Department of Computer Science & Engineering
University of Asia Pacific (UAP)

Final Examination Spring 2016
Program: B. Sc. Engineering (4th Year/2nd Semester)

Course No. CSE 437   Course Title: Pattern Recognition

Credits: 3

Full Mark: 150

Duration: 3 Hours

Instructions:

1. There are Eight (8) Questions. Answer any Six (6). All questions are of equal value. Part marks are shown in the margins.
2. Non-programmable calculators are allowed.

Q.1   a) Define pattern recognition. Mention the different approaches of pattern recognition.   (12)

    b) Draw and explain the block diagram of a pattern recognition system.   (13)

Q.2   Develop a pattern recognition system for automatic sorting of two incoming fishes (Rui and   (25)
Katla) on a conveyor belt on the basis of their recognizing features (legth/lightness/width/head size).

Q.3   a) Define prior and posterior probabilities, likelihood and evidence. Also write down the   (10)
Bayesian decision equation on the basis of the above-mentioned terms for a classification/recognition problem.

    b) Explain confusion matrix for a two-category situation.   (08)

    c) Describe ROC (Receiver Operating Characteristic) curve of a pattern recognition   (07)
system.

Q.4   a) We have a database describing 100 examples of printer failures. Of these, 75 examples   (12)
are hardware failures, and 25 examples are driver failures. Of the hardware failures, 15
had Windows operating system and of the driver failures, 15 had Windows operating
system.

       (i)   Calculate P(windows | hardware) using the information in the problem.

       (ii)   Calculate P(driver | windows) using Bayes' rule and the information in the
problem.

    b) In an yearly checkup, the doctor will give you either good news or bad news. The bad   (13)
news is that you tested positive for a serious disease, where the test is 98% accurate
(that means, the probability of testing positive given that you have the disease is 0.98
or the probability of testing negative given that you don't have the disease is also
0.98). The good news is that this is a rare disease, striking only one in 10,000 people.
Why is it good news that the disease is rare? What are the chances that you actually
have the disease?

Q.5 a) What are Principal Components? Explain the basis of Principal Component Analysis (PCA)? (10)

b) What do you mean by feature selection and feature reduction? (08)

c) Find the eigenvalues and eigenvectors of the matrix A: (07)

$$A = \begin{bmatrix} 5 & 4 \\ 9 & 7 \end{bmatrix}$$

Q.6 a) Explain the basis of Linear Discriminant Analysis (LDA). (10)

b) Differentiate between PCA and LDA. (08)

c) Discuss the differences between LDA and K-means clustering. (07)

Q.7 a) Answer the following and also show reasoning: (12)
   (i) Given a linear SVM that perfectly classifies a set of training data. Then, which training examples could be removed and still produce the same results as of original training set?
   (ii) Under what condition, if any, would removal of exactly one training example cause the margin of a linear SVM to increase?

b) Describe the Linear SVM with necessary conditions. (13)

Q.8 a) Discuss the differences between ANN and biological neural network and also draw some analogy. (10)

b) What is a Perceptron? Describe the MSE algorithm for training Perceptron. (08)

c) Consider the following set of training vectors (patterns) X_1 and X_2 are used in training a Rosenblatt's single-layer Perceptron. The desired outputs d, initial weights W^0 and learning rate α are given below. Calculate the updated weight just after the one run forward if we consider only the training set X_1. (07)

$$X_1 = \begin{bmatrix} 0.5 \\ -1 \\ 0 \\ 1 \end{bmatrix}; \quad X_2 = \begin{bmatrix} -1 \\ 1 \\ 0.5 \\ -1 \end{bmatrix}; \quad d = \begin{bmatrix} 1 \\ -1 \end{bmatrix}; \quad W^0 = \begin{bmatrix} 1 \\ -1 \\ 0 \\ 0.5 \end{bmatrix}; \quad \alpha = 0.15$$

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Final Examination   Spring 2016   4th Year 2nd Semester

Course Code: CSE 411   Course Title: VLSI Design

Credits: 3

Duration: 3 Hours

Full Marks: 150

<u>Instructions:</u>
1. There are **Eight (8)** Questions. Answer any **Six (6)**. All questions are of equal value. Part marks are shown in the margins.
2. Non-programmable calculators are allowed.

