

University of Dhaka
Department of Computer Science and Engineering
1st Year 2nd Semester B. Sc. in Computer Science and Engineering
Final Examination, 2013
CSE-1201: Discrete Mathematics

Total Marks: 60

Time: 2.5 Hours

[Answer any Four (4) of the following Six (6) questions.]

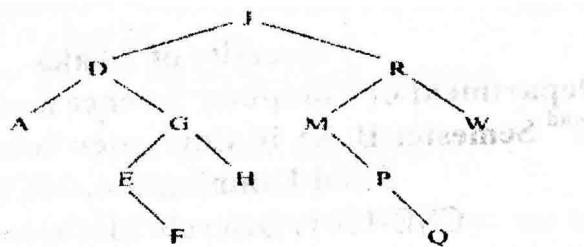
1. a) What are contrapositive, the converse, and inverse of the implication "The home team wins whenever it is raining"? 3
- b) How can this English sentence be translated into a logical expression? 3
"You cannot ride the roller coaster if you are under 4 feet tall unless you are older than 16 years old."
- c) What does the statement $\forall x T(x)$ mean if $T(x)$ is "x has two parents" and the universe of discourse consists of all people? 2
- d) Using mathematical induction prove that $n^3 - n$ is divisible by 3 when n is a positive integer. 3.5
- e) If n is an integer greater than 1, then n can be written as product of prime P. 3.5

2. a) Translate each of these statements into logical expressions using predicates, quantifiers, and logical connectives. 6
 - i) No one is perfect.
 - ii) All your friends are perfect.
 - iii) One of your friends is perfect.
 - iv) Not everybody is your friend or someone is not perfect.
- b) Show that if A, B, and C are sets then $|A \cup B \cup C| = |A| + |B| + |C| - |A \cap B| - |A \cap C| - |B \cap C| + |A \cap B \cap C|$. 4
- c) Given A = {1,2,3} and B = {a,b}.
Find (i) AxB (ii) BxA (iii) BxB 3
- d) Are the following propositions logically equivalent? 2
 $p \leftrightarrow q$ and $(p \rightarrow q) \wedge (q \rightarrow p)$

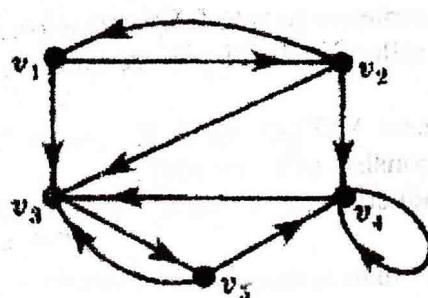
3. a) Given A = {1,2,3,4} and B = {x,y,z}. Let R be the following relation from A to B: 6
 $R = \{(1,y),(1,z),(3,y),(4,x),(4,z)\}$
 - i) Determine the matrix of the relation.
 - ii) Draw the arrow diagram of R.
 - iii) Find the inverse relation R^{-1} of R.
 - iv) Determine the domain and range of R.
- b) Solve each linear congruence equation: 5
 - i) $3x \equiv 2 \pmod{7}$
 - ii) $4x \equiv 6 \pmod{10}$
- c) Find the smallest positive integer such that when x is divided by 2 it yields a remainder 1, when x is divided by 3 it yields a remainder 2, when x is divided by 5 it yields a remainder 4. 4

4. a) Describe pigeonholes principle? 2
- b) Write the algorithm for finding GCD of two numbers. 3
- c) At least how many people were born in the same month among 150 people? 2
- d) Find the number of ways that a party of seven persons can arrange themselves: 3
 - i) In a row of seven chairs
 - ii) Around a circular table.
- e) Calculate public key and private key pair when $p = 17$ and $q = 13$. 5

5. a) Answer these questions about the rooted tree illustrated. 6
 - i) Which vertex is the root?
 - ii) Which vertices are internal?
 - iii) Which vertices are leaves?



