L-2/T-1/CSE **Date : 09/11/2019**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-1 B. Sc. Engineering Examinations 2018-2019

Sub : **CSE 203** (Data Structured and Algorithms I)

Full Marks : 210 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE**.

1. (a) Dream coins are used by the people of the Dreamland. Assume that only the following coins are available at this land: \$1, \$7, \$11, and \$15. **(10)**

(i) Write an example of an amount where the greedy strategy for the Coin- Change problem does not provide an optimal solution. You must mention the optimal solution, and the greedy solution.

(ii) By using Dynamic Programming, find the minimum number of coins that add up to a given amount of money of \$20.

(b) Write a divide-and-conquer algorithm that finds the Maximum and the Minimum of an array of n distinct elements. First write the recurrence relation for the running time T(n) of the algorithm, and then solve it by Recursion Tree Method. **(10)**

(c) Consider the following instance of the 0/1 knapsack problem. Solve this instance using dynamic programming. Assume that the knapsack capacity is 7. You have to show the dynamic programming table and find all solutions using this table. **(15)**

Item	Weight	Value
1	1	50
2	3	60
3	5	100
4	2	70
5	2	80

2. (a) Consider a divide-and-conquer algorithm as follows: if the problem size is less than or equal to 5, then it solves the problem at constant time. Otherwise, it divides the problem of size n into 4 subproblems, each with a size of n/3. This division takes $O(\sqrt{n} \log n)$ time. The algorithm then solves the subproblems recursively, and merges their solutions at time O(n). Write the recurrence relation for the running time T(n) of this algorithm. **(10)**

Solve the following recurrences by using the Master theorem.

(i) $T(n) = 9T(n/3) + 5n\sqrt{n} + 8\log n$

(ii) $T(n) = 3T(n/4) + 3n^2 + 4n + 5$

(iii) $T(n) = 4T(n/2) + 5n^2 + 7\sqrt{n}$

(b) Suppose that you run a bus lending business, and each request is at the format: (start time, end time). A bus can be used by one user at time. Suppose that you have got the following bus-one requests for the next day. **(12)**

Contd P/2

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Contd..... Q. No. 2(b)

{[1, 6), [4, 8), [6, 8), [9, 15), [6, 9), [11, 15), [2, 6)}

Find all solutions of the maximum number of requests that can be satisfied by using

(i) earliest start time,

(ii) shortest interval, and

(iii) earliest end time.

(c) Let A_1 (1×4), A_2(4×5), A_3(5×3), A_4 (3×6), A_5 (6×7), A_6 (7×1) be six matrices. Compute m[1, 6] by assuming m[1, 3] = 35, m[2, 4] = 132, m[1, 5] = 95, m[2, 5] = 270, m [2, 6] = 95, m [4, 5] = 126, m [4, 6] = 60. **(13)**

3. (a) Briefly explain the steps that are to be followed for solving a problem using dynamic programming method. **(10)**

   (b) Show that the fractional knapsack problem has the optimal substructure property. Also show that the 0-1 knapsack problem has the overlapping subproblems property. **(10)**

   (c) Write the quick sort algorithm. Analyze the best case and worst case time-complexities of the algorithm. **(15)**

4. (a) Explain, with examples, the *union-by-rank* and the *path-compression* heuristics that are used in UNION and FIND operations of disjoint-set data structures. **(10)**

   (b) Assume that you are given a Max Priority Queue of n elements. Write a function that first finds and then deletes the minimum element of the priority queue. **(10)**

   (c) Find all longest common subsequences of X = ⟨TAAGUATU⟩ and Y = ⟨AUAGTUT⟩ by using dynamic programming method. Also find a shortest common supersequence of X and Y using an LCS of X and Y. **(15)**

   The shortest common supersequence problem is defined as: Given two sequences X and Y, find the shortest sequence that has both X and Y as subsequences. For example, for two sequences X = ⟨BUET⟩ and Y = ⟨CSE⟩, a shortest common supersequence is ⟨BCUSET⟩.

SECTION – B

There are **FOUR** questions in this section. Answer any **THREE**.

