L-4/T-2/CSE **Date : 01/01/2013**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2010-2011

Sub : **HUM 371** (Financial and Managerial Accounting)

Full Marks: 140 Time : 3 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE**.

1. (a) What is economic entity assumption? **(2)**

   (b) What are the elements of an accounting equation? **(3⅓)**

   (c) On 1st June, 2011 Mr. Rafiq started a consultancy agency. The following transactions took place in the month of June: **(18)**

June 1	:	Invested Tk. 80,000 as capital in the business.
June 4	:	Hired a personal secretary at a monthly salary of Tk. 4,000.
June 6	:	Purchase supplies for Tk. 2,000 cash.
June 9	:	Paid advertising expense Tk. 6,000 cash.
June 12	:	Purchased office equipment for Tk. 30,000 on account.
June 15	:	Earned Tk. 40,000 for service rendered, 40% of which is received in cash and the balances billed to a customer on account.
June 20	:	Paid the salary of personal secretary.
June 27	:	Borrowed from a bank Tk. 20,000 cash by signing a note payable.
June 28	:	Paid Tk. 2,000 cash to accounts payable.

   Required: Show the effects of transactions on the accounting equation.

2. (a) "Every debit must have its corresponding credit." Explain. **(3⅓)**

   (b) Mr. Jalal started a fast food shop. It has the following events for May, 2011: **(20)**

May 1	:	Mr. Jalal invested Tk. 400,000 in his new business.
May 4	:	Bought furniture for Tk. 200,000 from Otobi Furniture on account.
May 7	:	Bought supplies for Tk. 350,000 for cash.
May 11	:	Paid advertising expense Tk. 35,000 cash.
May 13	:	Mr. Jalal withdrew cash Tk. 1,500 from the business.
May 15	:	Sold fast food for Tk. 45,000 for a birthday party on cash.
May 18	:	Paid Tk. 55,000 to Otobi Furniture.
May 22	:	Took loan Tk. 75,000 from Sonali Bank by signing a note payable.
May 23	:	Received an electricity bill for Tk. 3,500.
May 27	:	Additional investment made by Mr. Jalal for Tk. 10,000 cash.

   Required:

   (i) Prepare journal entries for the above transactions.

   (ii) Prepare ledger accounts of "Mr. Jalal's Capital" and "Otobi Furniture".

Contd P/2

HUM 371

3. (a) "Adjusting entries are required by the cost principle of accounting." Do you agree? Explain. **(3⅓)**

(b) Sifat Ahmed started his business "Sifat Automobile" from 1st June, 2011. Following is the trial balance as on June 30, 2011 **(20)**

Sifat Automobile
Trial Balance
June 30, 2011

Accounts title	Debit (Tk.)	Credit (Tk.)
Cash	16,500	
Accounts Receivable	4,000	
Prepaid Insurance	2,400	
Supplies	1,500	
Office Furniture	15,000	
Accounts payable		3,500
Unearned Service Revenue		6,000
Sifat, Capital		30,000
Service Revenue		3,900
Salary expense	2,000	
Rent expense	1,000	
Drawings	1,000	
Total	43,400	43,400

Analysis reveals the following additional data:

→ One third of the unearned service revenue has been earned during the period.

→ Salary accrued for the month of June Tk. 600.

→ Insurance expires at the rate of Tk. 200 per month.

→ Tk. 500 of supplies has been used during the month.

→ Office furniture is being depreciated Tk. 200 per month.

Required:

(i) Prepare adjusting entries for June 30, 2011.

(ii) Prepare adjusted trial balance for June 30, 2011.

Contd P/3

HUM 371

4. Following balances are extracted from the ledger balances of Tom Company at 31st December, 2011

Tom Company

Adjusted Trial Balance

December 31, 2011

Accounts Title	Debit (Tk.)	Credit (Tk.)
Accounts Receivable	12,000	
Accounts Payable		6,000
Cash	30,500	
Tom's Capital		50,900
Supplies	900	
Salaries	7,000	
Sales Salaries	3,000	
Inventory (31-12-2011)	4,000	
Rent	13,000	
Notes payable		5,000
Bonds payable		20,000
Store Equipment	25,000	
Machinery	2,500	
Unearned Commission		3,000
Sales		47,000
Cost of goods sold	30,000	
Prepaid Insurance	4,000	
Total	131,900	131,900

Adjustment:

→ Two thirds of supplies were used during the period.

→ Depreciation 10% on Store Equipment.

→ 60% of rent relates to office and the remaining to sales.

Required:

(a) Prepare- **(17⅓)**

(i) A multiple step income statement

(ii) An owners equity statement.

(iii) A classified balance sheet at December 31, 2011.

(b) Compute- **(6)**

(i) Current ratio,

(ii) Quick (Acid test) ratio,

(iii) Return on asset ratio.

Contd P/4

HUM 371

SECTION – B

There are **FOUR** questions in this Section. Answer any **THREE**.

5. (a) What is meant by cost Accounting? State the purposes for studying cost Accounting? **(5⅓)**

(b) The following information has been taken from the accounting record of Salton Manufacturing Company for the last year ended June 30, 2011. **(18)**

Direct material	Tk. 180,000
Direct labour	160,000
Indirect labour	110,000
Depreciation (50% for factory, 50% for administrative)	20,000
Advertising	15,000
Free distribution of goods	9,000
Administrative salaries	15,000
Salesman salaries	10,000
Marketing expense	16,000
Utilities expense (70% for factory, 30% for administrative)	10,000
Rent for factory building	3,000
Sales	3000,000
Finished goods inventory (July 1, 2010)	10,000
Finished goods inventory (June 30, 2011)	15,000

Required:

(i) Prepare a schedule of cost of goods sold

(ii) Prepare income statement.

6. (a) What are the different methods of allocating overhead cost of service departments to the production departments? Which one is best and why? **(3⅓)**

(b) Consider the following information relating to two production departments (P_1 and P_2) and two service departments (S_1 and S_2) of Apple Company Limited. Answer the following requirements. **(15)**

	Service department		Production department		Total
	S_1	S_2	P_1	P_2	
Cost before allocation (Tk)	200,000	300,000	800,000	700,000	2000,000
Direct labour hours finished by S_1	—	2,000	5,000	3,000	10,000
Machine hours finished by S_2	14,000	—	20,000	16,000	50,000

Required:

(i) Allocate cost under direct method

(ii) Allocate cost under step down method

(iii) Allocate cost under linear equation method.

Contd P/5

HUM 371

Contd. Q. No. 6

(c) State Ford Computer Limited has two divisions: micro computer division and mini computer division. The following data are related to 2011. **(5)**

Fixed cost to operate the computer facility of the company	Tk. 2000,000
Practical capacity	20,000 hours
Budgeted hour usages:	
Micro computer division	8000 hours
Mini computer division	2000 hours
Total	10,000 hours
Budgeted variable cost Tk. 150 per hour	
Actual hour usages:	
Micro computer division	9000 hours
Mini computer division	1000 hours
Total	10,000 hours

Required: Allocate the cost between two divisions using dual rate allocation method.