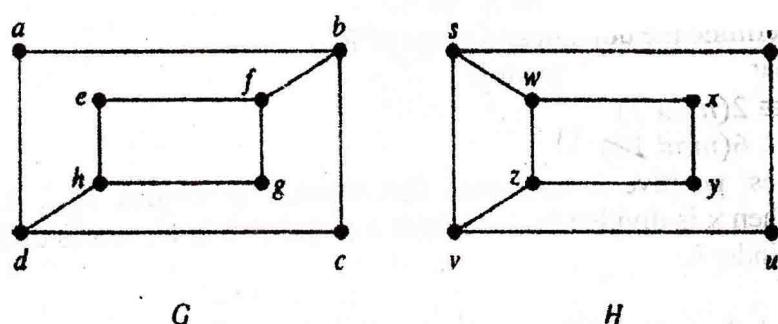
- iv) Which vertices are children of J?
 v) Which vertex is the parent of H?
 vi) Which vertices are siblings of D?
 vii) Which vertices are ancestors of M?
 viii) Which vertices are descendants of D?
- b) Consider the directed graph G



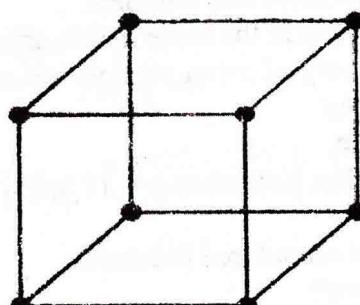
- i) Describe G formally.
 ii) Find all simple paths from v1 to v4.
 iii) Find all simple paths from v1 to v4.
 iv) Find all cycles in G.
 v) Is G strongly connected?
 vi) Find the indegree and outdegree of each vertex of G.
 vii) Find the successor list of each vertex of G.
 viii) Are there any sources or sinks?
 ix) Find the subgraph H of G determined by the vertex set $V' = \{v_1, v_2, v_3\}$.

6. a) Let f and g be the functions from the set of integers to t set of integers defined by $f(x) = 2x + 3$ and $g(x) = 3x + 2$.
 i) What is the composition of f and g
 ii) What is the composition of g and f.
 iii) Is f one-to-one function.
 iv) Is g one-to-one function.

- b) What is isomorphic graph? Are the following graphs isomorphic? Justify your answer.



- c) What is planner graph? Is following graph a planner graph? Justify your answer.



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Final Examination, 2013
MATH-1223: Linear Algebra

Total Marks: 60

Time: 2.5 Hours

[Answer any Four (4) of the following Six (6) questions.]

1. a) Define the terms Euclidean inner product, norm and distance in R^n and C^n . Find the dot product of two vectors $\underline{u} = (1+i, i, 2i)$ and $\underline{v} = (-i, 2+i, 3i)$ in R^3 and length of \underline{u} and \underline{v} . 5
- b) For which values of k are the vectors $\underline{u} = (1, 7, k+2, -2)$ and $\underline{v} = (3, k, -3, k)$ in R^4 orthogonal? 5
- c) State Cauchy-Schwarz and Minkowski's inequalities in R^n and verify by taking any two vectors in R^n . 5
2. a) Determine the value of 'a' such that the following system of equations x, y and z has:
 i) a unique solution ii) no solution iii) more than one solution

$$\begin{aligned} ax + y + z &= 1 \\ x + ay + z &= 1 \\ x + y + az &= 1 \end{aligned}$$
8
- b) Find the inverse matrix if possible by using elementary row operations of the matrix 7

$$A = \begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{pmatrix}$$
3. a) Define linear dependence and independence of a set of vectors in a vector space. Let u, v and w be three linearly independent vectors. Show that the vectors $u+v, u-v$ and $u-2v+w$ are also linearly independent. 8
- b) Define linear combination of vectors. Express (if possible) the matrix $A = \begin{pmatrix} 2 & 1 \\ -1 & -2 \end{pmatrix}$ as a linear combination of the matrices $A_1 = \begin{pmatrix} 1 & 1 \\ 0 & 1 \end{pmatrix}, A_2 = \begin{pmatrix} 1 & 1 \\ -1 & 0 \end{pmatrix}$ and $A_3 = \begin{pmatrix} 1 & -1 \\ 0 & 0 \end{pmatrix}$. 7
4. a) Write down the augmented matrix of the following system of equations:

