

**RAJSHAHI UNIVERSITY OF ENGINEERING & TECHNOLOGY**  
**DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING**

4<sup>th</sup> Year Even Semester Examination 2020

COURSE NO: CSE 4201      COURSE TITLE: Computer Graphics and Animations

FULL MARKS: 72

TIME: 3 HRS

- N.B. (i) Answer any SIX questions taking any THREE from each section.  
(ii) Figures in the right margin indicate full marks.  
(iii) Use separate answer script for each section.

SECTION : A

15/30

Marks

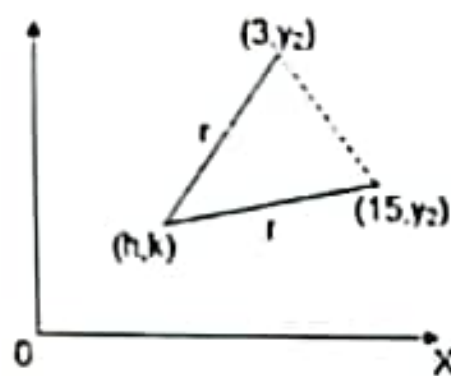
- Q.1 (a) Differentiate computer graphics and image processing. 2 1+1 2  
(b) Consider a full HD video whose frame size is 1920 x 1080. We want to see this video with the same aspect ratio but with different frame size, such as 4K UHD video frame. If the height of 4K UHD video frame is 2160, what will be the width? 2 2/2

3x/6

- (c) Why the CMY color model is used by most of the printer instead of RGB color model? 2 ~1/2  
(d) Consider a line that is needed to draw in 2D plane whose slope lies between the interval  $0 < m < 1$ . Derive a mathematical formula for drawing the line also provide an algorithm after derivation by assuming that the derived formula has the lowest complexity. 6

Q.2

- (a) Illustrate eight point symmetry properties for drawing a circle whose radius and center point are given. 3  
(b) Write an algorithm to draw an arc of a circle using the polynomial method. 3  
The following figure provides the necessary information for drawing the arc.



- (c) Write the steps to implement the boundary fill algorithm using 8-connected definition for region pixels. 3  
(d) Describe the purpose of the Control and Focusing Electrode in a CRT tube monitor. Why is the CRT monitor on the verge of extinction? 3

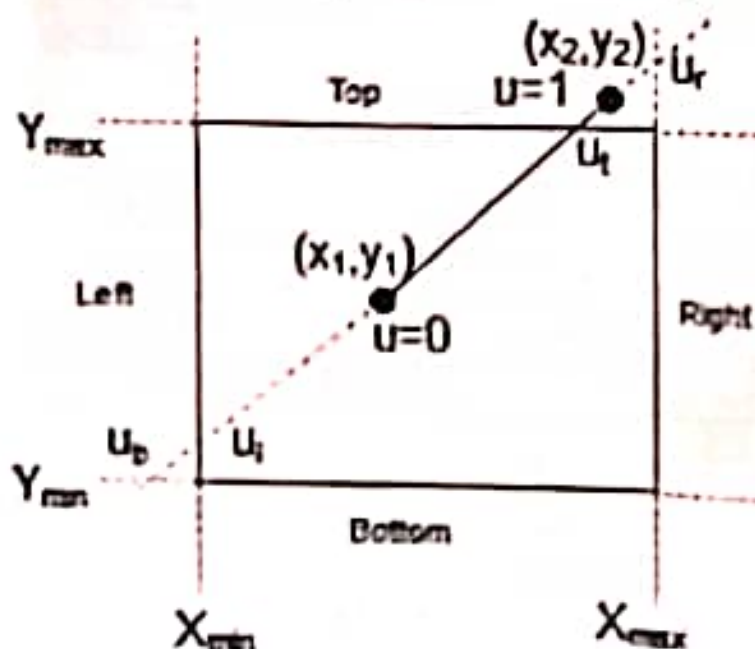
- Q.3 (a) Write down the limitation of scan-converting a line using direct equation and DDA approach. 2 2/2  
(b) Indicate which raster locations would be chosen by Bresenham's algorithm when scan-converting a line from pixel coordinate (1,1) to pixel coordinate (8,5). 4 4/4