7. (a) What is Break-Even Point? What are the basic assumptions in Cost-Volume-Profit (CVP) analysis? **(3⅓)**

(b) Sun drop company has the following information related to cost structure and other data. **(20)**

Cost data:

Direct material	Tk. 115.00
Direct labour	Tk. 10.00
Variable manufacturing overhead	Tk. 5.00
Total variable cost per unit	Tk. 130.00
Total fixed cost	~~Tk. 180.00~~ 180,000
Selling price per unit	Tk. 150.00
Number of units produced and sold 30,000 units	

Required:

(i) Compute BEP in units and in value. (BEP = Break-Even-Points)

(ii) Compute Degree of Operating Leverage (DOL) and prove it by assuming 15% increase in sales.

(iii) Prepare income statement if selling price increases by Tk. 2.00 per unit, fixed cost increases by Tk. 15000 and sales volume decreases by 10%.

(iv) Compute BEP in units if selling price increases by 10% and variable cost increases by 15%.

(v) Compute Margin of safety in units and value.

(vi) Compute number of units sold if profit target after tax is Tk. 400,000.

(vii) Computer number of units sold if target profit is Tk. 500,000.

Contd P/6

HUM 371

8. (a) What is inventory costing? Describe the differences between variable costing method and absorption costing method. **(5⅓)**

(b) The following data related to Dehtom Shell Company, for its operation during September 2010. **(18)**

Beginning inventory	0 units
Units produced during the period	18000 units
Units sold	16000 units
Selling price per unit	Tk. 150
Production cost per unit:	
Direct materials	Tk. 120
Direct labour	Tk. 5
Variable manufacturing overhead	Tk. 5
Fixed manufacturing overhead	Tk. 200,000
Operating variable cost per unit	Tk. 6
Operating fixed cost in total	Tk. 150,000

Required:

(i) Prepare income statements under variable costing method and absorption costing method.

(ii) Calculate percentage of operating income under each method.

(iii) Explain the difference for using two methods.

L-4/T-2/CSE

Date : 01/01/2013

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2010-2011

Sub : **HUM 371** (Financial and Managerial Accounting)

Full Marks: 140 Time : 3 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

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Contd P/2

HUM 371

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HUM 371

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HUM 371

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HUM 371

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HUM 371

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Operating fixed cost in total	Tk. 150,000

Required:

(i) Prepare income statements under variable costing method and absorption costing method.

(ii) Calculate percentage of operating income under each method.

(iii) Explain the difference for using two methods.

L-4/T-2/CSE **Date : 26/12/2012**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2010-2011

Sub : **HUM 275** (Economics)

Full Marks: 140 Time : 3 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

The figures in the margin indicate full marks.

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE**.

1. (a) What do you mean by demand pull and cost push inflation? **(5)**

   (b) What are the causes of demand pull and cost push inflation? **(10⅓)**

   (c) Explain the effects of cost push and demand pull inflation on the price level and output. **(8)**

2. (a) Define Gross Domestic Product (GDP) and Gross National Product (GNP). **(5)**

   (b) Explain the income, expenditure and value addition methods to measure Gross Domestic Product (GDP). **(12⅓)**

   (c) What are not counted in Gross Domestic Product (GDP)? **(6)**

3. (a) Suppose, an arbitrary total cost function: **(10)**

$$TC = 5Q^3 - 90Q^2 + 3750Q$$

   sketch the graphs of total cost (TC), average cost (AC) and marginal cost (MC) curves. Then show the relationships among them.

   (b) Mention the properties of perfectly competitive market, monopoly market, monopolistic market, oligopoly market and monopsony market. **(8⅓)**

   (c) Show graphically 'economies of scale' and 'diseconomies of scale'. **(5)**

4. (a) Given the total production (TP) function: **(10)**

$$TP = -2K^3 + 360K^2$$

   Sketch the graphs of total product (TP), average product (AP) and marginal product (MP) curves. Show the relationships among them.

   (b) Show graphically the 'super normal profit', 'abnormal loss' and 'normal profit' of a firm in a perfectly competitive market. **(8⅓)**

   (c) How can a producer's equilibrium be obtained in iso-cost isoquant analysis? **(5)**

Contd P/2

HUM 275

SECTION – B

There are **FOUR** questions in this Section. Answer any **THREE**.

5. (a) How many kinds of economic systems are there? Describe all the features of different economic systems. **(12)**

   (b) What is opportunity cost? Explain with examples. **(4⅓)**

   (c) What are the three fundamental problems of every economy? **(7)**

6. (a) What are the factors that affect the demand curve of a commodity? Explain with graph. **(10)**

   (b) Distinguish between the concepts of "change in quantity demanded" and "change in demand". **(3⅓)**

   (c) How would the equilibrium of 'Rice' be affected due to the following changes in the market? Explain with graph: **(10)**

   (i) If average income increases.

   (ii) If input price increases.

7. (a) How does the disequilibrium situations arise in the market due to price disturbance? Explain with graph. **(13⅓)**

   (b) Calculate the equilibrium price and the equilibrium quantity of Rice from the following demand and supply functions: **(10)**

   $$Q_{dx} = 2000 - 20P_x \text{ .....(i)}$$

   $$Q_{sx} = 1000 + 30P_x \text{ .....(ii)}$$

8. (a) Define price elasticity of demand. Write down the formula with example. **(8)**

   (b) What are the factors that affect the supply curve of a commodity? Explain with graph. **(10)**

   (c) Distinguish between the cardinal utility and ordinal utility theory of consumer behaviour. **(5⅓)**

L-2/T-2/CSE **Date : 20/11/2012**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-2 B. Sc. Engineering Examinations 2010-2011

Sub : **CSE 207** (Algorithms)

Full Marks : 210 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this Section. Answer any **THREE**.

1. (a) Write an exponential-time algorithm and a linear-time algorithm for finding the nth Fibonacci number. Prove the time-complexity of each of your algorithms. **(12)**

   (b) How do you prove the correctness of an algorithm? **(6)**

   (c) Compare the properties of subproblems of a divide-and-conquer method and that of a dynamic programming method. **(6)**

   (d) Explain the dynamic programming approach for solving the independent set problem on trees with illustrative examples. **(11)**

2. (a) Define a flow network. Give the Ford-Fulkerson algorithm for finding the maximum flow in a flow network, and analyze the time complexity of the algorithm. **(15)**

   (b) Compute the minimum number of scalar multiplications for the matrix-chain-multiplication $A_1A_2A_3A_4A_5$ using dynamic programming approach, where A_1 is a 13×5 matrix , A_2 is a 5×80 matrix, A_3 is a 80×3 matrix , A_4 is a 3×30 matrix and A_5 is a 30×25 matrix. Also, show the ordering of the matrices for multiplication with the minimum number of scalar multiplications. **(15)**

   (c) Derive the recursive equitation for solving the longest increasing subsequence problem by dynamic programming. **(5)**

3. (a) Show that the independent set problem is as hard as the vertex cover problem. **(8)**

   (b) Show that the independent set problem is in NP. **(8)**

   (c) Show that the vertex cover problem is NP-hard by reducing the 3-SAT problem to the vertex cover problem. **(11)**

   (d) Show that the vertex cover problem is reducible to the clique problem in polynomial time. **(8)**

4. (a) Give a non-deterministic algorithm for sorting n elements in an array. **(5)**

   (b) Describe a 2-approximation algorithm for the traveling salesperson problem where the edge weights satisfy triangle inequality. Prove the approximation ratio. **(10)**

Contd P/2

CSE 207

Contd ... Q. No. 4

(c) Describe a backtracking approach with a state-space tree for solving the 4-Queens problem.

