean cheese, but strong clean cheese and light mouldy ones are much appreciated. They have a sensor deciding if a cheese is tasty (strong/ light) and another one identifying the presence of mould. They want to use this input to identify cheese that are ready to be sold. **(Mouldy = musty)**

3) What are the advantages of neural network?

Consider the following three cases.

a) Flight Control Using an ANN.
b) ANN-based segmentation and apple grading by machine vision.
c) ANN-based face detection.

For each of these cases, identify the main characteristics of the ANN used,

i. What is the kind of network used? Is it a classifier or an approximator? Justify
ii. What are the input and output of the neural network?
iii. How is the neural network trained?
iv. How is the performance of the network evaluated?

4)

(a) What is the role of the hidden layers in a neural network?
(b) What is the most popular algorithm for training a neural network? What is its principle?
   i. Give the design of the ANN.
   ii. Describe a neural network that could be used to control the steering of a robotic car on a race track. How can it be trained?
(c) What are the types of problems that can be solved with neural networks? What are the advantages? What are the inconvenient?

5) Consider the fuzzy set A whose membership functions is,

$$A(x) = \begin{cases} 0.5\left(\frac{x}{3} - \frac{5}{3}\right) & if\ 5 \le x \le 8 \\ -0.5\left(\frac{x}{3} - \frac{11}{3}\right) & if\ 8 < x \le 11 \\ 0 & else\ where \end{cases}$$

(a) Sketch the graph of the function. What is its height? Is it normal

(b) Perform the operation of concentration, dilation, contrast intensification, and fuzzification for the normalized (if A is not normal) fuzzy set. After performing those operations, what can you say about them and the normalized (again, it A is not normal) fuzzy set regarding the inclusion and equality relationships.

6)

(a) Explain the fuzzy set and degree of membership.

(b) What are the main applications areas of fuzzy logic?

(c) With a suitable diagram distinguish between the conventional control realization and fuzzy logic based control realization.

7)

(a) What are the two different usages of the term "fuzzy logic"? Identify the appropriate usage for each sentence below.

- Fuzzy logic has found many real-world applications.
- Fuzzy logic generalizes classical two-valued logic.
- An important rationale underlying the development of fuzzy logic is the principle of incompatibility.

(b) What are the two major motivations for developing fuzzy logic? Describe these motivations using any two problems that you encounter in your daily life.

(c) What is the motivation for using fuzzy logic in control engineering?

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