B.Sc (HONS.) IN COMPUTER SCIENCE AND ENGINEERING FIRST YEAR SECOND SEMESTER EXAMINATION, 2019

[According to the New Syllabus]

CSE-510221

(Digital Systems Design)

Time—3 hours

Full marks—80

*[N.B. The figures in the right margin indicate full marks. Answer any **four** questions. Different parts of a questions must be answered sequentially.]*

Marks

1. *(a)* Define digital system. Write down importance of digital system. 4

(b) Discuss the major parts of a digital computer with required diagram. 6

(c) Define ASCII and Gray Code. Convert $(123.45)_8 = (?)_2 = (?)_{Hex} = (?)_{BCD}$. 5

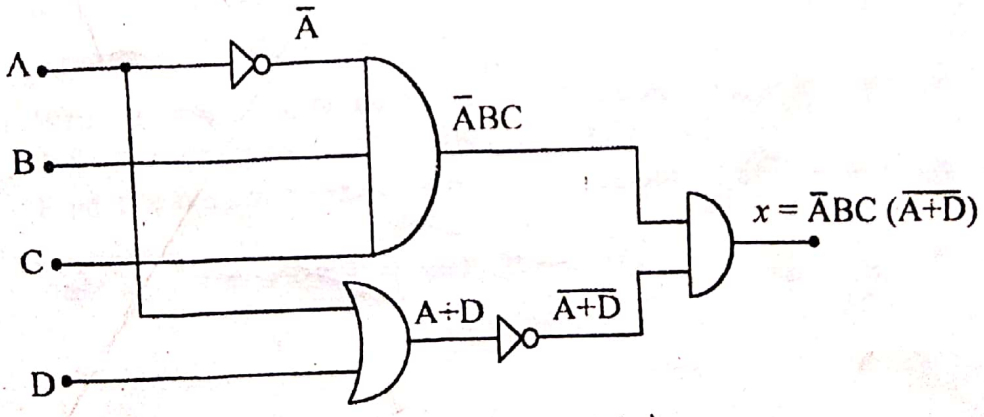
(d) Write down Demorgan's theorem. Prove Demogan's theorem with 3 variables. 5

2. *(a)* What a universal gate? Prove the universality of NOR gate. 5

(b) Define K-map. Using K-map simplify the expression $y = \overline{C}\,(\overline{A}\,\overline{B}\,\overline{D} + D) + A\overline{B}\,C + \overline{D}$, also draw the logic diagram of simplified y. 6

(c) What is don't care condition of K-map? Explain. 3

(d) Consider the following Boolean logic diagram. If you want to get the output value $x = 0$ and $x = 1$, then what will be the input values of A. B, C, D : 6



01753123

Marks

3. (a) Define flipflop. Draw the logic circuit of an S-R flipflop with NAND latch and explain its logic operation. 7

(b) Design and discuss the MOD-6 counter. 7

(c) Write down the truth table for a full adder. Draw the logic circuit and explain its operation. 6

4. (a) Explain the operation of successive approximation ADC with required diagram. 8

(b) What is the largest value of output voltage from an eight bit DAC that produces 1·0V for a digital input of 00101000? 5

(c) Differentiate between EPROM and DRAM. 4

(d) Mention the advantageous of successive approximation ADC over digital Ramp ADC. 3

5. (a) What is encoder? Explain the working principle of 8 line to 3 line encoder with logic diagram and truth table. 8

(b) Define MUX and DMUX. Why MUX is called data selector? Explain. 6

(c) Draw and explain BCD to 7 segment decoder. 6

6. (a) What are the differences between combinational logic circuit and sequential logic circuit? 5

(b) Define memory. Discuss the basic organization of a memory unit of 3×4 bits. 5

(c) How many $32k \times 8$ RAM chips are needed to provide a memory capacity of 256k bytes? 5

(d) Describe the functional parts of an ALU. 5

B.Sc (HONS.) IN COMPUTER SCIENCE AND ENGINEERING FIRST YEAR SECOND SEMESTER EXAMINATION, 2019

[According to the New Syllabus]

CSE-510223

(Discrete Mathematics)

Time—3 hours

Full marks—80

[N.B. The figures in the right margin indicate full marks. Answer any four questions.]