- 8x/12 (c) A box is defined by four coordinates A(3,4), B(5,4), C(5,8), and D(3,8). If someone wants to triple the size of the box and perform a 30 degrees clockwise rotation with respect to a certain point P(5,3). Find the coordinates of the box after performing the required transformations. 4 ~1/4

- (d) Consider a geometric object having multiple boundary colors, which region filling algorithms will be selected by you? Justify your answer within three sentences. 2 2/2

- Q.4 (a) Consider the following figure. Write the mathematical equations and algorithm for clipping a line using Liang-Barsky method. 5 ~1/5

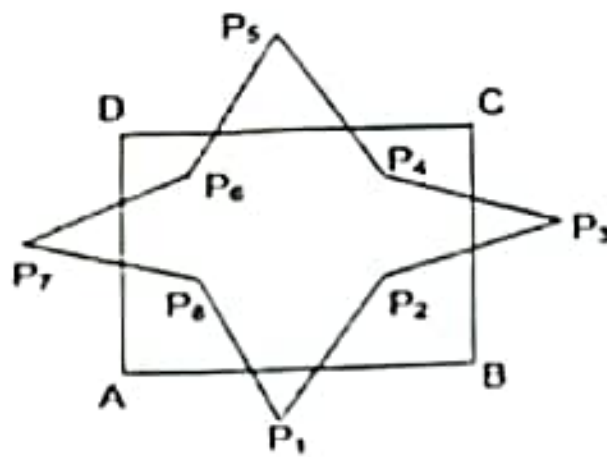
4x/12





- (b) Write the steps of Sutherland-Hodgman algorithm for polygon clipping and clip the following polygon using this algorithm.

5 2/5



- (c) Explain the following terms with suitable figure
- i) Convex polygon
  - ii) concave polygon

2 2/2

### SECTION : B

11/28

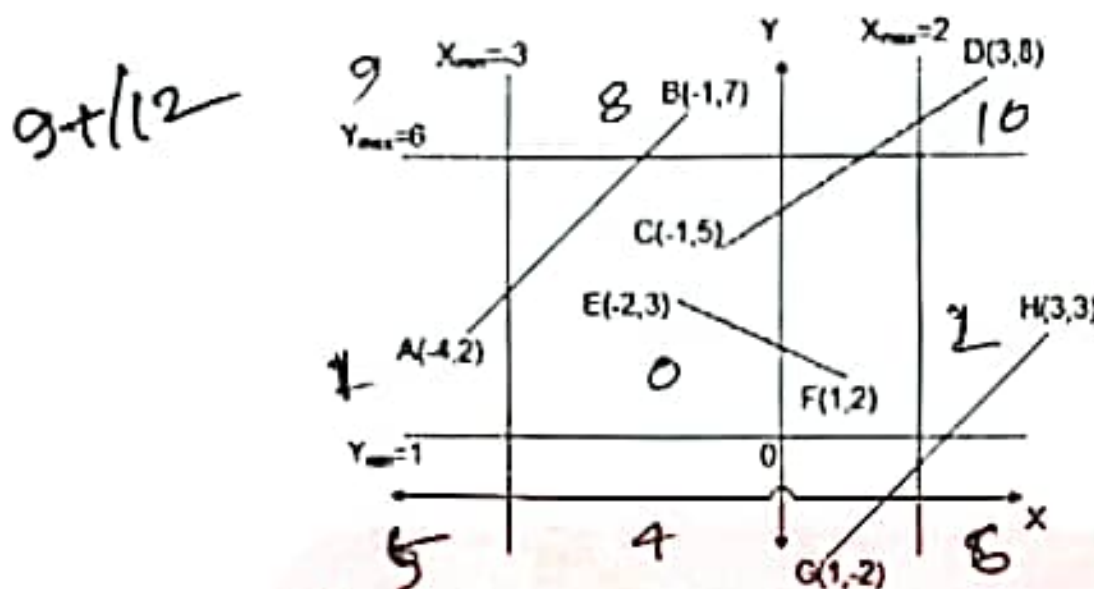
- Q.5. (a) For a specific scene, we need a 3-dimensional triangle, which is defined by the following coordinates  $A(3,2,5)$ ,  $B(2,-2,-2)$ , and  $C(4,1,7)$  to be rotated about  $45^\circ$  counter clockwise about a line  $L1$  that has the direction  $V = 4\hat{j} + 4\hat{k}$  and passing through the point  $C(0,4,0)$ . Find out the updated coordinate of the rotated triangle.
- (b) A 3-dimensional polygon is defined by the following coordinates  $A(0,0,0)$ ,  $B(1,0,0)$ ,  $C(0,1,0)$ ,  $D(0,0,1)$ . For adjusting the polygon in a particular scene it needs to be reflected with respect to a plane passing through origin and having a normal vector whose direction is  $N = 2\hat{i} - \hat{j} - \hat{k}$ . What will be the coordinates of the reflected polygon?

