KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering 4th Year 2nd Term Examination, 2015
Department of Computer Science and Engineering
CSE 4207
Computer Graphics

TIME: 3 hours   FULL MARKS: 210

N.B. i) Answer **ANY THREE** questions from each section in separate scripts.
   ii) Figures in the right margin indicate full marks.

SECTION A

(Answer **ANY THREE** questions from this section in Script A)

1. a) What are the raster and vector graphics? Write the differences between vector and raster   (07)
        graphics.
    b) We wish to scale a triangle A(0,0), B(1,1), C(5,2) to twice its size. While keeping vertex   (10)
        C fixed. This scaling can be expressed as a composite transformation. Describe and write
        the matrices for the component transformations.
    c) Transform Triangle1 to Triangle2 in the following figure by a sequence of basic   (13)
        transformations. Write the transformation matrices in 2D Homogeneous coordinates.
        Compute the final transformation matrix. Note that the size of triangle as also been
        changed; see the figure for dimensions.
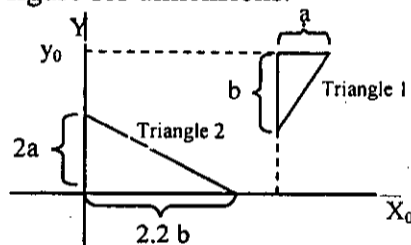
    d) What are the drawbacks of DDA algorithm over Bresenham's line drawing algorithm.   (05)

2. a) Scan convert the line segment from point (5,8) to point (9,12).   (10)
    b) Why is the point to point line error always $\leq 1/2$ for the mid-point scan conversion   (10)
        algorithm?
    c) Prove that $R(\theta_1).R(\theta_2)=R(\theta_1+\theta_2)$ Where $R(\ )$ is a rotation function and θ_1, θ_2 are angle of   (08)
        rotation.
    d) Convert these homogeneous points to Cartesian $(0,1,3,2),(2,1,3,4),(2,4,3,5)$.   (07)

3. a) When performing Cohen-Sutherland line clipping, how do we use outcodes to check for   (06)
        trivial rejection (what exact operation and comparison would you use?).
    b) What are the new coordinates of the diamond shaped polygon whose vertices are A(-1,0),   (11)
        B(0,-2), C(1,0) and D(0,2). About the horizontal line y=2 after the reflection.
    c) Derive the perspective projection matrix. In a perspective projection matrices with $z_0 =6$,   (11)
        scene point (-20,8,15) projects to what (x,y) point on the virtual image plane? To what
        (x,y) point on the real image plane?
    d) Describe the traditional graphics pipeline and explain what is done in each stage.   (07)

4. a) Use the Liang-Bersky algorithm to clip the lines in following figure   (12)
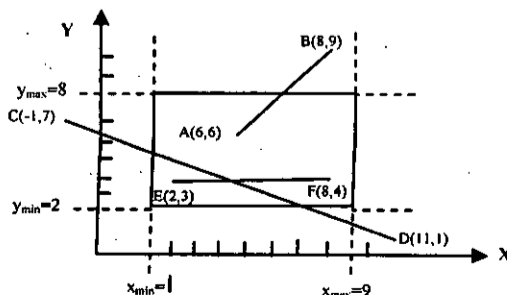
b) What are the steps to calculate a transformation matrix to find the mirror reflection of an object with respect to an arbitrary plane whose normal is N and a point P is on the plane. (10)

c) Derive a 3D transformation matrix to rotate an object by θ degree with respect to z-axis. (09)

d) State the name of different types of parallel and perspective projections. (04)

SECTION B

(Answer **ANY THREE** questions from this section in Script B)

5. a) Why do we need illumination models? Derive the Phong specular reflection model and combine diffuse and specular reflection. (13)

b) What is error diffusion? Write the algorithm for error diffusion image representation. (08)

c) Describe the strength and weakness of Ray tracing, using the theory of "The Rendering Equation". (06)

d) Compare between Phong surface rendering method and Gouraud surface rendering method. Which is better and why? (08)