$$\begin{aligned} x - 2y + z &= -1 \\ 2x - 3z &= 2 \\ x + y - 2z &= 0 \end{aligned}$$
7
 Hence solve the system of linear equations.
 b) Let $T : R^2 \rightarrow R^3$ be the linear transformation defined by

$$T(x_1, x_2) = (x_2, -5x_1 + 13x_2, -7x_1 + 16x_2).$$
 Find the matrix for T with respect to the bases $B = \{(3,1), (5,2)\}$ and $B' = \{(1,0,-1), (-1,2,2), (0,1,2)\}$. 8
5. a) Define basis and dimension of a vector space. Write down the standard basis and dimension of R^4, P_4 and $M_{4 \times 4}$. 7
- b) State dimension theorem. Find the rank and nullity of the matrix 8

$$A = \begin{pmatrix} 1 & -1 & 3 \\ 5 & -4 & -4 \\ 7 & -6 & 2 \end{pmatrix}$$

 and verify the dimension theorem.
6. a) Define the kernel and image of a linear transformation. Let $T : R^4 \rightarrow R^3$ be linear transformation defined by $T(x, y, s, t) = (x - y + s + t, x + 2s - t, x + y + 3s - 3t)$.
 Find a basis and dimension of the i) kernel of T and ii) image of T . 8
- b) Define eigenvalues and eigenvectors of linear transformation. Find the bases of the eigenspaces of the matrix $A = \begin{bmatrix} 1 & 3 \\ 4 & 2 \end{bmatrix}$. 7

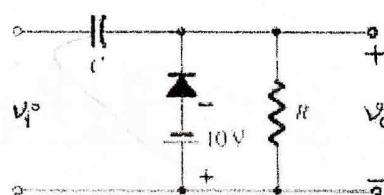
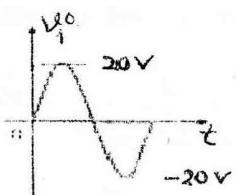
Department of Computer Science and Engineering
 1st Year 2nd Semester B. Sc. in Computer Science and Engineering
 Final Examination, 2013
 EEE 1222: Basic Electronics

Total Marks: 60

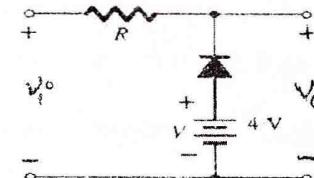
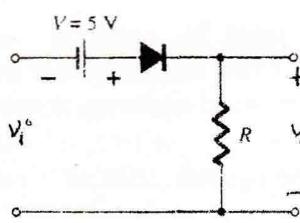
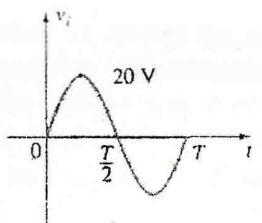
Time: 2.5 Hours

[Answer any four (4) of the following Six (6) Questions]

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| 1. | a) What are the properties of semiconductor? How do you classify semiconductors? | 2+3 |
| b) | What is barrier potential? Explain how it is formed in a Diode. | 4 |
| c) | Differentiate between light emitting (LED) diode and Zener diode. Explain how Zener diode acts as a voltage stabilizer? | 2+4 |
| 2. | a) Draw and describe the operation of a full-wave rectifier. What are the advantages and disadvantages of a full-wave bridge rectifier? | 4+2 |
| b) | Calculate the output of the following circuit for the input indicated. | 5 |



- | | | |
|----|--|---|
| c) | Draw the output of the following two circuits. | 4 |
|----|--|---|