5. (a) You are given two sorted lists of size m and n. Give an O(logm + logn) time algorithm for computing the kth smallest element in the union of two lists. **(12)**

   (b) Describe the worst case running time of the following code in "big-Oh" notation in terms of the variable n. You should give the tightest bound possible. **(5)**

Contd P/3

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Contd..... Q. No. 5(b)

```
int f(int n)
{
if (n < 10)
    { System.out.println("!"); return n+3; }
else
    { return f(n-1) + f(n-1); }
}
```

(c) Suppose that you observe that a program takes 30 seconds to complete on inputs of size 600, 4.5 minutes to complete on inputs of size 1800 and 20 minutes to complete on inputs of size 2000. Develop a reasonable assumption for the order of growth of the running time. **(10)**

(d) Given two arrays a [ ] and b [ ], each containing N distinct points in the plane, design an algorithm whose running time is linear under reasonable assumptions and uses at most linear extra space to determine whether the two arrays contains precisely the same set of points (but possibly in a different order). **(8)**

6. (a) Give the algorithm for converting an infix expression to postfix, evaluating a postfix expression using a stack. **(10)**

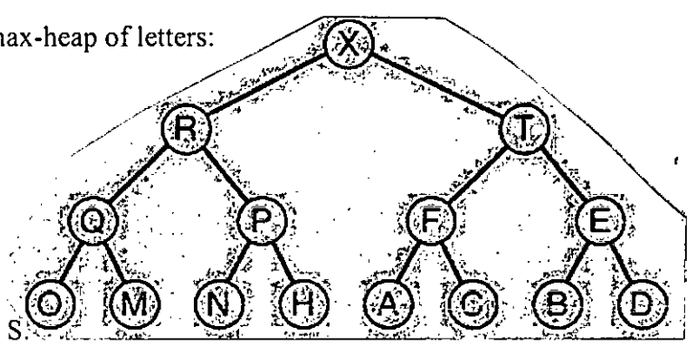
(b) Give a concise accurate description of a good way for quicksort to choose a pivot element. Your approach should be better than "use the entry at location [0]". **(5)**

(c) Ternary search, like binary search, is a divide-and-conquer algorithm. It is mandatory for the array (in which you will search for an element) to be sorted before you begin the search. In this search, after each iteration it neglects $\frac{2}{3}$ part of the array and repeats the same operations on the remaining $\frac{1}{3}$. Write an algorithm for ternary search and show its complexity. **(12)**

(d) Given a directed graph with N vertices and M edges that may contain cycles, write a function to find the lexicographically smallest topological ordering of the graph if it exists otherwise print-**1** (if the graph has cycles). **(8)**

Lexicographycally smallest topological ordering means that if two vertices in a graph do not have any incoming edge then the vertex with the smaller number should appear first in the ordering.

7. (a) Consider the following max-heap of letters: **(7)**



Draw the results of inserting S.

Contd P/4

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Contd..... Q. No. 7

(b) Suppose you have a set of numbers where you do a constant number of insertions and a linear number of lookups of the maximum over some time period. To maintain your set of numbers, you can choose between using either a heap or a binary search tree. i) Assume you are interested in minimizing the average total runtime over the time period. For each structure, what is the asymptotic upper bound on the average case runtime, and which of the two structures should you choose? **(12)**

ii) Suppose you realize that you are actually interested in the worst case. For each structure, what is the asymptotic upper bound on the worst case runtime, and which of the two structures should you choose now?

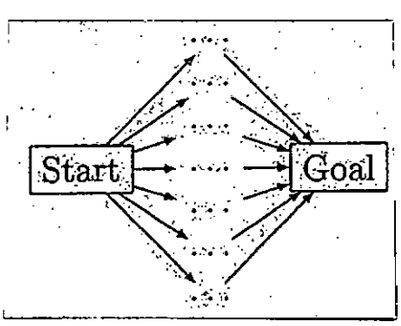
(c) Explain when there is no back edge, if DFS is performed on an undirected graph. **(8)**

(d) Give the running times of DFS in terms of |V| and |E|, when using adjacency lists and adjacency matrix to represent the graph, respectively. **(8)**

8. (a) Write a function int treeHeight ( ) for a Binary Search Tree that computes the height of the tree. Give a worst-case big-Oh running time in terms of n, where n is the number of nodes in the tree. **(8)**

(b) Write functions void deleteMax ( ) for a Binary Search Tree that deletes the maximum element in the tree (or does nothing if the tree has no elements). Give a worst-case big-Oh running time in terms of n, where n is the number of nodes in the tree. Do not assume the tree is balanced. **(7)**