6. a) Consider a triangle which has three vertices as $P_1(1,2)$, $P_2(5,0)$ and $P_3(3,4)$. A scan line S go through it and intersection points are $P_4(3,1)$ and $P_5(4,1)$. Inside the triangle there is a point $P(3.5,1)$ on scan line. Normals for three vertices are $N_1(0,1,0)$, $N_2(0,0,1)$ and $N_3(0,0.7,0.7)$. We also have the following values: L=(0,0.7,0.7), v=(0,0,1), $K_a=0.1$, $I_a=0.5$, $K_d=0.5$, $K_s=0.2$, $n_s=1$, $I_L=0.6$, where symbols denote usual meanings. Find Intensity I_4, I_5, and I_p on scan line with Gouraud shading. (22)

b) Prove that reflected ray path, (13)

$$T = \frac{n_i}{n_r}u - (\cos\theta_r - \frac{n_i}{n_r}Cos\theta_i)n,$$ where u is incoming ray and n is normal.

7. a) 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 if a ray with s=2J+5K and d=I-2K intersects the spheres and draw necessary diagram to show the intersections. (14)

b) What do you mean by depth buffer method and z-fighting? (06)

c) Define Hermite Surface. Find geometry vector G_{HX} for Hermite surface. Also find twist of the vector. (10)

d) What is terrain in computer graphics? How do you generate terrain? (05)

8. a) What is particle system? How particles are generated? (07)

b) Define fractal. What are the classifications of fractal objects? How is fractal generated? (09)

c) What do you know about geometric continuity? Explain G^0, G^1 and G^2 geometric continuity? (08)

d) Explain briefly about natural cubic splines and cubic Bezier curves. (11)

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering 4th Year 2nd Term Examination, 2015
Department of Computer Science and Engineering
CSE 4239
Data Mining

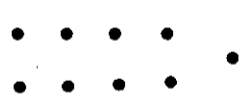TIME: 3 hours   FULL MARKS: 210

N.B. i) Answer **ANY THREE** questions from each section in separate scripts.
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SECTION A
(Answer **ANY THREE** questions from this section in Script A)

1. a) What is data mining? Explain data mining as a process of knowledge discovery. (10)
   b) What do you mean by meta data repository? What are the components of meta data repository? (06)
   c) How is a data warehouse different from a database? How are they similar? (09)
   d) Define data cleaning as way of data preprocessing? How can you detect data discrepancy? (10)

2. a) Define data integration? How can the equivalent entities of multiple data sources be matched up? Explain with example. (10)
   b) Consider the following stock prices for company C1 and C2. If the stocks are affected by the same trends, will their prices rise or fall together? (07)

Time	C1	C2
t1	6	20
t2	5	10
t3	4	14
t4	3	5
t5	2	5

   c) Define data cube. Explain the operations of OLAP on multidimensional data. (09)
   d) What do you mean by curse of dimensionality? Draw the lattice of cuboids for < item, time, location, supplier> (09)

3. a) What is cluster analysis? How do you measure the quality of a clustering algorithm? Describe the four cases of the cost function for k- mediod clustering technique. (12)
   b) Differentiate between agglomerative and divisive methods of clustering? Explain the dendogram representation for hierarchical clustering using the following data points. What are the limitations of BIRCH? (10)

   ● ● ● ●
         ●
   ● ● ● ●

   c) Define Clustering Feature (CF) and CF tree for BIRCH clustering. Apply the BIRCH algorithm for the following data set. <2, 5>, <3, 2>, <4, 3>, <5, 6>, <6, 8>, <8, 10>. (13)

4. a) Define Outlier. What are the different types of outlier? (07)
   b) Explain the idea of parametric and non parametric methods outlier detection. (08)
   c) Define Mohalnobis distance. How can you use Mohalanobis distance as a measure of multivariate outlier detection? Explain. (12)
   d) How can you detect intrusion by outlier detection technique? (08)

SECTION B
(Answer **ANY THREE** questions from this section in Script B)

5. a) Define attribute? Differentiate between discrete and continuous attributes. (10)
   b) Discuss the steps to measure the dissimilarity between ordinal attributes. Consider the following table containing attributes of mixed type (13)

Object ID	Test -1	Test -2	Test-3
1	Code-A	Excellent	45
2	Code-B	Fair	22
3	Code-C	Good	64
4	Code-A	Excellent	28

Show the dissimilarity matrix of the ordinal attribute and find the most similar objects.

c) How does a boxplot visualization identify outliers? Explain with example. (12)

6. a) What do you mean by closed frequent pattern? How can you mine closed frequent pattern? (10) Explain.
   b) "Strong associative rules are not necessarily interesting"- Why? What is the cure? (11)
   c) A database has six transactions described in the following table. Let min-sup=60% and min- (14) conf = 80%.