1.   Consider the following function –

   $F = \overline{(YZ + X)}$

   a) What is the name of the function?   5
   b) Draw schematic of the function.   5
   c) Sketch the stick diagram of the function.   15

2. a) Do you need to employ any clocking strategy for sequential circuit? Explain your position.   5
   b) Define the following terms for clocking a system   5
      -Setup Time
      -Hold Time
      -Clock to Q delay time
   c) Explain clock distribution in modern circuits.   15

3. a) With the help of a diagram show master and slave register.   5
   b) Explain lithography during semiconductor manufacturing process.   5
   c) Write down the CMOS fabrication process names by sequence during manufacture with brief description of each process.   15

4. a) What is etching? Describe two popular techniques of etching with proper diagram.   5
   b) What is LOCOS? Explain.   5
   c) Consider an IC with 500 million transistors. There are 100 million logic transistors with average width of 121 and activity factor of 0.1. The remaining transistors work as memory transistors with average width of 41 and activity factor of 0.02.   15

      Here the supply voltage is 1.0 V with 65 nm process. Given that, C = 1 fF/mm (gate) + 0.8 fF/mm (diffusion)

      Estimate dynamic power consumption @ 1 GHz.
      Neglect wire capacitance and short-circuit current.

5. a) With the help of formula, briefly explain instantaneous power and average Power in a transistor chip.   5

b) What is activity factor? Write conventional notation for activity factor.   5

c) Consider the following 4-input AND gate built using a tree (a) and a chain (b) of gates.   15

Determine the activity factors at each node in the circuit assuming the input probabilities

$P_A = P_B = P_C = P_D = 0.5$.

(a)   (b)
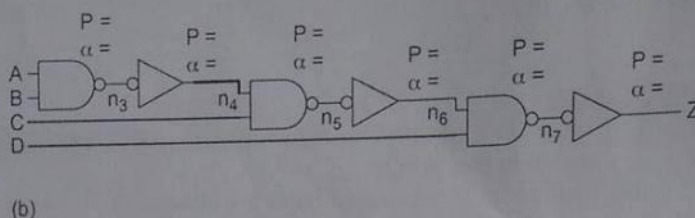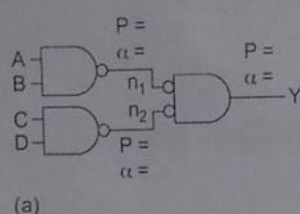
6. a) Explain the following formula   5

$$P_{switching} = \frac{V_{DD}}{T}\left[Tf_{sw}CV_{DD}\right]$$

b) Explain the following terms   5
-Carrier
-Mobility
-Velocity

c) Explain power dissipation in CMOS circuit.   15
Hint: use formula for both static and dynamic power.

7. a) Explain robustness of CMOS circuit.   5
b) What is bathtub curve? Explain with the help of a diagram.   5
Clearly mark the interesting points.
c) What are Mobility Degradation and Velocity Saturation? How do they affect our   15
CMOS circuit?

8. a) Briefly describe current leakage and their sources in a CMOS channel.   5
b) There are two factors that directly contribute towards deviation of I-V   5
characteristics of our transistor. What are they?
Write down their formula.
(Only formula).
c) With the help of a graph, explain C-V characteristics of MOS transistor.   15

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Final Examination   Spring 2016   4th Year 2nd Semester

Course Code: CSE 435   Course Title: Computer Interfacing   Credits: 3

Full Marks: 150   Duration: 3 Hours

Instructions:
1. There are **Eight (8)** Questions. Answer any **Six (6)**. All questions are of equal value. Part marks are shown in the margins.
2. Non-programmable calculators are allowed.

1.	a)	Write down the major characteristics of secondary memory.	5
	b)	What is fast sequential reading? Explain.	5
	c)	With the help of a diagram show the operation of RAM as cache memory.	15
2.	a)	What are the components used in a flatbed scanner?	5
	b)	Define the following terms for storage device	5
		-Medium	
		-Access Time	
		-Transfer Rate	
	c)	How are the files structured in CD-ROM to avoid potential discrepancy and time related problems?	15
3.	a)	Define the following terms for a HDD:	5
		Seek Time, Transfer Time, Latency.	
	b)	Draw the diagram of a Disk Drive clearly showing platter, surface and other interesting points.	5
	c)	Calculate the total capacity of the disk with following features	15
		Number of bytes per sector = 128	
		Number of sectors per track = 160	
		Number of tracks per cylinder = 1	
		Number of cylinders = 3030	
		Clearly show your work and logic behind the result.	
4.	a)	Define the following terms in the context of Ink Jet Printer	5
		-Print Head	
		-Sliding Rod	
		-Ink Chamber	

-Droplets

-Resistor 5

b) What are the key factors of a printer? Briefly explain. 15

c) Store a file of 10000 records on a disk with the following characteristics:

Number of bytes per sector = 256

Number of sectors per track = 120

Number of tracks per cylinder = 33

Number of cylinders = 2662

How many cylinders does the file require if each data record requires 128 bytes?