(d) Solve the following instance of the 0/1 knapsack problem using a branch-and-bound approach with a state-space tree.

Item	Weight (KG)	Profit (Tk)	
1	3	12	
2	7	42	
3	5	25	Capacity = 10
4	4	40	

SECTION – B

There are **FOUR** questions in this Section. Answer any **THREE**.

5. (a) Deduce the recurrence relation for the time complexity of Merge Sort and solve it using iterative substitution method.

(b) Suppose you are choosing between the following three algorithms: **(3×4+3**

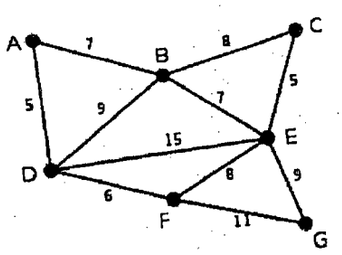
(i) Algorithm A solves problems of size n by dividing them into five subproblems of half the size, recursively solving each subproblem, and then combining the solutions in linear time.

(ii) Algorithm B solves problems of size n by recursively solving two subproblems of size n−1 and then combining the solutions in constant time.

(iii) Algorithm C solves problems of size n by dividing them into nine subproblems of size n/3 each, recursively solving each subproblem, and then combining the solutions in $O(n^2)$ time.

What are the running times of each of these algorithms and which one would you choose?

(c) Consider the graph in the following figure-



Construct a minimum-cost spanning tree for the graph using Prim's algorithm. You have to show the intermediate stages of your simulation.

Contd P/3

CSE 207

Contd ... Q. No. 5

(d) Prove the correctness of Prim's algorithm for minimum spanning trees. **(5)**

6. (a) State and explain the cases where a divide and conquer algorithm cannot be solved recursively. **(6)**

(b) Suppose, the task of a machine is to serve maximum number of jobs queued in front of it. Each job is specified by a start time and a finish time. Multiple jobs may have the same start time. Consider the following approaches for servicing maximum number of jobs- **(4+4+5=13)**

(i) Choose the job with the earliest start time

(ii) Choose the job with the shortest duration

(iii) Choose the job with maximum number of non-conflicting jobs.

For each of the approaches mentioned above, provide an example where the machine fails to serve maximum number of jobs.

(c) Consider the following table - **(10+6=16)**

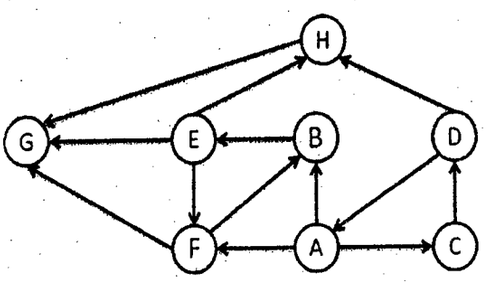
Job No.	Start Time	Finish Time
1	0	2
2	0	4
3	3	7
4	6	8
5	9	14
6	0	15
7	10	16
8	18	20
9	17	21

Table 1.

The table contains information about the start time and finish time of jobs waiting to be served by a machine. Apply the greedy approach "earliest start time first" on Table 1 and show each step of your simulation. Also, analyze the time complexity of this approach for a set of n jobs.

7 (a) Compare the exploration styles of DFS and BFS in graphs. **(5)**

(b) Consider the following graph- **(4+6=10)**



For the graph, construct the corresponding DFS tree and identify front, back and tree edges.

Contd P/4

CSE 207

Contd ... Q. No. 7

(c) Prove that- "A directed graph G has a topological ordering if and only if G is acyclic". **(10)**

(d) Explain how BFS develops the concept of shortest-paths in graphs and how this concept is adopted to implement Dijkstra's algorithm for finding shortest paths in graphs. **(10)**

8. (a) Write an algorithm that finds the strongly connected components of a given graph in linear time. Prove that, your algorithm runs in linear time. **(4+5=9)**

(b) Deduce the time complexity of Dijkstra's single source shortest-path algorithm with special importance to the types of data structures being used and their effect on the algorithm's efficiency. **(8)**

(c) Prove the correctness of Dijkstra's single source shortest-path algorithm. **(13)**

(d) Explain how Bellman Ford algorithm can identify negative cycles in a graph. **(5)**

L-4/T-2/CSE

Date : 08/01/2013

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2010-2011

Sub : **CSE 473** (Pattern Recognition)

Full Marks : 210 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE**.

1. (a) How are data points classified into different categories before an actual clustering is done in a density based clustering algorithm? Explain a typical simulation to set the values of the associated parameters. **(9+6=15)**

   (b) Given a training observation sequences of an event as $O = \{o_1, o_2, \ldots, o_K\}$, formulate an expectation maximization (EM) algorithm to determine the parameters of a *Hidden Markov Model* (HMM) that best fits the training data. Assume suitable structure of the HMM, e.g., the number of hidden and visible states. **(20)**

2. (a) Define the measurements used to define proximity between two sets. Which one is used in 'group average' hierarchical clustering? **(13)**

   (b) Why does the basic sequential algorithmic scheme (BSAS) depend on the order of data presentation? Is maxmim algorithm order dependent? Justify. **(6+6=12)**

   (c) In what conditions and why does bisecting *k*-means algorithm guarantee to produce non-empty clusters? **(10)**

3. (a) A transmitter sends a bit sequence $I_0, I_1, I_2 \ldots$ through a communication channel. Due to channel corruption, the k^{th} sample received at the receiving end is given by $x_k = 0.5I_k + I_{k-1} + I_{k-2} + \eta_k$, where η_k is a noise sequence. The decision about $\hat{I}_k$, the k^{th} transmitted bit, is based on the vector, $x_k = [x_k, x_{k-1}]$. Show how *Viterbi* algorithm can be used to determine the transmitted bit sequence. Your answer should include at least (i) state transition diagram along with justified probabilities, (ii) distance measurement and (iii) the algorithm. **(25)**

   (b) Explain why (i) agglomerative clustering and (ii) bisecting k-means do not guarantee to produce optimal clustering? **(10)**

4. (a) Does a perceptron algorithm provide a unique classifier if the training example are linearly separable? Justify. **(10)**