(c) Suppose you have a graph like the one below. The dots signify some part of the graph that you don't know exactly, not a straight link. You know however, that there are many paths from the start to the goal. You also know that they tend to be rather long. Suppose that you want to implement a program that searches for a path and returns the first one it can find. You have no need for finding the optimal path in any sense, just any path will do. Would you want to use BFS or DFS as the basis for your program? Justify your answer. **(10)**



(d) Describe a situation where storing items in an array is clearly better than storing items on a linked list. **(5)**

(e) Write a method isHeap( ) which determines whether a particular binary tree is a heap. What is the big-Oh bound on the running time of this algorithm? **(5)**

L-2/T-1/CSE **Date: 26/10/2019**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-1 B. Sc. Engineering Examinations 2018-2019

Sub: **CSE 205** (Digital Logic Design)

Full Marks: 210 Time: 3 Hours

The figures in the margin indicate full marks

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE** questions.

1. (a) Design a security lock using PLA which will be opened using the following combinations. **(12)**

$$A(x,y,z)=\sum(1,3,5,6)$$
$$B(x,y,z)=\sum(0,1,6,7)$$
$$C(x,y,z)=\sum(3,5)$$
$$D(x,y,z)=\sum(1,3,4,5,7)$$

(b) Express $f(A,B,C,D)=\sum(0,4,8,9,10,11,12,14)$ with the two level forms of logic "NAND-AND" and "OR-NAND". **(6)**

(c) Using *K*-Map minimize $f(w,x,y,z)=\sum(1,2,3,7,10,12,14)+d(0,6,8,13)$. Find the *Prime Implicants* and *Essential Prime Implicants*. Write down the responsible *minterm* for each *Essential Prime Implicants*. **(12)**

(d) Simplify the following expression to POS and SOP. **(5)**

$$ACD'+C'D+AB'+ABCD$$

2. (a) Design a logic circuit which return the smaller value between two 4-bit binary numbers A and B. Show the operation with input $A = 7$, $B = 9$. **(12)**

(b) Using 4-bit binary adder and XOR gate design a circuit which takes two 4-bit BCD inputs A and B, and return $A+1$ if input is 00, A' if input is 01, $A'+1$ when input is 10 and A when input is 11. **(13)**

(c) Design a circuit with 4-bit binary adder which returns $A\times B$. A and B are 3-bit binary numbers. **(10)**

3. (a) Design a logic circuit for $f(w,x,y,z)=\sum(0,2,6,7,10,11,12,14)$, with 2-4 line decoder which has A, B as input lines, decoder is enabled by active low enables $EN1'$ and $EN2'$ (use the minimum number of extra logic gates). **(14)**

(b) Design a 8 to 3 priority encoder with the priority order of data input is given as, 5, 0, 7, 4, 6, 3, 2, 1 (5 has the highest priority and 1 has the lowest priority). **(13)**

(c) Show that a decoder can be used as a demultiplexer. **(8)**

Contd P/2

CSE 205

4. (a) What are the differences between an *odd parity checker* and *odd parity generator*? **(8)**

(b) Using 4×1 line MUX design a logic circuit for $f(w,x,y,z)=\Pi(0,2,5,6,7,8,9,10)$, where the MUX has selector bits S_0, S_1, input lines I_0, I_1, I_2, I_3, and enables $EN1'$ is active low and $EN2$ is active high. (If S_2S_1 = 00, I_0 is selected; if S_1S_0 = 01, I_1 is selected; S_1S_0 = 10, I_2 is selected; .....so on.) **(15)**

(c) Design a 1 bit Full Subtractor using 4×1 multiplexer (MUX).
The MUX has selector bits S_0S_1, input lines I_0, I_1, I_2, I_3 and active low Enable EN'. (If S_1S_0 = 00, I_0 is selected; if S_1S_0 = 01, $_1$ is selected; S_1S_0 = 10, I_2 is selected; S_1S_0 = 11, I_3 is selected.) **(12)**

SECTION – B

There are **FOUR** questions in this section. Answer any **THREE** questions.