6

6

- Q.6 (a) Show the window to viewport mapping with suitable equation.
- (b) Let,  $R$  be the rectangular window whose lower left hand corner is at  $L(-3,1)$  and upper right hand corner is at  $R(2,6)$ . Find the region codes for the endpoints in the following figure. Also find the clipping categories.

3 3/3  
6 6/6



- (c) Determine a decision based on some objective measurement whether a point  $P(x,y)$  lies to the left or to the right of a line segment joining the points  $A(x_1,y_1)$  and  $B(x_2,y_2)$ .

3 ~ 1/3

- Q.7 (a) Tilting is defined as a rotation about the X-axis followed by a rotation about the Y-axis. Now, a person wants to tilt a 3-dimensional triangle  $P(-5,5,-5)$ ,  $Q(1,-6,6)$ ,  $R(2,-3,4)$ , 30 degrees clockwise about the X-axis and 45 degrees anti-clockwise about the Y-axis.

5 ?/5

- (b) A 3D triangle specified by the following co-ordinates  $P(-5,5,-5)$ ,  $Q(1,-6,6)$ ,  $R(2,-3,4)$  is reflected with respect to a plane passing through a point  $C(0,2,0)$  and having a normal vector whose direction is  $N = 2\hat{i} + \hat{j} + \hat{k}$ . Find the co-ordinates of the transformed triangle.

7 ?/7

- Q.8. (a) What is planar geometric projection? What things are needed to define a projection plane?

3 ✓/1

- (b) How local co-ordinates are converted into clip co-ordinates? Explain the process in brief.

5

- (c) Define the working of the following OpenGL function:

- i) `glutInitDisplayMode`
- ii) `glMatrixMode`
- iii) `gluPerspective`
- iv) `glutSwapBuffer`

4 1/3

2+1/4



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4<sup>th</sup> Year Even Semester Examination 2020

COURSE NO: CSE 4203 COURSE TITLE: Neural Networks and Fuzzy Systems  
FULL MARKS: 72 TIME: 3 HRS

- N.B. (i) Answer any SIX questions taking any THREE from each section.  
(ii) Figures in the right margin indicate full marks.  
(iii) Use separate answer script for each section.

SECTION : A

Marks

- Q.1. (a) In what perspective, Human brain is more powerful than computer? Explain briefly. 3  
(b) Explain the learning processes of biological neuron. 3  
(c) Why graceful degradation occurs in human brain? Explain with proper example. 3  
(d) Which mechanisms provide the capability of fault tolerance for human brain? Write with example. 3
- Q.2. (a) Briefly explain (i) Hamming distance measure (ii) Euclidean distance measure (iii) City block (iv) Square distance 4  
(b) Briefly explain nearest neighbour classification with a simple example. 4
- Q.3. (a) Describe the steps by which Naive Bayes classifier performs. 4  
(b) Write down the multi-layer perceptron learning algorithm. 4  
(c) Describe the learning difficulties in multi-layer perceptron learning algorithm. Also write the solutions of those problems? 4  
(d) Describe the fault tolerance of multi-layer perceptron network. 4
- Q.4. (a) "Hidden layer acts as a feature detector"-how? Explain with proper example. 3  
(b) Write the equations to adopt input to hidden layer and hidden to output layer nodes for multi-layer perceptron neural networks algorithm. Explain each part of those equations. 5  
(c) What is Kolmogorov theorem? What are the impacts of it in multi-layer perceptron neural networks for various layers? Explain with figure. 4