Marks

1. *(a)* What is proposition? Find the negation of the proposition "Today is Friday" and express this in simple English. 5

(b) What is tautology? Show that $(p \wedge q) \rightarrow (p \vee q)$ is a tautology. 5

(c) Express the statement "Every student in this class has studies calculus" as a universal quantification. 5

(d) What are the truth values of the propositions $R(1, 2, 3)$ and $R(0, 0, 1)$? 5

2. *(a)* Define power set. What is the power set of the set $\{0, 1, 2\}$? 4

(b) Using set builder notation and logical equivalences show that $\overline{A \cap B} = \overline{A} \cup \overline{B}$. 6

(c) Define one-to-one and onto functions with examples. 5

(d) Translate the following statements into logical expressions : "Some students in this class has visited Mexico" and "Every student in this class has visited either Canada or Mexico" using quantifiers. 5

3. *(a)* Define rules of inference. Write down the basic rules of inference. 4

(b) Using mathematical induction show that, $1 + 2 + 2^2 + \ldots\ldots\ldots + 2^n = 2^{n+1} - 1$ for all nonnegative integers n. 5

(c) Define the Sum Rule and the Product Rule. How many different bit strings are there of length seven? 5

(d) Simplify the sum-of-products expansions using Karnaugh maps : 6

(i) $xyz + x\bar{y}\,\bar{z} + \bar{x}yz + \bar{x}\,\bar{y}\,\bar{z}$.

(ii) $x\bar{y}z + x\bar{y}\,\bar{z} + \bar{x}yz + \bar{x}\,\bar{y}z + \bar{x}\,\bar{y}\,\bar{z}$.

4. *(a)* Write a recursive procedure for Ackermann function, use the definition of the Ackermann function to find A (1, 3). 5

(b) Find the matrix representation of the relations SoR where the matrices representing R and S are $M_R = \begin{bmatrix} 1 & 0 & 1 \\ 1 & 1 & 0 \\ 0 & 0 & 0 \end{bmatrix}$ and $M_S = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 1 & 0 & 1 \end{bmatrix}$. 5

[Please turn over

Marks

(c) How can the final exams at a University be scheduled so that no student has two exams at the same time. [For instance, suppose the courses are numbered 1 to 7 and following pairs of cources have common students : 5

(1, 2), (1, 3), (1, 4), (1, 7), (2, 3), (2, 4), (2, 5), (2, 7), (3, 4), (3, 6), (3, 7), (4, 5), (4, 6), (5, 6), (5, 7) and (6, 7)].

(d) If G is a connected planar simple graph with e edges and v vertices, where $v \geq 3$ then $e \leq 3v - 6$. 5

5. (a) Define multigraph and pseudograph with examples. 5

(b) Construct BST of the following values : 5

14, 3, 4, 12, 14, 11, 5, 2, 8, 2, 7, 9, 16, 6, 20.

(c) Draw the Hasse diagram representing the partial ordering $\{(a, b) \mid a \text{ devides } b\}$ on $\{1, 2, 3, 4, 6, 8, 12\}$, 5

(d) Evaluate the prefix expression : 5

$+ - * 235 / \hat{} 234$.

6. (a) State Euler's theorem and prove it using required diagram. 5

(b) Describe the universality of NAND & NOR gate. 5

(c) What is the chromatic number of the Graph-G and H : 5

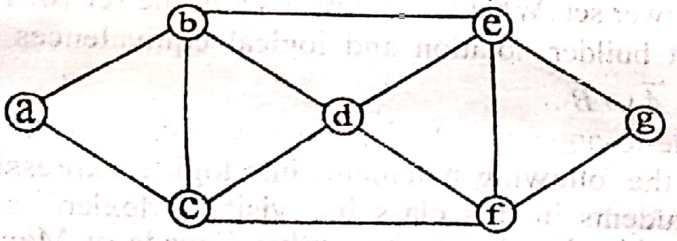


Fig : G

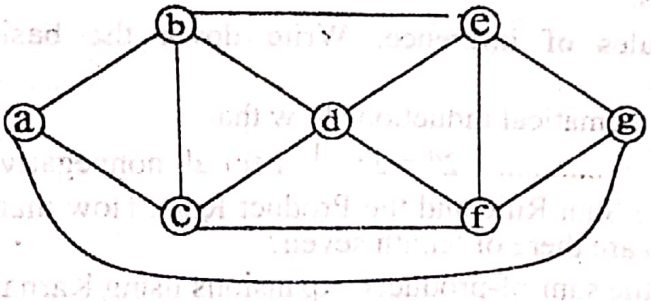
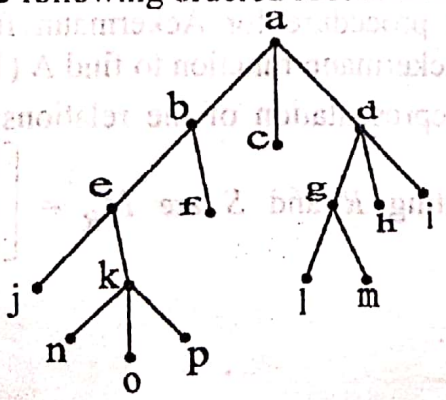