5. (a) Design a sequence recognizer that recognizes the sequence 1101 from an input sequence. Note that the sequence is overlapping. Design the circuit using S-R flipflops and draw the circuit diagram. **(20)**

(b) Draw the circuit diagram of a master-slave J-K flipflop using only NAND gates. **(8)**

(c) Design a BCD ripple down counter using D flip-flops. **(7)**

6. (a) Design a circuit for a digital lock using T latches. The lock has two input push-button switches A, B and it outputs a single pulse (Z1) for each activation. The two switches are interlocked mechanically so that simultaneous pulses are not possible. The lock should have the following features: **(20)**

   (i) The opening sequence is AABABA.
   (ii) Three B pulses should give an absolute reset.
   (iii) Any incorrect use of the A switch will cause an output (Z2) to ring a bell to warn that the lock is being tampered.

(b) Design a serial parity generation circuit. The circuit receives a sequence of bits and determines whether the sequence contains an even or odd number of ones. The circuit output p should be 0 for even parity, that is, if the sequence contains an even number of ones, and 1 for odd parity. **(8)**

(c) Design a 4 bit Jhonson counter using a shift register and illustrate its operation using a timing diagram. **(7)**

Contd P/3

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7. (a) For the incompletely specified machine shown in Figure for question 7(a), complete the implication table and determine the maximum compatibles and the maximum incompatibles. Find the upper bound and the lower bound of the number of states of the minimal machine. Give the state table of the minimal machine. **(20)**

PS	NS, Z	
	x = 0	x = 1
A	B, 0	C, 1
B	D, 0	C, 1
C	A, 0	E, 0
D	-	F, 1
E	G, 1	F, 0
F	B, 0	-
G	D, 0	E, 0

Figure for question 7(a)

(b) For the state-table, in Figure for question 7(b), of a completely specified circuit, find the equivalent partitions and write the state-table of the minimal machine. Name the states that are equivalent. **(8)**

PS	NS, Z		
	I	J	K
A	A,0	B,1	E,1
B	B,0	A,1	F,1
C	A,1	D,0	E,0
D	F,0	C,1	A,0
E	A,0	D,1	E,1
F	B,0	D,1	F,1

Figure for question 7(b)

(c) Discuss why the condition S = R = 1 leads to an unstable condition for an SR latch. **(7)**

8. (a) Construct a primitive flow table for a fundamental mode circuit where the output, z, equal 0 when the two inputs, x_1 and x_2, are equal. z = 1 results when x_1 = 0 and x_2 changes from 0 to 1, and when x_1 = 1 and x_2 changes from 1 to 0. No other input change causes any output change. Determine the reduced flow table containing the minimum number of rows. **(10+10)**

Contd P/4

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Contd... Q. No. 8

(b) For the given reduced flow table in the Figure for question 8(b), find a valid assignment without any critical race and complete the modified flow table. **(8)**

x_1x_2	00	01	11	10
a	(a)/0	d/0	(a)/1	c/0
b	(b)/0	c/-	(b)/0	d/-
c	b/0	(c)/1	a/1	(c)/0
d	a/0	(d)/0	b/0	(d)/1

Figure for question 8(b)

(c) Obtain the Mealy equivalent state table for the Moore machine of the following state table: **(7)**

PS	NS		Z
	x = 0	x = 1	
A	A	B	0
B	C	B	0
C	C	D	1
D	A	D	0

L-2/T-1/CSE **Date: 20/10/2019**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-1 B. Sc. Engineering Examinations 2018-2019

Sub: **EEE 263** (Electronic Circuits)

Full Marks: 280 Time: 3 Hours

The figures in the margin indicate full marks

The symbols used have their usual meanings. Make necessary assumptions if required.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE** questions.

1. (a) Draw the circuit of a full-wave bridge rectifier and show the output wave shape for a sinusoidal input. **(16⅔)**

(b) For a full wave bridge rectifier, find the value of peak current through the diode and PIV for the diode. Given, V_S = 12 V (rms), V_{DO} = 0.7 V and R = 100 Ω. **(10)**

(c) Comment on the value of RC time constant for a rectifier circuit. **(10)**

(d) For a sinusoidal input, draw the output waveshape for the circuit shown in Fig. for Q. 1(d). **(10)**