   (b) What is the rationale for margin maximization in *support vector machine* (SVM)? Why does SVM use 'kernel trick' to classify linearly non-separable training samples? **(12)**

Contd P/2

CSE 473

Contd ... Q. No. 4

(c) Given the following *Bayesian Belief Network* (BBN), classify whether a person is a heart patient or not if s/he exercises but does not take healthy diet. **(13)**

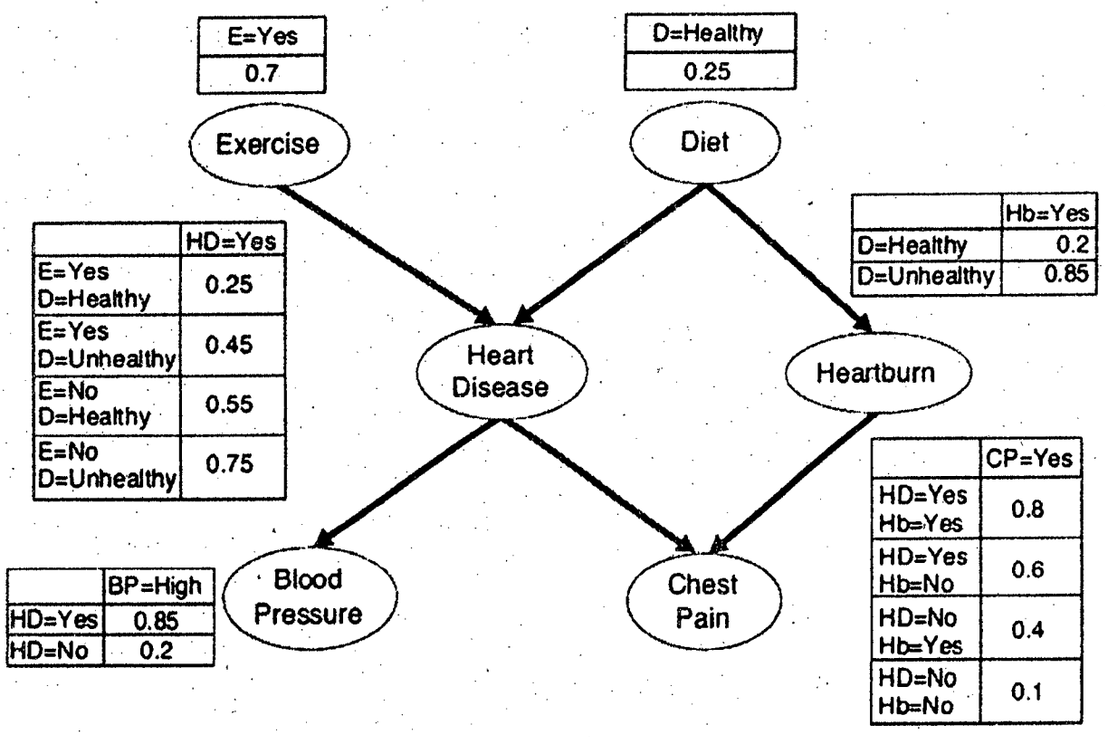


Figure for Question No. 4(c)

SECTION – B

There are **FOUR** questions in this section. Answer any **THREE**.

5. (a) Briefly explain the Bayesian classification rule for two-class problem. **(10)**

(b) For the two-class Bayesian classification problem, assume that the feature space is 1-dimensional (the x-axis) and the densities of two classes are $p(x|\omega_1) = e^{-|x-\mu 1|}$ and $p(x|\omega_2) = e^{-|x-\mu 2|}$. Let $\mu_1 = 0$ and $\mu_2 = 2$. The decision regions are given by $R_1 = \{x \mid x \leq 1\}$ and $R_2 = \{x \mid x > 1\}$. Compute the probability of error $Pe_1 = P(x \in R_2, \omega_1)$ when it is assumed that the prior probabilities of the two classes are equal. **(8)**

Contd P/3

CSE 473

Contd ... Q. No. 5

(c) Consider a two-class Bayesian classification problem with two one-dimensional Gaussian class densities $p(x|\omega_1)$ and $p(x|\omega_2)$ and with means equal to zero and variances $\sigma_1^2 = 1$ and $\sigma_2^2 = 0.5$. Assume that the other parameters are $P(\omega_1) = 0.7$ and $(\lambda_{21} - \lambda_{22})/(\lambda_{12} - \lambda_{11}) = 7$. What is the correct class for the pattern represented by the following feature: $x = -1.9$? **(12)**

(d) Write down the names of five applications of pattern recognition. **(5)**

6. (a) There are two classes (ω_1 and ω_2) and three samples $x_1 = -2 \in \omega_1$, $x_2 = -1 \in \omega_2$, and $x_3 = 2 \in \omega_2$. Use these data to train a classifier using the perceptron algorithm, when the weight vector is initially $w(0) = [1, 1]^T$ and the adaptation parameter ρ is assumed to be constant 0.45. Train the perceptron using these samples. For each iteration indicate the value of the weight vector, the decision border $g(x)$, and the samples which are misclassified. **(15)**

(b) Prove that, perceptron learning algorithm converges to a solution in a finite number of steps. **(12)**

(c) What is the on-line mode of back-propagation learning algorithm? **(3)**

(d) What happens if the value of the learning constant is small in back-propagation algorithm? What happens if its value is large? **(5)**

7. (a) Find the edit distance between the word 'poem' and its misspelled version 'poten'. Assume all costs are equal. Draw the optimal path. **(12)**

(b) Draw the following three lines in the two-dimensional space **(10)**

$$x_1 + x_2 = 0,$$
$$x_2 = 14,$$
$$x_1 - x_2 = 0.$$

For each polyhedron formed by the lines, determine the vertex of the hypercube into which it will be mapped by the first hidden layer perceptions (with step activation function) of an MLP. Give an example how should each polyhedron be assigned to one (out of two) class if

(i) a two-layer network is sufficient to obtain perfect classification and

(ii) a three-layer network is required.

(c) Briefly explain the two-dimensional logarithmic search procedure. **(10)**

(d) What is Chomsky Normal Form (CNF)? **(3)**

8. (a) Describe a 2-D line drawing description grammar. Briefly explain two applications of this grammar. **(9+3=12)**

(b) Explain the COCKE-YOUNGER-KASAMI (CYK) parsing algorithm using a suitable example. **(15)**

(c) Define the following : (i) Attributed Graph (ii) Match Graph (MG) **(8)**

Shapa 8/1/13

L-4/T-2/CSE **Date : 08/01/2013**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2010-2011

Sub : **CSE 463** (Computational Geometry)

Full Marks : 210 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE**.