- | | | |
|----|--|-----|
| 3. | a) Explain input and output characteristics of a common base transistor. | 5 |
| b) | Why DC biasing is necessary for transistor. Draw a voltage divider bias circuit and explain how the operating point is stable for this circuit and also calculate the operating point. | 1+7 |
| c) | Deduce the relation between α and β . | 2 |
| 4. | a) Draw a hybrid equivalent circuit of a single stage common emitter amplifier and calculate its voltage gain, current gain, input impedance and output impedance. | 8 |
| b) | What is field effect transistor (FET)? Discuss drain characteristic of a JFET. | 5 |
| c) | What are the advantages of FETs over BJTs? | 2 |
| 5. | a) What is operational amplifier? Write the ideal characteristics of an operational amplifier. | 4 |
| b) | What is non-inverting amplifier? Draw a non-inverting amplifier circuit using Op-Amp and calculate its gain. | 6 |
| c) | Draw an integrator circuit using Op-Amp and explain its operation. | 5 |
| 6. | a) What is feedback amplifier? Write the advantages and disadvantages of negative feedback. | 3 |
| b) | Draw a feedback amplifier circuit and explain how negative feedback decreases gain. | 6 |
| c) | What is voltage regulator? Draw a practical shunt regulator circuit and explain its operations. | 6 |

Department of Computer Science and Engineering
 1st Year 2nd Semester B. Sc. in Computer Science and Engineering
 Final Examination, 2013
 STAT 1224: Introduction of Statistics

Total Marks: 60

Time: 2.5 Hours

[Answer any four (4) of the following Six (6) Questions]

1. a) What do you mean by descriptive statistics and inferential statistics? Write down the characteristics of statistics. 5
- b) Define the following terms with example:
Parameter, Statistic and Estimator. 3
- c) Define scale of measurement. Discuss its type with examples. 4
- d) Distinguish between primary data and secondary data. What are the methods of data collection? 3

2. a) What do you mean by frequency distribution? Set out the steps involved in the construction of a frequency distribution from raw data. 5
- b) The following is the number of minutes to commute from home to work for a group of automobile executives. 7

28	25	48	37	41	19	32	26	16	23	23	29	36
31	26	21	32	25	31	43	35	42	38	33	28	

Organize the data into frequency distribution. Also present the above data by a histogram.

- c) What is a stem and leaf plot? What are it's advantages over histogram? 3

3. a) What is meant by central tendency of data? What are various measures of central tendency? Which measure is the best and why? 5
- b) Show that the sum of squared deviation from the arithmetic mean is less than the sum of squared deviation from any other value. 4
- c) The frequency distribution of rainfall (mm) in an area of 60 days are given below: 6

Rainfall:	100 - 110	110 - 120	120 - 130	130 - 140	140 - 150
Frequency:	7	10	15	20	8

Find the mean and median of rainfall.

4. a) Define mean deviation and standard deviation. Show that for any set of values x_1, x_2, \dots, x_n , the mean deviation about the arithmetic mean cannot exceed the standard deviation. 5
- b) What are the absolute and relative measures of dispersion? Write down the advantages of relative measures over absolute measures of dispersion. 4
- c) Student's ages in the regular daytime M.B.A. program and the evening program of DU are described by these two samples: 6

Regular M.B.A.:	23	29	27	22	24	21	25	26	27	24
Evening M.B.A.:	27	34	30	29	28	30	34	35	28	29

If homogeneity of the class is a positive factor in learning, use a measure relative variability to suggest which of the two groups will be easier to teach? CV

5. a) Define moments of a distribution. How do you find the raw moments and the central moments from a data set? 3
- b) Define skewness and Kurtosis. Sketch a symmetrical, positively skewed and negatively skewed distribution and indicate the appropriate positions of mean, median and mode. 5
- c) The first four moments of a distribution about origin of a variable x are 10, 108, 1201, and 13890. Find the mean, variance, β_1 and β_2 and comment on the skewness and kurtosis of the distribution. 7

6. a) Define correlation analysis and regression analysis. What do you mean by partial correlation? Show that the correlation coefficient is independent of origin and scale of measurement. 5
- b) A sample of 10 families in an area revealed the following figures for family size and the amount spent on food (in \$) per month: 6

Family size :	3	6	5	6	4	7	2	8
Amount spent on food :	99	104	151	129	74	162	70	165

- (i) Find the coefficient of correlation and comment.
- (ii) Estimate the regression line.
- (iii) Find coefficient of determination and comment.
- c) What is contingency table? From a contingency table, how would you determine whether two attributes are independent or not? 4

University of Dhaka
Department of Computer Science and Engineering
1st Year 2nd Semester B. Sc. in Computer Science and Engineering
Final Examination, 2013
EEE-1221: Digital Systems

Total Marks: 60

Time: 2.5 Hours

[Answer any Four (4) of the following Six (6) questions.]