SECTION : B

- Q.5. (a) How the perceptron learning rule produces a solution? Prove it mathematically. 4  
(b) What is vector quantization? Is it possible to perform vector quantization in Kohonen neural network algorithm? If so, why? 4  
(c) How a feed-forward network represents a radial basis function? Explain with an example. 4
- Q.6. (a) Write down the steps of Kohonen network algorithm. 4  
(b) Write down the Hopfield network algorithm. 4  
(c) Prove that the weight matrix in Hopfield network algorithm contains the information about the stored patterns. 4
- Q.7. (a) Let  $X = \{a, b, c, d\}$ ,  $Y = \{1, 2, 3, 4\}$  and  $\tilde{A} = \{(a, 0), (b, 0.8), (c, 0.6), (d, 1)\}$ ,  $\tilde{B} = \{(1, 0.2), (2, 1), (3, 0.8), (4, 0)\}$ . Here  $\tilde{A}$  and  $\tilde{B}$  are two fuzzy sets. Determine the implication relations 4  
 $\text{If } x \text{ is } \tilde{A} \text{ THEN } y \text{ is } \tilde{B}$   
(b) Apply the fuzzy Modus Ponens rule to deduce Rotation is quite slow given 4  
(i) If the temperature is high then the rotation is slow  
(ii) The temperature is very high. Let  $\tilde{H}(\text{high})$ ,  $\tilde{VH}(\text{very high})$ ,  $\tilde{S}(\text{slow})$ , and  $\tilde{QS}(\text{quite slow})$  indicate the associated fuzzy sets are follows:  
for  $X = \{30, 40, 50, 60, 70, 80, 90, 100\}$ , the set of temperature and  
 $Y = \{10, 20, 30, 40, 50, 60\}$  the set of rotations per minute.  
 $\tilde{H} = \{(70, 1), (80, 1), (90, 0.3)\}$   
 $\tilde{VH} = \{(90, 0.9), (100, 1)\}$   
 $\tilde{QS} = \{(10, 1), (20, 0.8)\}$   
 $\tilde{S} = \{(30, 0.8), (40, 1), (50, 0.6)\}$   
(c) Explain the following defuzzification techniques 4  
(i) Centroid method  
(ii) Center of sums



- Q.8. (a) We want to use the Genetic Algorithm to solve the following nonlinear programming problem 4

minimize  $(x_1 - 2.5)^2 + (x_2 - 5)^2$  subject to

$$5.5x_1 + 2x_2^2 - 18 \leq 0$$

$$0 \leq x_1, x_2 \leq 5$$

We decided to give two decimal places of accuracy to variable  $x_1$  and  $x_2$ .

- (i) How many bits are required for coding the variables  
(ii) Write down the fitness function which you would be using in reproduction?
- (b) Consider the following population of binary string for a maximization problem: 4

String	Fitness
01101	5
11000	2
10110	1
00111	10
10101	3
00010	100

Find out the expected number of copies of the best string in the above population of the mating pool under Roulette wheel selection.

- (c) Briefly discuss the following crossover techniques for GA 4
- (i) Two point crossover  
(ii) Uniform crossover

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**4<sup>th</sup> Year Even Semester Examination 2020**  
**COURSE NO: CSE 4207      COURSE TITLE: VLSI Design**  
**FULL MARKS: 72      TIME: 3 HRS**

- N.B. (i) Answer any SIX questions taking any THREE from each section.  
(ii) Figures in the right margin indicate full marks.  
(iii) Use separate answer script for each section.