1. Give a linear-time algorithm for triangulating a monotone polygon and analyze the running time. Describe how this algorithm would be useful for achieving a linear-time algorithm for triangulating a simple polygon without holes. **(35)**

2. Describe Chan's algorithm for convex hull in two dimension and derive the running time. **(35)**

3. (a) Prove that for a set of points in two dimension, the minimum spanning tree is a subset of its Delaunay triangulation. **(17½)**

   (b) State zone theorem. Use this theorem to give an $O(n^2)$-time incremental algorithm for computing the arrangement of n lines in the plane. **(17½)**

4. Given n points in one dimension, their height balanced binary search tree, and a search range [low, high], describe an O(k + n long n)-time algorithm for reporting all k points in the range. Analyze the running time. **(35)**

SECTION – B

There are **FOUR** questions in this section. Answer any **THREE**.

5. (a) For the graph shown in Figure for Question No. 5(a) show the constrained visibility representation. Set of paths Π is shown with thick lines. **(15)**

   (b) For a binary tree T with n vertices give an O(n) time algorithm for layered tree drawing that constructs a drawing Γ of T. Prove the time complexity of the algorithm. **(5+15)**

6. (a) Prove that every triangulated plane graph has a Schnyder Labeling. **(7)**

   (b) Show that for a complete binary tree there is an HV drawing having constant aspect ratio. Deduce the aspect ratio with necessary figures. **(14)**

   (c) Show that the intersection of n segments in the plane can be constructed in O((n + k)log n) time, where k is the number of intersection points on the segments. **(14)**

7. (a) For the graph shown in Figure for Question No. 7(a), find the straight line drawing using shift algorithm. (In the figure, vertices are numbered). **(28)**

   (b) Show 4 different straight line drawings of a Cubic Graph having 8 vertices. Discuss the trade-off of Aesthetics' among them. **(7)**

Contd P/2

CSE 463

8. (a) For the graph shown in Figure for Question No. 8, find the followings with necessary figures- **(15+20)**

   (i) Schnyder labeling and Realizer of the graph.

   (ii) The straight line drawing of graph using Realizer-Drawing Algorithm.

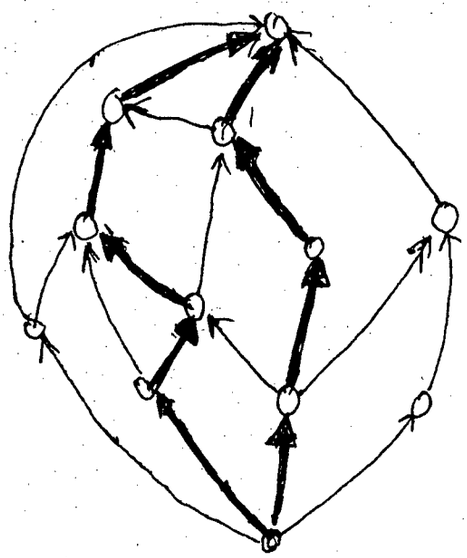


Figure for question no 5(a)

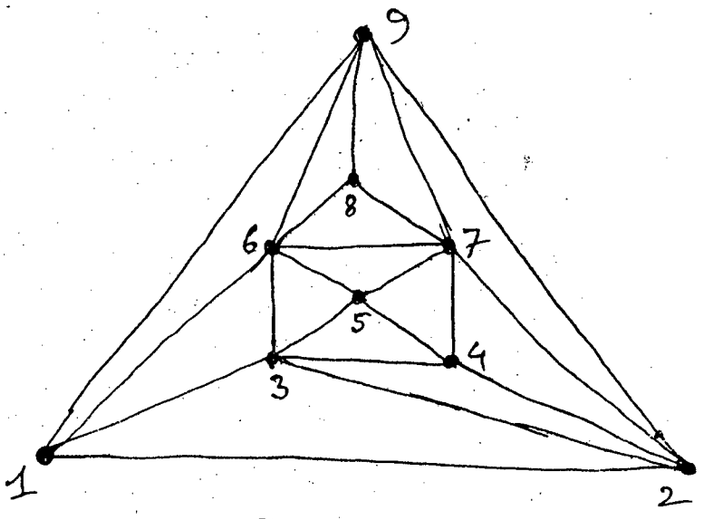


Figure for question no 8

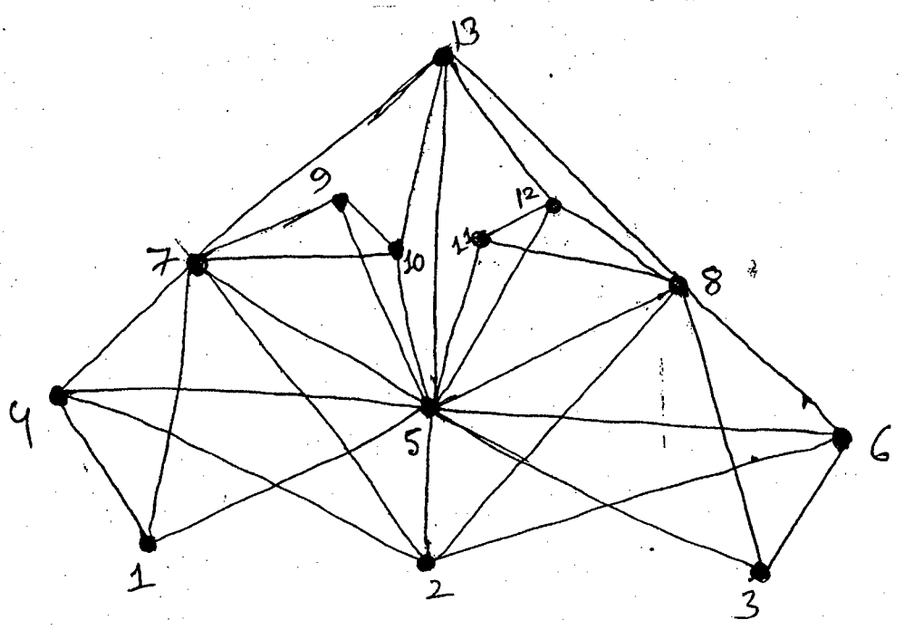


Figure for question no 7(a)

L-4/T-2/CSE

Date : 20/11/2012

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2010-2011

Sub : **CSE 409** (Computer Graphics)

Full Marks : 210 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this Section. Answer any **THREE**.

1. (a) Consider a list of polygons, sorted by farthest z in ascending order. Describe how 'Depth Sort Algorithm' determines the order of scan conversion of the polygons. **(15)**

   (b) Construct a 'BSP Tree' (partially) for the figure . 1(b). Take line segment 9 as the root and fully construct the right subtree of the root (line segment 9). **(20)**

2. (a) Describe the 'Midpoint Ellipse Scan Conversion' algorithm. [Pseudocode is not required] **(20)**

   (b) Use 'Cohen-Sutherland' line clipping algorithm to clip the lines 'AB' and 'CD' as shown in figure 2(b). **(15)**

3. (a) Consider the first two generations of a fractal curve as shown in figure 3(a). Write down the string production rule using the symbols 'F' , '–' and '+' ; where symbols carry their usual meaning. Note that, the turn angle is 90 degree. **(8)**

   (b) Write down the properties of 'Weighted Area Sampling'. **(6)**

   (c) Describe the 'Cyrus-Beck' parametric line clipping algorithm. **(18)**

   (d) Find the fractal dimension of the 'Koch Curve'. **(3)**

4. (a) What is the difference between a 'depth buffer' and a 'shadow buffer'. **(5)**

   (b) Derive the equation of 'Phong Illumination Model'. **(10)**

   (c) Write down short notes on the following topics: **(4×4=16)**

   (i) RGB color model

   (ii) CMYK color model

   (iii) HSV color model

   (iv) Half-toning

   (d) Write down two properties of spot light. **(4)**

Contd P/2

CSE 409

SECTION – B

There are **FOUR** questions in this Section. Answer any **THREE**.