TID	Items Bought
T1000	{M, O, N, K, E, Y}
T2000	{D, O, N, K, E, Y}
T3000	{M, O, N, K, E, Y}
T4000	{M, U, C, K, Y}
T5000	{C, O, O, K, I, E, S}
T6000	{M, A, K, E}

Now perform the followings
   i) Find the frequent itemset using Apriori principle.
   ii) List all the strong association rules.

7. a) What is the most significant advantages of FP-tree? Why FP-tree is complete in relevance to (07) frequent pattern mining?
   b) Differentiate between eager learner and lazy learner. (06)
   c) How can you split the discrete valued and continuous valued attributes for decision tree (10) algorithm?
   d) Consider the following table of *AllElectronics Customer* database. Classify the following tuple using Bayesian classification. X=(age = youth, income = medium, student = yes, credit_rating = Fair)

RID	Age	Income	Student	Credit_rating	Class: buys computer
1	Youth	High	No	Fair	No
2	Youth	High	No	Excellent	No
3	Middle-age	High	No	Fair	Yes
4	Senior	Medium	No	Fair	Yes
5	Senior	Low	Yes	Fair	Yes
6	Senior	Low	Yes	Excellent	No
7	Middle-age	Low	Yes	Excellent	Yes
8	Youth	Medium	No	Fair	No
9	Youth	Low	Yes	Fair	Yes
10	Senior	Medium	Yes	Fair	Yes
11	Youth	Medium	Yes	Excellent	Yes
12	Middle-age	Medium	No	Excellent	Yes
13	Middle-age	High	Yes	Fair	Yes
14	Senior	Medium	No	Excellent	No

8. a) How do you classify a point in KD tree? Draw a KD tree for the following points. (1, 1), (17) (4, 2), (7, 1), (2, 4), (5, 5), (9, 4), (4, 7), (8, 6), (6, 8).
   b) Discuss the advantages of a fuzzy set classifier over rule base classifier. (06)
   c) "Active learning is a supervised learning"- Justify the statement. (06)
   d) Discuss the following technique to improve the efficiency of apriori principle. (06)
      i) Partitioning
      ii) Sampling

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering 4th Year 2nd Term Examination, 2015
Department of Computer Science and Engineering
CSE 4211
Machine Learning

TIME: 3 hours   FULL MARKS: 210

N.B. i) Answer **ANY THREE** questions from each section in separate scripts.
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SECTION A
(Answer **ANY THREE** questions from this section in Script A)

1. a) Explain McCulloch-Pitts model of artificial neuron with appropriate sketch. Describe (09)
      significance of its individual components.
   b) Describe importance of bias weight in artificial neuron. "Only changing the weight value of (09)
      bias operation of a neuron may change"-justify the statement for appropriate logic gates.
   c) Draw single neuron model for following logics: (08)

      i) $y = x_1' x_2'$, ii) $y = x_1' x_2$, iii) $y = x_1 x_2$, and iv) $y = (x_1 x_2)'$.

   d) Describe shortly the three fundamental and practical issues of learning theory. (09)

2. a) Look the following two neural networks model. (10)
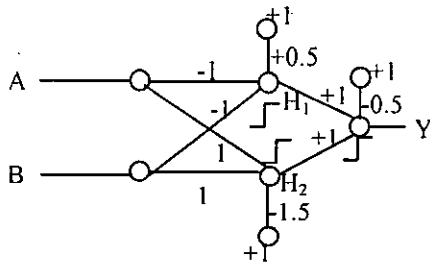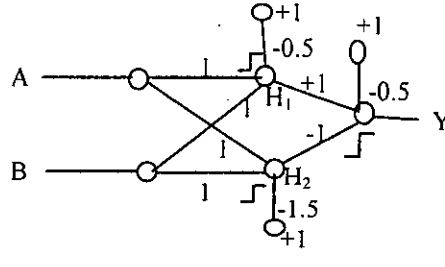
(i)   (ii)

   For the model tabulate the outputs of H_1, H_2 and Y for inputs (A and B) values 0 or 1. Are the
   model performs any logic gate operation? Which ones?
   b) What is the condition to use a function as activation function in ANN? Graphically represents (10)
      two different forms sigmoidal functions and their derivatives. How derivatives indicate the
      stability of ANN training?
   c) What is the naming significance of "Back Propagation (BP)" algorithm? Describe basic steps (07)
      of BP.
   d) What is local gradient in BP training procedure? For an ANN with two hidden layers, write (08)
      local gradients of each layer.