49+168

SECTION : A

29/32

Marks

- Q.1. (a) What is meant by physical design in VLSI? Write the components of physical design cycle. 3  
(b) Explain the different approaches to implement the digital design. 4  
(c) What is BiCMOS technology? What are the basic processing steps involved in BiCMOS process? 3  
(d) Define threshold voltage in CMOS. 2

- Q.2. (a) Define noise margin. Why resistor is not a good choice as load to implement an inverter? 2 2/2

- (b) Briefly explain the working principle of CMOS pass gate. 4 4/4

- (c) Consider the following NMOS inverter. Given that threshold voltages  $V_{tr} = 1V$  (For both  $T_1$  and  $T_2$ ), substrate voltages  $V_s = 0V$  (For both  $T_1$  and  $T_2$ ), supply voltage  $V_p = 5V$ . Now using  $\lambda = 0.6$ , find out the output voltage  $V_{out}$  for the given inverter when the input voltage  $V_{in} = \text{LOW}$ . 6 6/6

12/12

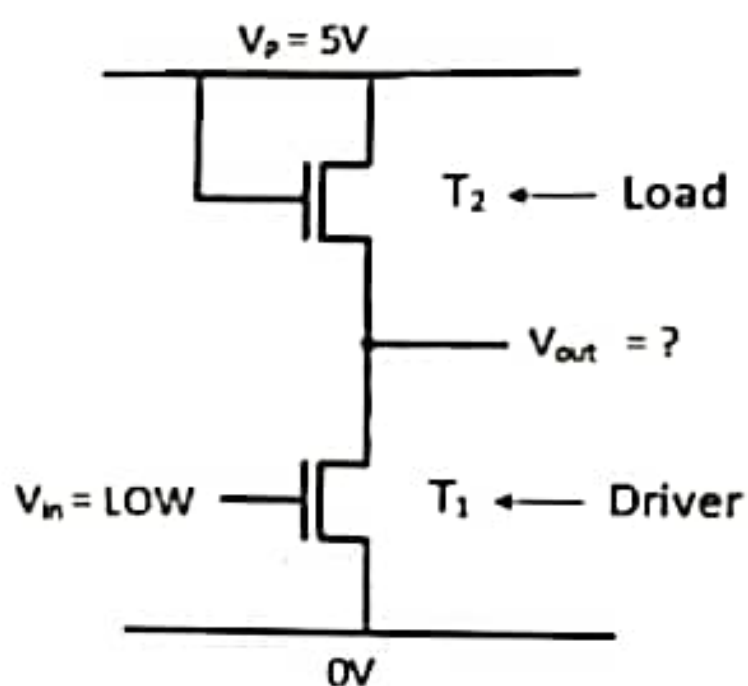


Figure: NMOS inverter

- Q.3. (a) What do you mean by pinch-off and flat band voltages? 2 1/1  
(b) What are the ratioed and ratioless circuit? How does a ratioed circuit control the speed and power dissipation of a MOSFET? Use mathematical reasoning to explain. 4 4/4

- (c) Consider the following NMOS inverter with depletion load and enhancement driver. For  $T_2$ : gate to source voltage  $V_{GS} = 0V$ , threshold voltage  $V_{th} = -4V$ , aspect ratio  $W_2/L_2 = 1/1$  are given. For output capacitance  $C_{out} = 1.2 pF$ , determine the time taken by the output voltage to rise from 1V to 4.3V in nano seconds. 6 6/6