5. (a) Discuss some applications of computer graphics. **(6)**

(b) Consider a 2D transformation which represents a reflection about a line L with slope m and y-intercept $(0, b)$. Find the corresponding 2D transformation matrix. **(14)**

(c) Write down the basic ray tracing algorithm. Let, S_1 be a sphere of radius 8 centered at (2, 4, 1) and S_2 a sphere of radius 10 centered at (10, –2, –5). Determine whether a ray starting from (0, 2, 5) having the direction (1, –2, 0) intersects the spheres. **(5+10=15)**

6. (a) Show that, linear combination of points is a valid point only if the combination is affine. **(5)**

(b) Consider a perspective projection on the plane $\mathbf{z} = 2$ for a viewer located at the origin. Let, the projection of the points $A(1, 1, 4)$, $B(2, 6, 6)$, $C(6, 2, 2)$, and $D(8, 4, 10)$ be A', B', C', and D' respectively. **(6+6+6=18)**

(i) Find the projection matrix.

(ii) Calculate the coordinates of A', B', C', and D'.

(iii) Explain why this is a one-point perspective projection. Also find the vanishing point.

(c) Construct the viewing transformation matrix from the information given below **(12)**

(i) *eye* position: (*eye.x, eye.y, eye.z*)

(ii) *look* position - the point to which *eye* is looking at : (*look.x, look.y, look.z*)

(iii) *up* vector - indicates the upward direction: (*up.x, up.y, up.z*)

7. (a) Derive *Rodrigue's* formula for 3D rotation around a normalized axis **a** (a_x, a_y, a_z) by an angle θ. **(8)**

(b) If an object is rotated 30 degree counterclockwise around the axis $i + 2j + 5k$, then 60 degree clockwise around the axis $2i - 4j + 3k$, **(5+6=11)**

(i) Find the individual rotation matrices using Rodrigue's formula.

(ii) Find the composite transformation matrix and express it in terms of a rotation around x-axis, followed by a rotation around y-axis, followed by a rotation around z-axis.

(c) What is quaternion? Let, p be a point in 3D projective space represented as a quaternion using homogeneous coordinates, $p = (x : y : z : w) \cong [(x, y, z), w] = [v, w]$, and let q be any non-zero quaternion. Then prove that, **(4+3+3+6=16)**

(i) The product qpq^{-1} takes $p = [v, w]$ to $p' = [v', w]$, with $N(v) = N(v')$.

(ii) Any non-zero real multiple of q gives the same action.

(iii) If $N(q) = 1$, then $q = [\hat{v}\sin\Omega, \cos\Omega]$ acts to rotate around unit axis $\hat{v}$ by 2Ω.

Contd P/3

8. (a) Explain how the *convex-hull property* of a spline can be useful in clipping. Show that, *Catmull-Rom* spline does not demonstrate this property. **(4+8=12)**

(b) How can we find the normal to a parametric surface $q(s, t)$? **(5)**

(c) Given a ratio $t = \frac{2}{3}$, at which a Bezier curve to be split, use *de Casteljau* construction to find the division matrices $D_B^L(t)$ and $D_B^R(t)$. **(12)**

(d) Represent the tetrahedron shown in figure using the *winged-edge* data structure. **(6)**

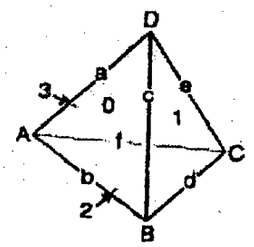
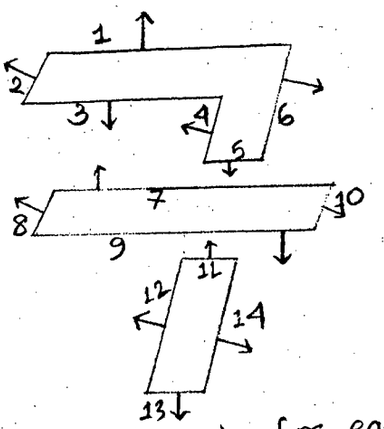


Figure for Ouestion 4(d)



(Arrow indicates Front for each line)

Figure for question no. 1(b)

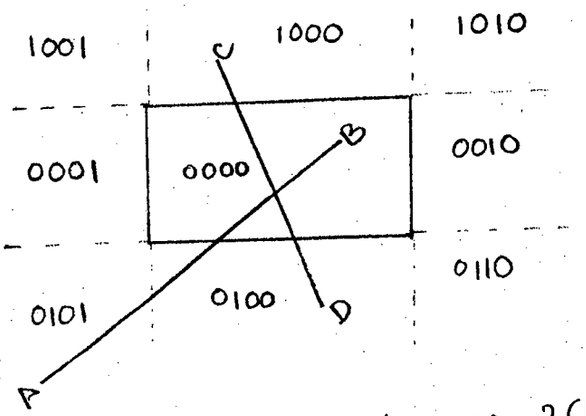


Figure for question no. 2(b)

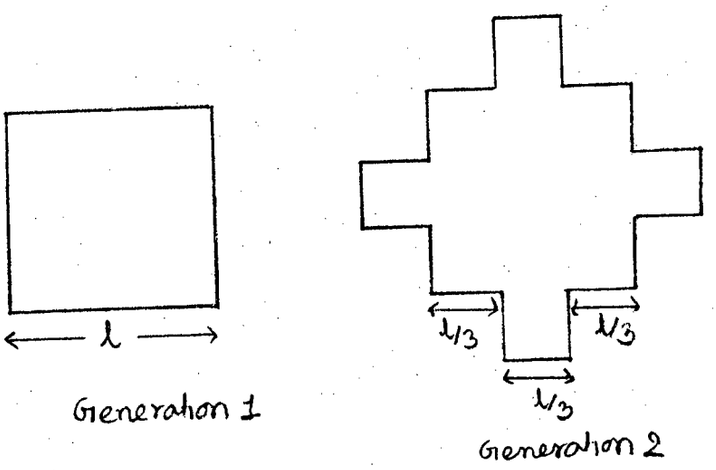


Figure for question no. 3(a)

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L-4/T-2/CSE **Date : 18/12/2012**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2010-2011

Sub : **CSE 471** (Machine Learning)

Full Marks : 210 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE.**

1. (a) Discuss three computer applications for which machine learning approaches seem appropriate and three for which they seem inappropriate. **(7)**

(b) The size of decision trees is the crucial factor for learnability by ID3 and its variants. Unfortunately, not all simple Boolean functions can be expressed by small decision trees. Suppose that a concept c is merely a disjunction of some attribute values. (For example, $c = x_1 \vee x_3 \vee x_4 \vee x_6 \vee x_7$). Do such c allow for "small" decision tree representations? **(7)**

(c) Explain with an appropriate example how we can avoid over-fitting and under-fitting in constructing decision trees. **(15)**

(d) What is VC dimension? How can we utilize such dimension in measuring the complexity of a learning machine? **(6)**

2. (a) Consider the following set of training examples: **(5)**

Instance	Classification	a_1	a_2
1	+	T	T
2	+	T	T
3	–	T	F
4	+	F	F
5	–	F	T
6	–	F	T

(i) what is the entropy of this collection of examples with respect to the target function classification?

