KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering 4th Year 2nd Term Examination, 2017
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) Explain the differences between "object coordinates", "world coordinates", and "camera (08)
      coordinates".
   b) When can you convert a quadratic Beizer curve to a cubic Hermite curve? (07)
   c) In Breshenham's algorithm, we saw the efficiency of incremental evaluation. For the (10)
      function, $f(x) = y = x^2 - 3$, compute the incremental evaluation function.
   d) If $(x_0, y_0) = (5,4)$ and $(x_{end}, y_{end}) = (8,10)$, use Breshenham's algorithm to compute pixels (10)
      for the line segment.

2. a) 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 (07)
      rotation.
   b) Transform Triangle1 to Triangle2 in the following figure by a sequence of basic (14)
      transformations. Write the transformation matrices in 2D homogeneous coordinates. Compute
      the final transformation matrix. Note that size of the triangle has also been changed; see the
      figure for the dimensions.
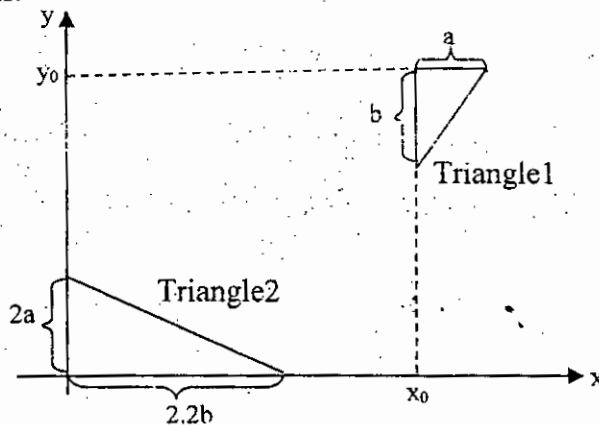
   c) Reflect the diamond-shaped polygon whose vertices $A(-1,0), B(0,-2), C(1,0)$ and $D(0,2)$ about (14)
      the line $y = x + 2$.

3. a) We want to draw a cubic Beizer curve starting from $A = (0,0)$ to the point $B = (w,0)$. At A the (10)
      curve is tangent with y-axis and at B the curve is tangent with x-axis. (see figure below).
      Draw control points and give the possible positions of them (ignoring h), use new parameters
      where necessary.
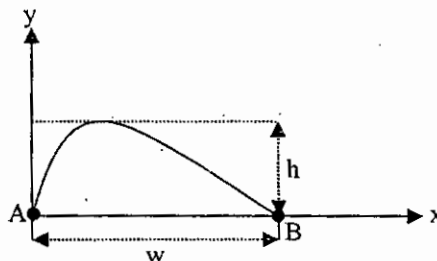
   b) Define fractal. What are the classifications of fractal objects? How is fractal generated? (09)
   c) Find fractal dimension of Koch curve. (05)
   d) Explain depth-buffer algorithm in details for visible surface detection. What are the (11)
      advantages and disadvantages of z-buffer algorithm?

4. a) How is painting priority of a surface determined by painter's algorithm? (09)

b) A Beizer curve is to be drawn given the control points (14)
$P_1(40,40), P_2(10,40), P_3(60,60), P_4(60,0)$. Calculate the coordinates of the points on the curve corresponding to the parameter $t = 0.2, 0.4, 0.6$. Draw a rough sketch of the curve and show coordinates of the various points on it.

c) What is the advantage of using curved surfaces for rendering? How to display it efficiently in (07) practice?

d) What are the drawbacks of Digital Differential Analyzer (DDA) algorithm? (05)

SECTION B

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

5. a) What are the three stages of computer graphics pipe-line? Briefly explain each of them. (10)

b) Let a line L, defined in parametric form below. Determine a rotation matrix about L with (14) rotation angle $= 30°$.

$$L: \begin{cases} x = 2 + 3t \\ y = 4t \qquad 0 \le t \le 1 \\ z = 3 + 4t \end{cases}$$

c) 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?)

d) What is GPU? Can it be used in Phong shading? Why? (05)