11/11

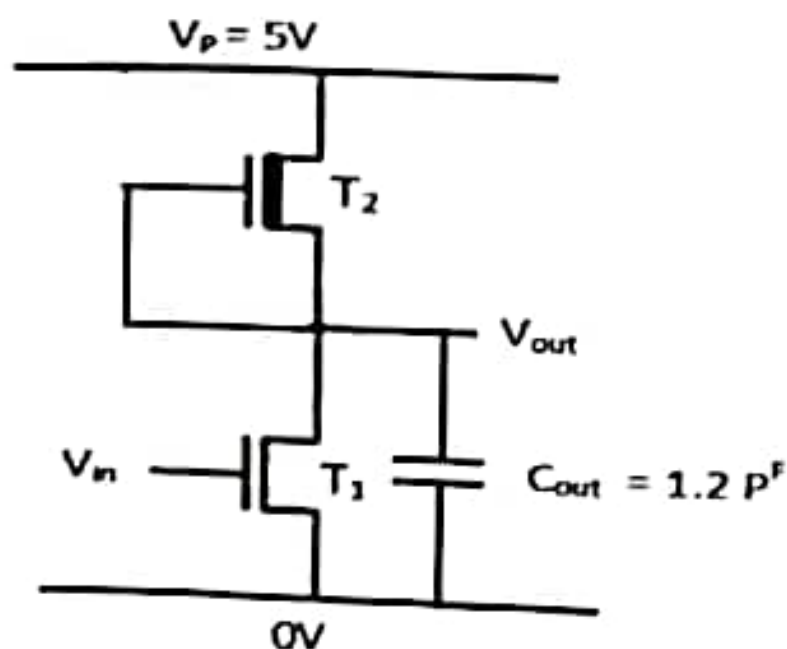


Figure: NMOS inverter with depletion load and enhancement driver



- Q.4. (a) What is stick diagram? What are the uses of stick diagram?  
 (b) Give the various color coding used in stick diagram.  
 (c) Draw the color plate stick diagram for the following expression.  
 $Y = (A + B + C)D$   
 (d) Explain VLSI design rules.

3 4/3  
 2 4/2  
 4 4/4  
 3

### SECTION : B

- Q.5. (a) Define rise time and fall time.  
 (b) Derive the rise time for NMOS inverter with enhancement type NMOS load.  
 (c) Design an AND gate using pass transistor.

20/36

3 4/3  
 6 ?/4  
 3 ?/6

- Q.6. (a) Draw the color plate stick diagram of parity generator basic one bit cell.  
 (b) Design a 1-transistor DRAM cell.  
 (c) Implement the following function using PLA technology.

6+12

$$y_1 = abc + ab\bar{c} + \bar{a}b\bar{c}$$

$$y_2 = ab + \bar{a}\bar{b}\bar{c}$$

$$y_3 = ac + bc + ab$$

4 4/4  
 4 2/4  
 4 ?/4

- Q.7. (a) Draw the Gajski-Kuhn Y-chart and its alternate representation with appropriate labeling.  
 (b) Explain VH, HV, VHV and HVH models of multilayer routing with appropriate diagrams.  
 (c) Consider the Boolean function as  $F = ab + bc + ca$  and (i) Firstly implement F by CMOSFET (Use pull-up and pull-down principle) (ii) Finally draw the color plate stick diagram.

3  
 4  
 5

- Q.8. (a) Write short notes:  
 (i) Skewed slicing tree  
 (ii) WHEEL floorplan  
 (iii) Switchbox in routing.

3 3/3

Draw necessary figures for each of the above points while writing short notes.

- (b) Draw and explain the read and write operation of a six transistor SRAM cell.  
 (c) Design a 4X4 Barrel shifter (Left) using NMOS pass transistor. Consider input as 0010 and control signal as 0100, find out the output of your Barrel shifter.

12/12

4 4/4  
 5 5/5

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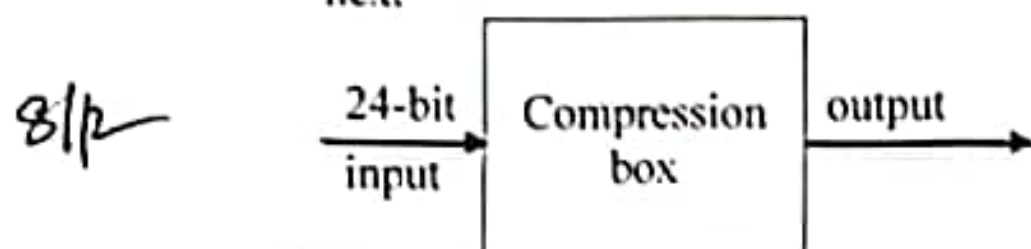
- N.B. (i) Answer any SIX questions taking any THREE from each section.  
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(iii) Use separate answer script for each section.