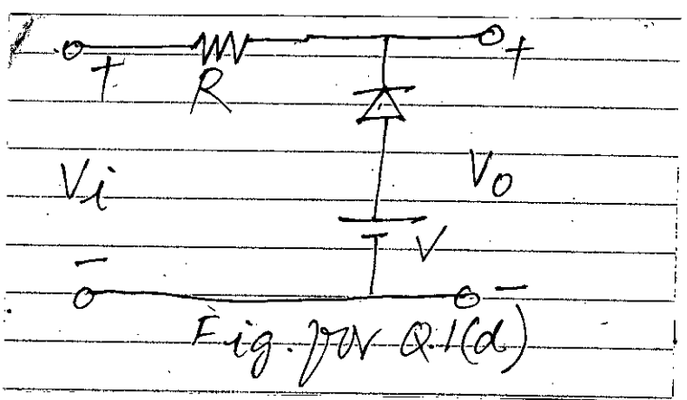


Fig. for Q.1(d)

2. (a) Draw the energy band profile of a pnp transistor under zero bias and forward-active mode bias conditions. **(23)**

(b) For the common collector circuit shown in Fig. for Q. 2(b) derive the expressions for A_v, A_i, R_i and R_0 using T model for the transistor. **(23⅓)**

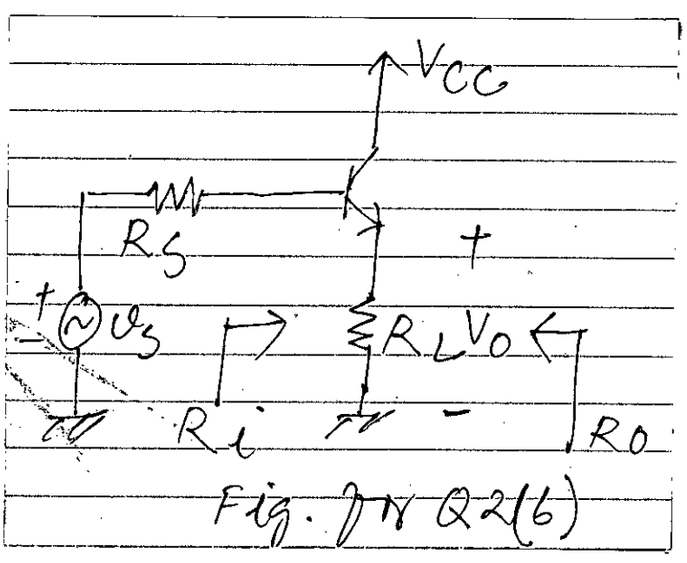
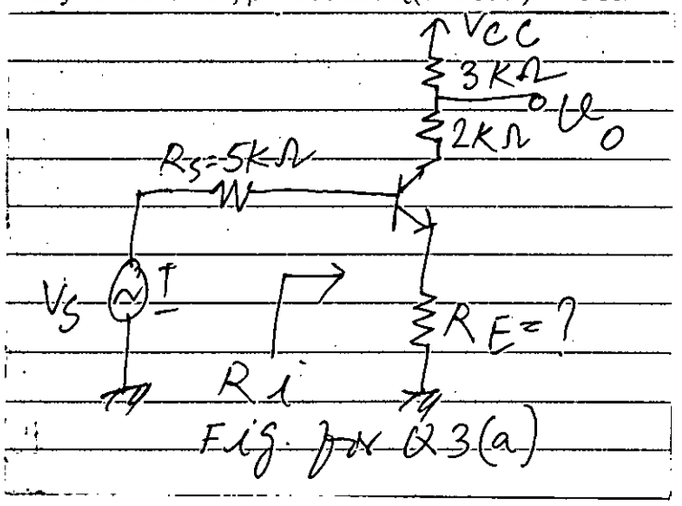


Fig. for Q2(b)

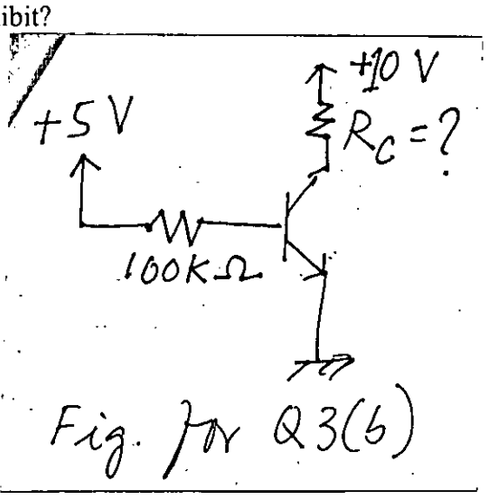
Contd P/2

EEE 263/CSE

3. (a) For the circuit shown in Fig. for Q. 3(a), find the value of R_E, so that R_i is five times the value of R_s. Then using these values find R_i, R_o, A_v and A_i for the circuit. You can neglect early effect. Given, $\beta = 100$ and r_e(T-model) = 40 Ω. **(26⅔)**