6. a) Explain the importance of projection in computer graphics. Find a parallel projection matrix (10) with DOP $V = aI + bJ + cK$ and xy as projection plane.

b) Consider a point $P = (2,3,4)$ in eye space. Let a symmetric projection window is defined with (12) aspect ratio $= 1.25$, fovy $= 60°$, near and far plane of the view volume is at a distance 1 and 5 respectively. Find the perspective transformation of the point P in normalized device coordinate space.

c) What is the importance of maintaining pseudo depth in perspective transformation? (05)

d) Describe the anomalies of perspective projection. (08)

7. a) What is view volume? Describe how a parallelepiped view volume can be converted to (10) canonical view volume.

b) Consider the polygon defined by the points p_1, p_2, p_3, p_4, and p_5 as shown in figure below. (15) Use Sutherland-Hodgeman algorithm to clip polygon against the rectangular window defined by the point $(x_{min}, y_{min}) = (5,6)$ and $(x_{max}, y_{max}) = (10,10)$. Compute the final points list.
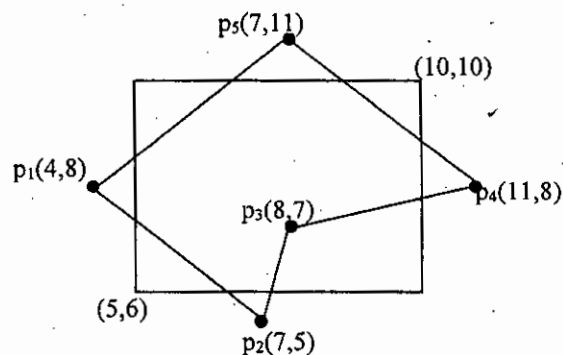
c) In ray tracing a large computational cost is associated with determining ray-object (10) intersections. Suggest a method that may reduce this cost.

8. a) The normal at a vertex $(0,1,2)$ on a surface is $(0,4,5)$. The light source is at $(0,1,4)$. The diffuse (10) color of the light is $(0.9,0,0.2)$. The diffuse reflectivity of the surface are $(0.4,1,0)$. What will the RGB color of the vertex be? Assume there is no specular, emmisive or ambient component or light attenuation.

b) Explain how light intensity attenuation can be modeled. (07)

c) Let S, be a sphere of radius 10 centered at $(10,-2,-5)$. Determine if a ray $S = 2J + 5K$ and (10) $d = I - 2K$ intersects the sphere.

d) Compare the working principle of Phong and Gouraud shading. (08)

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering 4th Year 2nd Term Examination, 2017
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) Define data mining. Why data mining is necessary?   (08)
   b) What do you mean by meta data repository? What are the components of meta data (07)
      repository?
   c) "Data mining also known as knowledge discovery from data."-justify the statement. (10)
   d) Define data cleaning as a way of data preprocessing. How can you detect data discrepancy? (10)

2. a) What are the techniques of data reduction? Explain the idea of principle component analysis (12)
      as measure of dimensionality reduction.
   b) What is correlation coefficient? How can you use correlation coefficient to remove data (06)
      redundancy?
   c) Consider the following data for the analysis of the attribute age.   (09)
      13, 15, 16, 16, 19, 20, 21, 22, 22, 25, 30, 30, 33, 35, 35, 40, 45, 46, 52, 70.
        i) Use smoothing by bean means to smooth the above data
        ii) Use min-max normalization to transform the value 52 into the range [0-1]
        iii) Use z-score normalization to transform the value 45 if stdv = 12.9.
   d) "A data warehouse is based on a multidimensional data model"- Explain the statement. (08)

3. a) What do you mean by measure in data cube? Explain different types of measures. (10)
   b) A data warehouse consists of four dimensions namely date, spectator, location and game and (15)
      two measures count and charge where charge in the fare that a spectator pays when watching
      a game on a given date. Spectators may be students, adults, or seniors with each category
      having its own charge rate.
        i) Draw a star schema for the data warehouse
        ii) Draw the lattice cuboids for the data cube
        iii) Taking location dimension as the example, explain the bitmap indexing technique.
   c) A data cube C has n dimensions each dimension has exactly P distinct values in the base (10)
      cuboid. If there is no concept of hierarchies associated with dimensions
        i) What is the maximum and minimum number of cells possible in the base cuboid?
        ii) What is the maximum and minimum number of cells possible in the data cube C?