32+69

**SECTION : A** 22+36

Marks

- Q1. (a) What is security policy? Briefly explain the following policies in network security: (i) Access Control Policy and (ii) Remote Access Policy. 06 3/6  
(b) Find the Likelihood of data security if risk = 20 and consequence = 4. 02 1/2  
(c) Prepare a risk assessment table of an organization with the following threats: (i) theft of sensitive information (ii) cyclone damage (iii) malware and virus (iv) website failure (v) electricity failure and (vi) Hardware failure. 04 3  
Q2. (a) What is block cipher? Explain the working procedure of Feistel cipher. 03 2/3  
(b) Find the output of the following compression box with the table given if the input is 'B2C' hex. 03 3



23	5	1	6
14	22	3	2
10	15	7	11
9	17	8	13

- (e) Draw the block diagram of DES algorithm. 04 4/4  
(f) What are the functions of S-box in DES algorithm? 02 2/2  
Q3. (a) Write down the important properties of AES algorithm. 03  
(b) Find the initial key matrix of AES if key is "DONQTCALLMETHHERE". 04  
(c) Explain briefly the steps followed in AES round function. 03  
(d) Write down the benefits of AAA protocol. 02  
Q4. (a) What are the properties of RSA algorithm? Why is it considered as a strong encryption algorithm? 03 3/3  
(b) Encrypt the plaintext "I" using RSA algorithm with p = 7 and q = 11. 04 4/4  
(c) What are the biggest threats to e-commerce? 02 2/2  
(d) Explain the functions of the following in the viewpoint of security: (i) PGP (ii) Sandbox and (iii) Proxy Server. 03 3/3

**SECTION : B** 10+33

02 2/2

04 2/4

03 3/3

03 3/3

03 3/3

03 3/3

03 3/3

06 2/2

06 2/2

06 2/2

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**4<sup>th</sup> Year Even Semester Examination 2020**  
**COURSE NO: CSE 4221** **COURSE TITLE: Data Mining**  
**FULL MARKS: 72** **TIME: 3 Hours**

- N.B. (i) Answer any SIX questions taking any THREE from each section.  
(ii) Figures in the right margin indicate full marks.  
(iii) Use separate answer script for each section.

33/62+

**SECTION : A** 12+/36

Marks

- Q.1 (a) Describe "Data Mining" as a process of knowledge discovery.  
(b) Data quality can be assessed in terms of several issues including accuracy, completeness and consistency. For each of the above three issues, discuss how the assessment of data quality can depend on the intended use of the data, giving examples. Propose any other dimensions of data quality.  
(c) Explain the use of the following analytical tools: (i) Quantile Plot (ii) Scatter Plot and (iii) Loess Curve.  
(d) Describe the major tasks in "Data Cleaning".

03 2/3  
03 1/3

03 3/3

03 1/3

- Q.2 (a) Following is a Data Set (in increasing order) for an attribute age: 13, 15, 16, 16, 19, 20, 20, 21, 22, 22, 25, 25, 25, 25, 25, 30, 33, 33, 35, 35, 35, 35, 36, 40, 45, 46, 52, 70.  
(i) Use smoothing by bin means to smooth the above data using a bin depth of 3. Illustrate your steps. Comments on the effect of this technique for the given data.  
(ii) How might you determine outliers in the data? and (iii) What are other methods there for data smoothing?  
(b) Differentiate between incomplete, noisy and inconsistent data. Describe the process of recovery.  
(c) Write brief note on the followings: (i) Cross-Correlation (ii) Mutual Information and (iii) Covariance.

05

04

03

- Q.3 (a) What Bayes Theorem (Bayes Rule) is all about?  
(b) What are the advantages of using Naive Bayes Algorithm?  
(c) The following table shows the fictional dataset that describes the weather conditions for playing a game of golf.