Fig : H

(d) Determine the order in which a pre-order traversal visits the vertices of the following ordered rooted tree : 5



B.Sc (HONS.) IN COMPUTER SCIENCE AND ENGINEERING FIRST YEAR SECOND SEMESTER EXAMINATION, 2019

[According to the New Syllabus]

CSE-510225

(Linear Algebra)

Time—3 hours

Full marks—80

[N.B. The figures in the right margin indicate full marks. Answer any four questions.]

Marks

1. *(a)* Define linear equation with examples. 2

(b) Determine the value of λ such that the following system of linear equations in unknowns x, y, z has : 6

(i) a unique solution *(ii)* no solution *(iii)* more than one solutions.

(c) Define norm of a vector. Consider the points, $P(3, \lambda, -2)$ and $Q(5, 3, 4)$ in $\mathbb{R}^3$. Find the value of λ so that $\overrightarrow{PQ}$ is orthogonal to the vector $(4, -3, 2)$. 6

(d) Prove that, $\begin{vmatrix} -a & -b & c & d \\ b & -a & -d & c \\ c & -d & a & -b \\ d & c & b & a \end{vmatrix} = (a^2 + b^2 + c^2 + d^2)^2$. 6

2. *(a)* Define *(i)* symmetric matrix *(ii)* square matrix *(iii)* idempotent matrix *(iv)* singular matrix. 4

(b) If A and B are comparable matrices and A^T and B^T are the transpose matrices of A and B respectively, then prove that *(i)* $(A^T)^T = A$, *(ii)* $(A + B)^T = A^T + B^T$, *(iii)* $(AB)^T = B^T A^T$. 1+1+4 =6

(c) Solve the following system of linear equations with the help of matrix : 5

$x + 2y + 3z + 4 = 0$

$2x + 4y + 5z + 7 = 0$

$3x + 5y + 6z + 10 = 0$

(d) Show that the matrix $A = \begin{bmatrix} 2 & -1 & 1 \\ -2 & 3 & -2 \\ -4 & 4 & -3 \end{bmatrix}$ is idempotent. 5

[Please turn over

Marks

3. *(a)* Define linear transformation. Show that the product of two linear transformation is a linear transformation. 2+5=7

(b) Let S and T be the linear operators of $\mathbb{R}^2$ into $\mathbb{R}^2$ defined by $S(x, y) = 3x + 2y, -6x + y)$ $T(x, y) = (2x + y, x - y)$. Find formulae defining properties $S + T$, ST, TS and S^2. 7

(c) Define *(i)* System of linear equation
(ii) Consistent
(iii) Homogeneous
(iv) Non-homogeneous 6

4. *(a)* Define minors and co-factors with example. 3

(b) If $\Delta = \begin{vmatrix} x & x^2 & x^3+1 \\ y & y^2 & y^3+1 \\ z & z^2 & z^3+1 \end{vmatrix}$ then prove that, 6

$\Delta = (x-y)(y-z)(z-x)(xyz+1)$. Also show that if x, y and z are not equal and $\Delta = 0$, then $xyz + 1 = 0$.

(c) Prove that,

$$\begin{vmatrix} 1 & a & a^2 & a^3 \\ 1 & b & b^2 & b^3 \\ 1 & c & c^2 & c^3 \\ 1 & d & d^2 & d^3 \end{vmatrix} = (d-c)(d-b)(d-a)(c-b)(c-a)(b-a).$$ 6

(d) Prove that, $\begin{vmatrix} 1+a_1 & a_2 & a_3 & a_4 \\ a_1 & 1+a_2 & a_3 & a_4 \\ a_1 & a_2 & 1+a_3 & a_4 \\ a_1 & a_2 & a_3 & 1+a_4 \end{vmatrix} = 1+a_1+a_2+a_3+a_4.$ 5

5. *(a)* Define image and kernel of a linear transformation. 4

(b) Show that, $T: \mathbb{R}^3 \to \mathbb{R}^2$, where $T(x, y, z) = (x+y-z, 2x-y+2z)$ is a linear transformation. Find a basis and dimension for ImT and ker T. 5+6=11