3. a) What is the effect of learning rate in BP? How momentum parameters speed up training in (05)
      BP?
   b) What are basic differences between Radial Basic Function (RBF) network and MLP? (05)
   c) Why hybrid training algorithm is required for training RBF networks? Draw sketch diagram (08)
      of a RBF network and put parameter values to solve XOR problem.
   d) What are the properties and usefulness of the followings: (07)
      i) Local Addressable Memory, ii) Content Addressable Memory, and iii) Associative
         Memory.
   e) Calculate the weight set (w) of a Hetero- Associative Memory for the following samples: (10)

Pattern	Source, s(p)	Target, t(p)
1	(1 0 0 0)	(1 0)
2	(1 1 0 0)	(1 0)
3	(0 0 0 1)	(0 1)
4	(0 0 1 1)	(0 1)

   Finally verify that the system work correctly.

4. a) Differentiate learning and generalization. Which one is more desirable and why? (05)
   b) Why ensemble of classifiers is necessary when a MLP able to capture any arbitrary function? (05)
      What is the condition for better ensemble construction?
   c) Among the studied ensemble methods, whose are able to take facility of multi-processing (07)
      system? How?

d) Describe an ensemble method which promotes diversity through artificial patterns. (08)

e) What is support vectors in support vector machine (SVM)? How SVM may classify non (10) linearly separable data? Explain with appropriate examples.

5. a) Why we prefer nature-inspired heuristic methods although they might not give exact solution (05) for a particular optimization task?

b) Why selection is necessary in Genetic Algorithm (GA)? Write down the differences between (12) Rank based selection and Tournament selection.

c) Write down the importance of using mutation in GA. Also write down the effects of mutation (07) rate in GA.

d) Is it possible to find out the population size from the Roulette wheel given below? Explain. (06)

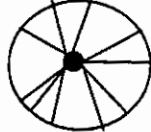

Fig. 5(d)

e) What is Elitism? Why is it important in GA? (05)

6. a) "In Particle Swarm Optimization (PSO) every particle updates position in each and every (08) iteration even it is the global best"-justify the statement from the velocity and position update equations.

b) Write down the working procedure of Attractive Repulsive PSO and Multiswarm PSO. (08)

c) What is the effect of Lifespan controller in ALC-PSO? How Lifespan of a leader is adaptively (12) tuned? Explain.

d) Write down the similarities and dissimilarities between GA and PSO. (07)

7. a) Describe the importance of transition probability in selecting the next city in TSP using Ant (10) Colony Optimization (ACO).

b) "Pheromone evaporation pushes ACO convergence"-is it true? Justify your opinion. (08)

c) Explain the Employed bee phase, onlooker bee phase and scout bee phase of Artificial Bee (12) Colony Optimization (ABCO) algorithm.

d) Explain differences of Biogeography-Based Optimization (BBO) from ACO and PSO. (05)

8. a) How does Cuckoo Search (CS) algorithm provide exploration and exploitation? Explain. (08)

b) How does Bacterial Foraging Optimization Algorithm (BFOA) find the optimum solution? (05)

c) What is the benefit of using OPTICS clustering algorithm? How this algorithm works? (08) Explain.

d) Define the core point and border point. Consider the data points in the following figure Fig. (06) 8(d) with radius where Minpts = 6. Find out the core points and border points.
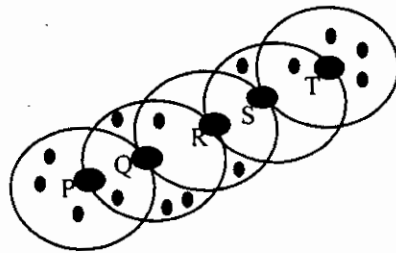

Fig. 8(d)

Is P and T density reachable from each other?

e) Consider a set of records that have three attributes namely salary, age and vacation. How (08) CLIQUE algorithm clusters data objects? Explain.