03 1/3  
02 1/3  
07 3/7

Sl	Outlook	Temperature	Humidity	Windy	Play Golf
1	Rainy	Hot x	High x	False x	NO
2	Rainy	Hot x	High x	False x	NO
3	Overcast	Hot ✓	High ✓	True	Yes
4	Sunny ✓	Cool ✓	Normal ✓	False	Yes
5	Sunny x	Mild	Normal x	False x	NO
6	Overcast	Cool ✓	Normal ✓	False	Yes
7	Rainy	Cool x	High x	True x	NO
8	Rainy	Mild	Normal ✓	True	Yes
9	Sunny ✓	Cool ✓	Normal ✓	False	Yes
10	Rainy	Mild	High ✓	False	Yes
11	Overcast	Cool x	Normal x	True x	NO
12	Overcast	Mild	Normal ✓	True	Yes
13	Sunny ✓	Hot ✓	High ✓	False	Yes
14	Sunny x	Mild	High x	True x	NO

Now using the Naive Bayes Classifier predict whether the golf would be played under the following conditions (i) Sunny, Hot, Normal, False (ii) Sunny, Cool, High, True.

- Q.4 (a) What is DBSCAN algorithm? Define density-reachability and density-connectivity.  
(b) Consider the following 12-two dimensional data points.  $P_1(7, 4)$ ,  $P_2(6, 4)$ ,  $P_3(5, 6)$ ,  $P_4(4, 2)$ ,  $P_5(6, 3)$ ,  $P_6(5, 2)$ ,  $P_7(3, 3)$ ,  $P_8(4, 5)$ ,  $P_9(6, 5)$ ,  $P_{10}(3, 6)$ ,  $P_{11}(4, 4)$ ,  $P_{12}(8, 2)$ . Use the Euclidean distance with  $EPS = 2$  and  $Minpts = 4$ . Find all core point, border points and noise points and show the final clusters using DBSCAN algorithm.

05 3/5  
07 2/7



## SECTION : B 21+/26+

- Q.5. (a) The major challenge in decision tree is the identification of the attribute for the root node in each level. This process is known as attribute selection. Explain the two measures of attribute selection. 04
- (b) Which criteria are used in LDA to create new axis. Explain these with example. 03
- (c) Justify the use of PCA in various applications like noise reduction, feature extraction, feature reduction. 06

- Q.6. (a) We generally will be more interested in association rules with high confidence. However, often we will not be interested in association rules that have a confidence of 100%, why? Then specifically explain why association rules with 99% confidence may be interesting (i.e. What might they indicate?) 03
- (b) For the following transactional data set, identify the frequent patterns and generate rules using FP-Growth algorithm. Consider min-sup = 60% and min-conf = 80%. 07 2+

TID	Items
T <sub>1</sub>	{E, K, M, N, O, Y}
T <sub>2</sub>	{D, E, K, N, O, Y}
T <sub>3</sub>	{A, E, K, M}
T <sub>4</sub>	{G, K, M, N, U, Y}
T <sub>5</sub>	{G, E, I, K, O}

- (c) Give a short example to show that items in a strong association rule actually may be negatively correlated. 02

- Q.7. (a) Among the different strategies to improve the efficiency of the Apriori Algorithm, describe any two strategies. 04 2+/4
- (b) For the following transactional data set, identify frequent item set using Dynamic Item set counting, consider support = 50% and M = 2. 05 5/5

Transaction ID	Items Purchased
T <sub>1</sub>	A, B, C
T <sub>2</sub>	B, C, D
T <sub>3</sub>	D, E
T <sub>4</sub>	A, B, D
T <sub>5</sub>	A, B, D
T <sub>6</sub>	A, B, C, D

- (c) In real-world data, tuples with missing values for some attributes are a common occurrence. Describe various methods for handling this problem. 03 4/3

- Q.8. (a) What is expectation-maximization (EM) algorithm? Briefly explain the EM algorithm. 03 2+/3

- (b) Discuss issues to consider during data integration. 03 1+/3

- (c) Using the data given: 13, 15, 16, 16, 19, 20, 20, 21, 22, 22, 25, 25, 25, 25, 25, 30, 33, 33, 35, 35, 35, 35, 36, 40, 45, 46, 52, 70. Answer the followings: (i) Use min-max normalization to transform the value 35 for age onto the range [0.0, 1.0]. 06 4/6

- (ii) Use z-score normalization to transform the value 35 for the age, where the standard deviation of age is 12.94 years (iii) Use normalization by decimal scaling to transform the value 35 for age and (iv) Comment on which method you would prefer to use for the given data and why?