(c) Find a linear transformation $T : \mathbb{R}^3 \to \mathbb{R}^4$ whose ImT is generated by $\{(1, 2, 0, -4), (2, 0, -1, -3)\}$. 5

6. *(a)* Define characteristic matrix and characteristic equation. 3

(b) Find the eigen values and eigen vectors of the matrix 8

$$A = \begin{bmatrix} 1 & 2 & 2 \\ 1 & 2 & -1 \\ -1 & 1 & 4 \end{bmatrix}$$

(c) State Cayley-Hamilton theorem. Using this theorem find the inverse of the matrix $A = \begin{bmatrix} 2 & 0 & -1 \\ 5 & 1 & 0 \\ 0 & 1 & 3 \end{bmatrix}$. 2+7=9

B.Sc (HONS.) IN COMPUTER SCIENCE AND ENGINEERING FIRST YEAR SECOND SEMESTER EXAMINATION, 2019

[According to the New Syllabus]

CSE-510227

(Statistics and Probability)

Time—3 hours

Full marks—80

*[N.B. The figures in the right margin indicate full marks. Answer any **four** questions.]*

Marks

1. (a) Define statistics. Discuss the importance of statistics. 5

   (b) What do you mean by statistical data? Describe the method of primary data collection. 6

   (c) Distinguish between : 4

   (i) Discrete variable and continuous variable.

   (ii) Qualitative variable and quantitative variable.

   (d) Describe frequency polygon and cumulative frequency curve or ogive. 5

2. (a) What are the differences between histogram and bar diagram? 4

   (b) In a class examination, the marks obtained by 30 students are given below : 10

   44, 32, 36, 56, 50, 34, 31, 46, 86, 76, 42, 46, 40, 56, 66, 42, 33, 80, 79, 81, 49, 40, 60, 63, 64, 76. 56, 57, 70, 82.

   (i) Construct a frequency distribution table by using suitable class interval.

   (ii) Construct a stem and leaf diagram for this data.

   (c) Define the following terms : 6

   (i) Arithmetic Mean

   (ii) Median

   (iii) Mode

3. (a) Describe the properties of arithmetic mean. 5

   (b) For two non-zero positive numbers, prove that, 5

   $AM \times HM = (GM)^2$.

   (c) Define variance. What are the qualities of good measure of dispersion? Which measure is suitable and why? 6

   (d) The mean salary paid to 200 employees in a shoe factory was found to be 2500. Later on, it was discovered that the salaries of two employees were wrongly taken as 3,000 and 3,500 instead of 3,500 and 3,200. Compute the correct mean salary. 4

[Please turn over

Marks

4. (a) What do you mean by kurtosis? Explain the different types of kurtosis with the help of diagram. 5

(b) Describe the absolute measures of dispersion. 5

(c) The first four moments of a distribution about the value 5 are 2, 20, 40 and 50 respectively. Obtain the first four central moments, β_1 and β_2. Comment on the skewness and kurtosis of the distribution. 6

(d) Determine the standard deviation from the obtained marks of the CSE students : 4

16, 12, 14, 15, 18.

5. (a) Describe the different types of simple correlation. 5

(b) Prove that the coefficient of correlation is an independent of origin and scale. 5

(c) Find the correlation coefficient from the following informations : 5

$\Sigma x = 56$, $\Sigma y = 40$, $\Sigma x^2 = 524$, $\Sigma y^2 = 256$, $\Sigma xy = 364$ and $n = 8$.

(d) Karl Pearson's coefficient of correlation between two variates x and y is $+0{\cdot}75$. Standard deviation of x is 3 and their covariance is 8·2. Find the variance of y. 5

6. (a) What do you mean by regression analysis? State the important properties of regression coefficient. 5

(b) By using the following informations : 5

$\Sigma x = 156$, $\Sigma y = 140$, $\Sigma x^2 = 1524$, $\Sigma y^2 = 1256$, $\Sigma xy = 1364$, $n = 18$.

Find the regression coefficient of y on x.

(c) Given the following information : 10

	Advertising expenditure (Tk. in lac)	Sales (Tk. in crore)
Mean	35	82
Standard deviation	9.03	17.16

correlation co-efficient = 0·61.

(i) Calculate the two regression equations.

(ii) Estimate the likely sales for an advertising expenditure of Tk. 40 lac.

(iii) What should be the advertising expenditure for attaining sales target Tk. 90 crore?