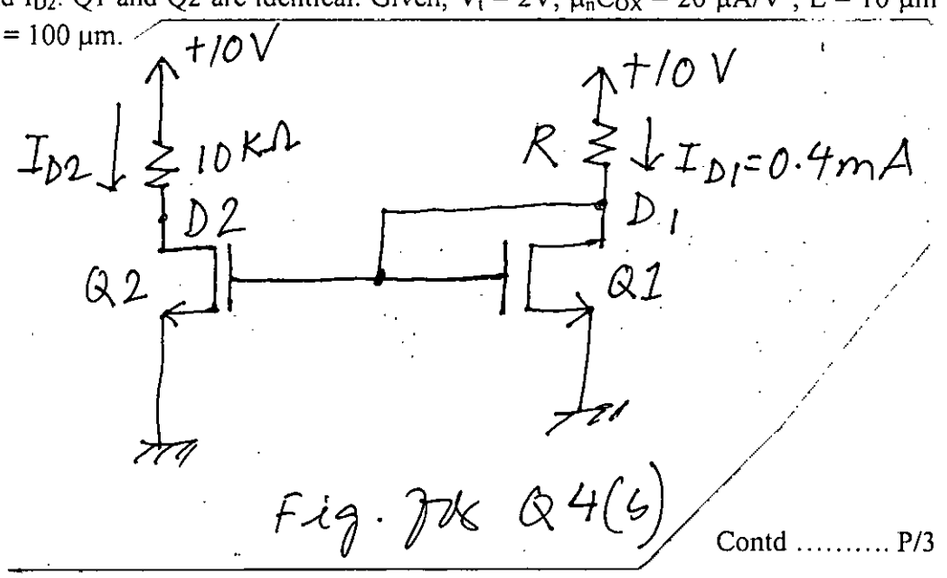


(b) The circuit shown in Fig. for Q. 3(b) is to be fabricated using a transistor type whose β can vary from 50 to 150. Design the circuit (find R_c), so that all fabricated circuits are guaranteed to be in the active mode (emitter junction forward biased and collector junction reverse biased). What is the range of collector voltages that the fabricated circuits may exhibit? **(20)**



4. (a) What is the difference between enhancement type and depletion type MOSFETs. Draw I_D, vs. V_{GS} characteristics and I_D vs. V_{DS} characteristics for different values of V_{GS} for enhancement type and depletion type MOSFETs. **(26⅔)**

(b) For the circuit sown in Fig. for Q. 4(b), find R so that $I_{D1} = 0.4$ mA. Also find V_{D1}, V_{D2} and I_{D2}. Q1 and Q2 are identical. Given, $V_t = 2$V, $\mu_n C_{OX} = 20\ \mu A/V^2$, L = 10 μm and W = 100 μm. **(20)**



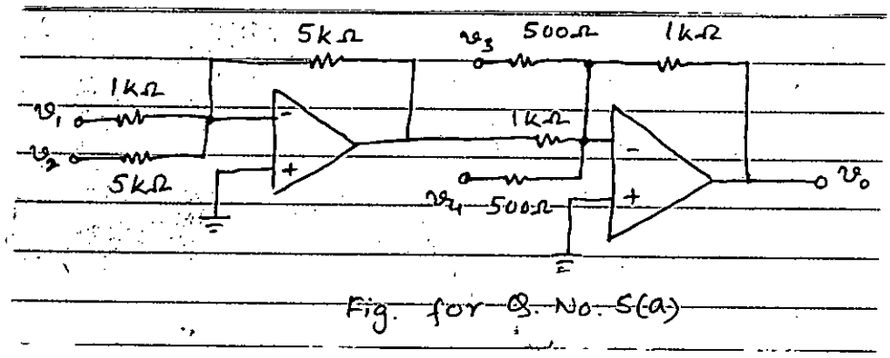
Contd P/3

EEE 263/CSE

SECTION – B

There are **FOUR** questions in this section. Answer any **THREE**.