(ii) What is the information gain of a_2 relative to these training examples?

(b) Show that the minimum number of training examples m required for any consistent learner to successfully learn any target concept in H for any desired values of δ and ε is **(15)**

$$m \geq \frac{1}{\varepsilon}\left(\ln|H| + \ln\left(1/\delta\right)\right)$$

(c) With the help of pseudo code describe FOIL algorithm for learning set of first-order rules. **(15)**

Contd P/2

CSE 471

3. (a) Draw a flowchart showing different components of a learning machine and briefly describe each of them. **(18)**

(b) What are the types of problems that can be solved with neural networks? What are the advantages and inconveniences of such networks? **(11)**

(c) Is PAC learning a learning method or some notion describing the performance of a learning method? Give your justifications. **(6)**

4. (a) Discuss the principal properties of genetic algorithms (GAs). When should GAs be used and why? **(10)**

(b) Explain the roles of encoding, crossover and mutation in GAs. **(10)**

(c) You are hired by a match making web site to find matches between two groups of N people each (men and women). Each person has ordered its preferences from 1 to k in the other group. You should define a genetic algorithm that finds matches such that everyone gets the topmost possible choice. Describe the chromosome encoding, the fitness function and mutation operator for such a GA. **(15)**

SECTION – B

There are **FOUR** questions in this section. Answer any **THREE**.

5. (a) Define consistent hypothesis and version space. State and prove the version space representation theorem. **(12)**

(b) The manager of a cricket club evaluates a batsman by the following attributes for recruitment: **(15)**

- Reflex (possible values: Slow, Quick)
- Range of Shots (possible values: Low, Medium, High)
- Foot Work (possible values: Bad, Average, Good)
- Running (possible values: Slow, Quick)

Use CANDIDATE-ELIMINATION algorithm to learn the version space of the target concept based on the following training examples:

(i) <Quick, Medium, Good, Slow>, Recruit = Yes

(ii) <Quick, High, Good, Slow>, Recruit = Yes

(iii) <Slow, Medium, Bad, Quick>, Recruit = No

(iv) <Quick, Medium, Good, Quick>, Recruit = Yes

Show each step of your computation.

(c) What are the advantages and disadvantages of k-nearest neighbor algorithm? **(8)**

Contd P/3

CSE 471

6. (a) Explain the various components of the Q learning algorithm with an illustrative example. **(13)**

(b) Prove convergence of Q learning for deterministic Markov decision processes. How can you modify the training rule to ensure convergence of Q learning in a nondeterministic environment? **(12)**

(c) How does reinforcement learning problem differ from other function approximation tasks? **(10)**

7. (a) Assume two different algorithms M1 and M2 were evaluated using cross-validation technique, in which the total number of examples in the data set is 500 and k is 10. The difference of sample error in the two algorithms were found and are shown in the following table: **(18)**

Iteration Number	No. of Samples Misclassified by M1	No. of Samples Misclassified by M2
1	7	8
2	6	4
3	7	10
4	9	9
5	8	9
6	9	6
7	10	3
8	8	11
9	7	9
10	6	5

Now compute the value of 95% confidence interval for the true difference of true error between the two algorithms. Assume that, the value of the t-statistic is 2.23.

(b) Prove that $\sigma_{error_s(h)} = \sqrt{\frac{error_s(h)(1 - error_s(h))}{n}}$; where the symbols have their usual meanings. **(12)**

(c) Write down three different criteria for the error function, E for Locally Weighted Linear Regression. Show the gradient weight update equation for each of these three criteria. **(5)**

Contd P/4

CSE 471

8. (a) How is instance based learning different from other learning methods? **(7)**

(b) Does CANDIDATE-ELIMINATION algorithm always converge to the correct hypothesis? Explain your answer. **(6)**

(c) Define lazy and eager learning. What are the advantages of lazy learning methods over eager methods? **(8)**

(d) What difficulties arise when we try to estimate the future accuracy of a hypothesis given only a limited set of data? **(7)**

(e) What are the limitations of the Find-S algorithm? How does Candidate-Elimination algorithm address these issues? **(7)**

A. S.M. Sohidull Islam

L-4/T-2/CSE

Date : 18/12/2012

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2010-2011

Sub : **CSE 461** (Algorithm Engineering)

Full Marks : 210 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE**.

1. (a) Give the definition and examples of LCS and CLCS. **(4+4=8)**

   (b) Define i-string, ILCS and CILCS. For the alphabet, $\Sigma = \{a, b, c, d\}$, do the followings: **(9+4+8+6=27)**

   (i) Show all the i-strings.

   (ii) Show the steps of determining ILCS in $O\left(n|\Sigma| + n^2|\Sigma|^{.376}\right)$-time with all the preprocessing steps.

   (iii) Show the derivation of the running time.

2. (a) State the superposition principle. Write the equation of superposition principle for multilevel system and multibit system. **(4+2+2=8)**

   (b) State the 'no cloning' theorem. How can a buffer be generated by using toffoli gate? **(4+3=7)**

   (c) Write the process of generating Bell states. Draw the circuit and label it properly. **(4+4=8)**

   (d) Draw the circuit of implementing Exclusive OR gate with exactly 5 (five) toffoli gates with proper labeling. **(12)**

3. (a) Define min-cut. Give a randomized algorithm to find out min-cut where, the probability of not finding a min-cut in a graph is less than $\frac{1}{\varepsilon}$, ε is a very small positive number. Justify your answer. **(3+8=11)**

   (b) Write the two basic properties and two main assumptions of a cache-oblivious memory model. **(8)**

   (c) Write two differences between Las Vegas and Monte Carlo randomized algorithms. Let, $0 < \varepsilon_2 < \varepsilon_1 < 1$. Consider a Monte Carlo algorithm that gives the correct solution to a problem with the probability of at least $1 - \varepsilon_1$, regardless of the input. How many independent execution of this algorithm suffice to raise the probability of obtaining a correct solution to at least $1 - \varepsilon_2$, regardless of the input. **(8+8=16)**

Contd P/2

CSE 461

4. (a) Derive the expected height of the skip list and the expected space required for a skip list. **(8+6=14)**

   (b) Prove that, the worst-case linear-time median algorithm, implemented with appropriate scans uses $O\left(1 + {}^{N}/_{B}\right)$ memory transfers, provided $M \geq 3B$, where M and B carry their usual meaning. **(10)**

   (c) Write the process of estimating the value of π from the Buffon's needle theorem. **(5)**

   (d) Write three motivations of designing cache-efficient and disk-efficient algorithms. **(6)**

SECTION – B

There are **FOUR** questions in this section. Answer any **THREE**.