4. a) "One person's garbage could be another's treasure." Explain the importance of mining outlier (05)
      using the above statement.
   b) What is parametric and non-parametric methods of outlier detection? How can you detect (12)
      univariate outlier?
   c) What is Cluster Based Local Outlier Factor (CBLOF)? How can you use it for outlier (08)
      detection?
   d) Explain dimensionality of data. Explain a method for finding outliers in high dimensions. (10)

SECTION B

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

5. a) Differentiate between symmetric and asymmetric binary attributes? How can you measure the (10)
      proximity of these attributes?
   b) How to compute the dissimilarity between objects described by-   (15)
        i) Nominal attributes ii) Numeric attributes iii) Term frequency vectors.
   c) How does a box plot visualization identify outliers? Explain with example.   (10)

6. a) Define frequent pattern and association rule. Suppose, an association rule A ──►B has (08)
      support = 60% and confidence = 80%. What do you mean by this statement? Explain.

b) A database has five transactions described in the following table. (14)

TID	Items_Bought
T100	M, O, N, K, E ,Y
T200	D, O, N, K, E ,Y
T300	M, A, K ,E
T400	M, U, C, K, Y
T500	C, O, O, K, I, E

Let min-sup = 4 and min-confidence = 80%. Now perform the followings:
   i) Find the frequent itemset using Apriori Principle
   ii) List all the strong association rules.

c) What are the advantages of FP-growth method over Apriori method for mining frequent (13) itemsets? Draw the FP-tree from the following table of five transactions. Where minimum support count = 3.

TID	Item
T1	C, D, G, I, M, P, F, A
T2	F, L, M, O, A, B, C
T3	B, F, H, J, O
T4	B, C, K, S, P
T5	E, L, P, N, M, A, F, C

7. a) Differentiate between supervised and unsupervised learning. (04)
   b) Discuss the trade-off between eager learner and lazy learner. Explain how lazy learner works. (10)
   c) Why is KD-tree necessary? Draw a KD-tree for the following points using median points as (16) splitting criteria.
   (1,2), (1,4), (2,2), (3,1), (4,3), (5,2), (6,5), (7,3), (8,1).
   Show all steps.
   d) Discuss the advantages of fuzzy set classifier over rule based classifier. (05)

8. a) What is cluster analysis? What is the major disadvantage of k-means clustering? How does (10) k-mediod clustering overcome this problem?
   b) Draw the dendogram representation for the agglomerative hierarchical clustering using the (08) following data points. Also show how clusters can be formed from the dendogram.
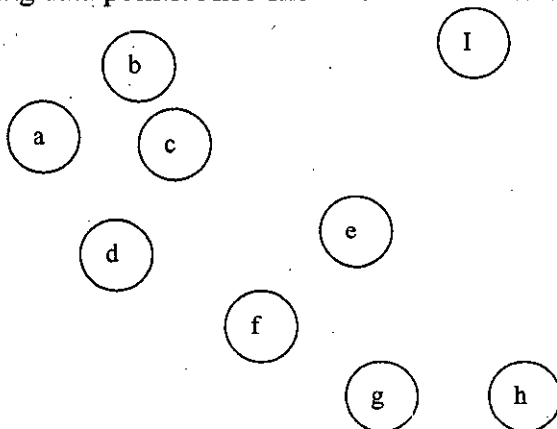
   c) Define core point, border point and noise point. Consider the data points of the following (12) figure where Minpts = 4.
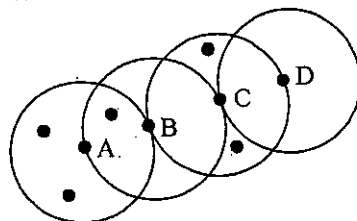
   Find out the core points and border points among A, B, C, D. Also answer the following questions:
   i) Is D density reachable from A? ii) Is A density reachable from D? Why or why not? Explain.
   d) What are the advantages and disadvantages of DBSCAN method of clustering? (05)