5. (a) Find the expression of output voltage, v_0 in terms of input voltages and resistances in the circuit shown in Fig. for Q. No. 5(a). Also, calculate the value of output voltage at t = 1 sec given that $v_1 = 2V$, $v_2 = 5V$, $v_3 = 1V$, and $v_4 = 5\sin(100\pi t)$. **(20)**

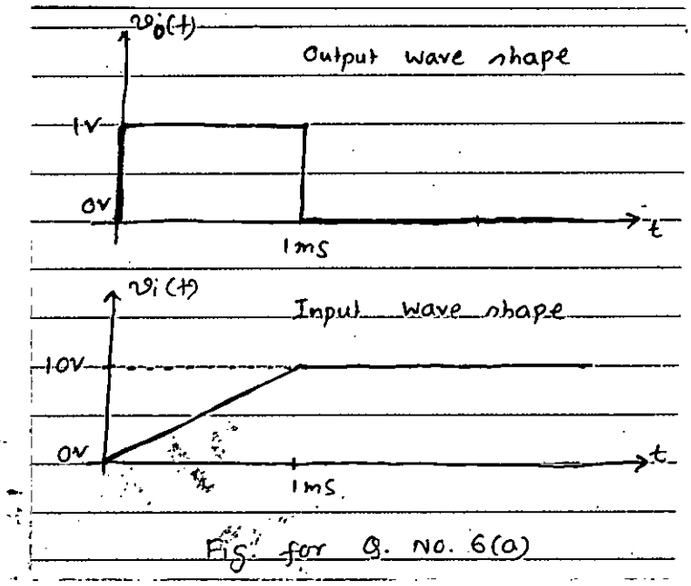


(b) Design an electronic analog computer using Op Amp that can solve the following differential equation. Give brief explanation of operation of the designed computer. **(26⅔)**

The differential equation is,

$$\frac{d^2v}{dt^2} + 4\frac{dv}{dt} + 5v - 5 = 0$$

6. (a) Design a circuit using Op Amp(s) for given input, $v_i(t)$ and output, $v_0(t)$ in Fig. for Q. No. 6(a). **(16)**



(b) Design a circuit using 555 IC which results in a square wave with oscillation frequency of 100 kHz and 75% duty cycle. Also, draw your designed circuit and output wave shape. **(20)**

(c) Write down the Barkhousen criterion. **(10⅔)**

Contd P/4

EEE 263/CSE

7. (a) For the Colpits oscillator show that frequency of oscillation w_0, is given by **(20)**

$$w_o = \frac{1}{\sqrt{L\dfrac{C_1C_2}{C_1+C_2}}}$$

(b) Draw the equipment circuit of piezoelectric crystal. Qualitatively draw the crystal reactance verses frequency and identify inductive and capacitive reactance region. **(10⅔)**

(c) Design a circuit using bistable multivibrator which generate triangular waveform with oscillation frequency of 2 kHz. Given that the triangular wave has a 10-V peak-to-peak amplitude. **(16)**

8. (a) Consider the inverter of Fig. for Q. No. 8(a) with a capacitor C connected between the output node and ground. I_f at t=0 goes low to high, find the equation of time for v_0 to reach $\frac{1}{2}$ (V_{OL} + V_{OH}). Also, calculate high-to-low propagation time for R = 25 kΩ and C = 20 pF. **(10⅔)**

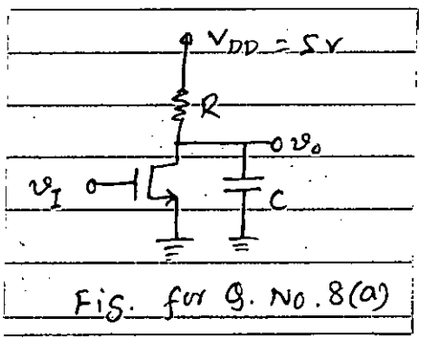


Fig. for Q. No. 8(a)

(b) Implement the function $f(A,B,C,D)=\sum m(0,4,8,9,10,11,12)$ using CMOS. **(13)**

(c) Calculate transistor $\frac{W}{L}$ ratios for the logic circuit shown in Fig. for Q. No. 8(c). Assume that for the basic inverter n = 1.5 and P = 5 and that the channel length in 0.25 μm. **(16)**