Clearly show your work and logic behind your answer.

5. a) Write 4 characteristics of RAM. 5

b) What is Storage device? Define online storage with relevant example. 5

c) Determine the transfer rate, in Mbytes/s, for a hard disk drive, given 15

Rotational speed = 7000 rpm

Sectors per track = 32

Data per sector = 1024 bytes = 1 Kb

6. a) What is EPROM? Describe outlining their basic work and manufacturing criteria. 5

b) Briefly explain interleaving in a disk storage management. 5

c) Chronologically describe the work of an Ink Jet printer. 15

7. a) What are computer-interfacing devices? How are they changing as technology grows? 5

b) What is magnetic storage? What are the characteristics of magnetic storage? 5

c) What is cylinder in a disk? Elaborately discuss the work of a disk controller. 15

8. a) What is Dot Pitch in Monitor? Discuss how to calculate and relevant properties 5

b) What are Bluetooth devices? Briefly discuss their compatibility with modern devices? 5

c) Discuss different types of monitors. With the help of a schematic diagram show the layers of LCD monitor. 15

Clearly mark interesting points.

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Final Examination Spring 2016
Program: B. Sc. Engineering (4th Year/2nd Semester)

Course No. CSE 407   Course Title: Artificial Intelligence & Expert System   Credits: 3

Full Mark: 150   Duration: 3 Hours

Instructions:

1. There are **Eight (8)** Questions. Answer any **Six (6)**. All questions are of equal value. Part marks are shown in the margins.
2. Non-programmable calculators are allowed.

Q.1   a) What are the original vision and present vision of Artificial Intelligence (AI)?   (10)

b) Explain the test mechanism to determine the intelligence of a machine. Also describe an important invention project of AI.   (08)

c) Discuss briefly about AI winter period.   (07)

Q.2   a) Define knowledge, meta-knowledge and hypothesis. Also give examples of each.   (10)

b) Differentiate between human and machine from knowledge representation and organization perspectives.   (08)

c) What is an expert system? Design and describe a simple rule-based expert system.   (07)

Q.3   a) What is meant by intelligent agent? Discuss the properties of an intelligent agent.   (10)

b) Explain the PEAS description of a medical diagnosis system.   (08)

c) Describe the main categories of intelligent agents.   (07)

Q.4   a) Write short notes on the following: (12)
    (i)   Deductive logic and inductive logic
    (ii)   Propositional and predicate logic

b) Represent the following knowledge using logic or PROLOG: (13)
    If Tom feels hungry, then he eats quickly. If he eats quickly, he gets heartburn. If he gets heartburn, he takes medicine. Tom feels hungry.

After representing the fact using logic or PROLOG, show that Tom is taking medicine.

Q.5   a) Explain blind and heuristic search techniques.   (10)

b) Consider a state space where the start state is 1 and the successor function for state n returns two states, numbers 2n and 2n+1. Now suppose the goal state is 19. List the order in which nodes will be visited for the iterative deepening search strategy.   (08)

c) Discuss the complexities of BFS, DFS and iterative deepening search strategies.   (07)

Q.6　a) Explain greedy and A* search techniques from objective function perspective. (10)

b) Describe gradient search strategy. What is the fundamental limitation of this search (08) technique?

c) Describe Modus Ponens with examples. (07)

Q.7　a) Explain cross-over and mutation with examples. Why mutation is important? (12)

b) It is necessary to optimize (maximize) the following function. Genetic algorithm is a (13) good way to optimize this function. Show the fitness for the first two generations.

$$f(x) = \frac{x^3}{1+5x^2}, \qquad 0 \le x \le 147$$

Q.8　a) Differentiate between fuzzy and probability citing an example. (10)

b) Explain fuzzy modifiers with examples? Draw some standard fuzzy membership functions. (08)

c) Explain two fundamental fuzzy operations with examples. (07)