1. a) Add and multiply the following numbers in the given base without converting to decimal: 5
 i) $(465)_8$ and $(215.3)_8$
 ii) $(659)_{12}$ and $(74)_{12}$
 - b) How many bits are required to represent the decimal numbers in the range from 0 to 999 using straight code? Using BCD code? 3
 - c) How many fractional bits $2^{-73.1}$ have? 3
 - d) If the digital circuits in a computer only respond to binary numbers, why are BCD code and hexadecimal numbers used extensively by computer scientists? 4
- pos*
2. a) i) Expand the following given expression into the equivalent SOP form and then simplify $f(A, B, C) = A\bar{C} \vee A\bar{B}\bar{C} \vee ABC \vee A\bar{B}C$ 6
 ii) Show how a two-input NAND gate can be constructed from two-input NOR gates.
 - b) Design a logic circuit, where four logic-signal lines A, B, C and D are being used to represent a 4-bit binary number with A as the MSB and D as the LSB. The binary inputs are fed to the logic circuit which produces a high output only when the binary number is greater than $(0110)_2 = (6)_{10}$ 4
 - c) Design a logic circuit with inputs P, Q and R so that output S is high whenever P=0 or whenever Q=R=1. 2
 - d) Write the sum-of-products expression from a circuit with four inputs and an output that is to be high only when input A is low at the same time that exactly two other inputs are low. 3
3. a) A circuit receives a 3-bit long binary numbers A and B. A comprises bits $a_2a_1a_0$ and B comprises bits $b_2b_1b_0$. Find the minimal SOP expression which will be 1 whenever A is greater than B. Use a 6-variable K-map. 4
 - b) What are the properties of Quine-McCluskey method of tabular reduction? Minimize the following given combinational single-output function using Quine-McCluskey Method: 4
- $$f(w, x, y, z) = \sum_m (0, 1, 5, 8, 10, 14, 15)$$
- c) Show that $(B \vee D)(A \vee D)(B \vee C)(A \vee C) = AB \vee CD$ 2
 - d) Design a two-level NAND-NAND circuit for the following given function: 3

$$f(w, x, y, z) = wxy \vee yz$$
 - e) Draw a K-map for the following given function and minimize it: 2

$$f(A, B, C, D) = \bar{D}\bar{B}\bar{A} \vee \bar{D}\bar{C}\bar{B} \vee \bar{D}C\bar{B}A \vee CBA \vee CBA \vee D\bar{C}B$$
4. a) Design a 4-to-1 MUX using a 2-to-4 decoder and basic logic gates. 3
 - b) Design a BCD-to-decimal decimal decoder which gives an output of all 0s when any invalid input combination occurs. 3
 - c) Explain the working principle of a multiplexer. Realize $f(a, b, c, d) = \sum(0, 1, 5, 7, 6, 10, 14)$ using a multiplexer. 4
 - d) Design a full-subtractor using NOR gates only. 2
 - e) Design a 16x8 ROM and explain its design procedure. 3
5. a) What is a trigger? Distinguish between latch and edge-triggered flip-flop. 2
 - b) Realize D-latch using S-R latch. How is it different from D flip-flop and explain its working principle. Draw the circuit of D flip-flop using NAND gates. 3
 - c) What is T flip-flop? Convert a J-K flip-flop into a T flip-flop. 2

- d) Construct a MOD-6 counter circuit. How do you convert a MOD-6 into MOD-5 counter? Explain it with the help of a circuit? 5
- e) Distinguish between synchronous and asynchronous counters. 2
- 6 a) Describe the basic operation of a magnitude comparator. 4
- b) Describe the basic operation of a digital-ramp ADC. 5
- c) What is the advantage of R/2R ladder DACs over those that use binary-weighted resistors? 3
- d) An eight-bit DAC has an output of 3.92 mA for an input of 01100010. What are the DAC's resolution and full-scale output? 3