5. (a) Describe with examples the meaning of problem classes P, NP, NPC and NP-hard and the relation among them. **(15)**

   (b) Prove that TSP is NP-complete. Use the reduction from Hamiltonian Cycle. **(15)**

   (c) Why is it important for a reduction to be polynomial time? **(5)**

6. (a) Give a 2-approximation algorithm for the Vertex Cover Problem. Analyze the approximation ratio. **(15)**

   (b) Give a 2-approximation algorithm for TSP with triangle inequality. Analyze the approximation ratio. **(20)**

7. Consider the stack operations PUSH, POP and MULTI-POP (k), where the last operation POPs off k elements from the stack (as long as it is possible). Show that the amortized cost of these operations are O(1) by using each of the three different methods: aggregate analysis, accounting method, and potential method. **(35)**

8. (a) Define online algorithm, deterministic and randomized online algorithm, and competitive ratio. Give some examples. What are the differences of online algorithms with offline algorithms? **(15)**

   (b) For the paging problem with cache size k, prove that any deterministic online paging algorithm cannot have a competitive ratio better than k. **(20)**

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19-12-12

L-4/T-2/CSE **Date : 18/12/2012**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2010-2011

Sub : **CSE 471** (Machine Learning)

Full Marks : 210 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE**.

1. (a) Discuss three computer applications for which machine learning approaches seem appropriate and three for which they seem inappropriate. **(7)**

   (b) The size of decision trees is the crucial factor for learnability by ID3 and its variants. Unfortunately, not all simple Boolean functions can be expressed by small decision trees. Suppose that a concept c is merely a disjunction of some attribute values. (For example, $c = x_1 \vee x_3 \vee x_4 \vee x_6 \vee x_7$). Do such c allow for "small" decision tree representations? **(7)**

   (c) Explain with an appropriate example how we can avoid over-fitting and under-fitting in constructing decision trees. **(15)**

   (d) What is VC dimension? How can we utilize such dimension in measuring the complexity of a learning machine? **(6)**

2. (a) Consider the following set of training examples: **(5)**

Instance	Classification	a_1	a_2
1	+	T	T
2	+	T	T
3	–	T	F
4	+	F	F
5	–	F	T
6	–	F	T

   (i) what is the entropy of this collection of examples with respect to the target function classification?

   (ii) What is the information gain of a_2 relative to these training examples?

   (b) Show that the minimum number of training examples m required for any consistent learner to successfully learn any target concept in H for any desired values of δ and ε is **(15)**

$$m \geq \frac{1}{\varepsilon}\left(\ln|H| + \ln\left(1/\delta\right)\right)$$

   (c) With the help of pseudo code describe FOIL algorithm for learning set of first-order rules. **(15)**

Contd P/2

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3. (a) Draw a flowchart showing different components of a learning machine and briefly describe each of them. **(18)**

(b) What are the types of problems that can be solved with neural networks? What are the advantages and inconveniences of such networks? **(11)**

(c) Is PAC learning a learning method or some notion describing the performance of a learning method? Give your justifications. **(6)**

4. (a) Discuss the principal properties of genetic algorithms (GAs). When should GAs be used and why? **(10)**

(b) Explain the roles of encoding, crossover and mutation in GAs. **(10)**

(c) You are hired by a match making web site to find matches between two groups of N people each (men and women). Each person has ordered its preferences from 1 to k in the other group. You should define a genetic algorithm that finds matches such that everyone gets the topmost possible choice. Describe the chromosome encoding, the fitness function and mutation operator for such a GA. **(15)**

SECTION – B

There are **FOUR** questions in this section. Answer any **THREE**.

5. (a) Define consistent hypothesis and version space. State and prove the version space representation theorem. **(12)**

(b) The manager of a cricket club evaluates a batsman by the following attributes for recruitment: **(15)**

- Reflex (possible values: Slow, Quick)
- Range of Shots (possible values: Low, Medium, High)
- Foot Work (possible values: Bad, Average, Good)
- Running (possible values: Slow, Quick)

Use CANDIDATE-ELIMINATION algorithm to learn the version space of the target concept based on the following training examples:

(i) <Quick, Medium, Good, Slow>, Recruit = Yes

(ii) <Quick, High, Good, Slow>, Recruit = Yes

(iii) <Slow, Medium, Bad, Quick>, Recruit = No

(iv) <Quick, Medium, Good, Quick>, Recruit = Yes

Show each step of your computation.

(c) What are the advantages and disadvantages of k-nearest neighbor algorithm? **(8)**

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6. (a) Explain the various components of the Q learning algorithm with an illustrative example. **(13)**

(b) Prove convergence of Q learning for deterministic Markov decision processes. How can you modify the training rule to ensure convergence of Q learning in a nondeterministic environment? **(12)**

(c) How does reinforcement learning problem differ from other function approximation tasks? **(10)**

7. (a) Assume two different algorithms M1 and M2 were evaluated using cross-validation technique, in which the total number of examples in the data set is 500 and k is 10. The difference of sample error in the two algorithms were found and are shown in the following table: **(18)**

Iteration Number	No. of Samples Misclassified by M1	No. of Samples Misclassified by M2
1	7	8
2	6	4
3	7	10
4	9	9
5	8	9
6	9	6
7	10	3
8	8	11
9	7	9
10	6	5

Now compute the value of 95% confidence interval for the true difference of true error between the two algorithms. Assume that, the value of the t-statistic is 2.23.

(b) Prove that $\sigma_{error_s(h)} = \sqrt{\frac{error_s(h)(1 - error_s(h))}{n}}$; where the symbols have their usual meanings. **(12)**

(c) Write down three different criteria for the error function, E for Locally Weighted Linear Regression. Show the gradient weight update equation for each of these three criteria. **(5)**

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8. (a) How is instance based learning different from other learning methods? **(7)**

(b) Does CANDIDATE-ELIMINATION algorithm always converge to the correct hypothesis? Explain your answer. **(6)**

(c) Define lazy and eager learning. What are the advantages of lazy learning methods over eager methods? **(8)**

(d) What difficulties arise when we try to estimate the future accuracy of a hypothesis given only a limited set of data? **(7)**

(e) What are the limitations of the Find-S algorithm? How does Candidate-Elimination algorithm address these issues? **(7)**