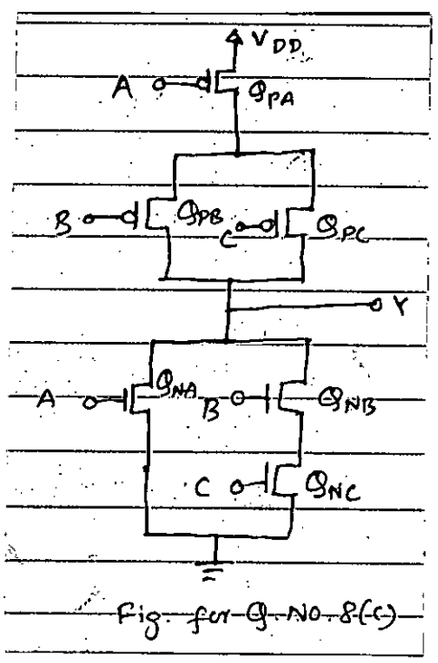


Fig. for Q. No. 8(c)

(d) Implement the following function, Y using CMOS transmission gate configuration. **(7)**

$$Y = AB + A\overline{C}$$

L-2/T-1/CSE **Date: 03/11/2019**

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L-2/T-1 B. Sc. Engineering Examinations 2018-2019

Sub: **MATH 245** (Complex Variables and Statistics)

Full Marks: 210 Time: 3 Hours

The figures in the margin indicate full marks

Symbols used have their usual meaning.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE** questions.

1. (a) If $|z_1|=|z_2|$ and $\text{amp}(z_1)+\text{amp}(z_2)=0$, then show that z_1 and z_2 are two complex conjugate numbers. **(10)**

(b) Prove that if the ratio $\frac{z-i}{z-1}$ is purely imaginary, then the point z lies on the circle whose centre $\frac{1}{2}(1+i)$ and radius $\frac{1}{\sqrt{2}}$. **(10)**

(c) Show that the transformation, $w=\frac{1+iz}{z+i}$ transform the real axis on the z-plane onto a circle in the w-plane. Find the centre and radius of this circle. **(15)**

2. (a) Write down Cauchy Riemann equations in polar form. If $f(z)=u(r,\theta)+iv(r,\theta)$ then test the differentiability of the function $f(z)=\sqrt{r}e^{i\frac{\theta}{2}}, (r>0, \alpha<\theta<\alpha+2\pi)$ in the indicated domain and hence show that $f'(z)=\frac{1}{2f(z)}$. **(15)**

(b) Show that $u=e^x\cos y$ is a harmonic function. Find an analytic function $f(z)=u(x,y)+iv(x,y)$ and express $f(z)$ in terms of z. **(10)**

(c) Show that the integral of $\bar{z}$ along a semi-circular arc $|z|=1$ from -1 to 1 has the value $-\pi i$ or πi according as the arc lies above or below the real axis. **(10)**

3. (a) Use Cauchy integral formula to evaluate $\oint_C \frac{\sin^6 z}{\left(z-\frac{\pi}{6}\right)^3}dz$, where C is the circle $|z|=1$. **(10)**

(b) Express $f(z)=\frac{1}{(z^2+1)(z+2)}$ in a Laurent series valid in the region $1<|z|<2$. **(13)**

(c) Evaluate $\int_C \frac{1}{z(2z-1)(z-4)}dz$, where $C=\{z:|z+2|+|z-2|=6, \text{positively oriented}\}$ by Cauchy's residue theorem. **(12)**

4. Evaluate the following integral using the method of contour integration: **(17+18)**

(a) $\int_0^{2\pi}\frac{\sin 2\theta d\theta}{5-3\cos\theta}$ (b) $\int_0^{\infty}\frac{dx}{(1+x^2)^2}$.

Contd P/2

MATH 245/CSE

SECTION – B

There are **FOUR** questions in this section. Answer any **THREE** questions.

5. (a) The Shareholder Research Bureau of BD conducted recently a research study on the price behavior of three leading industrial shares A, B and C for the period 1996 to 1999, the results of which are published as follows in the quarterly journal: **(15)**

Share	Average price (tk)	Standard Deviation (tk)	Current selling price (tk)
A	18.00	5.40	36.00
B	22.50	4.50	34.75
C	24.00	6.00	39.00

(i) Which share in your opinion appears to be more stable in value?

(ii) If you are the holder of all three shares which one would you like to dispose of at present and why?

(b) What is Skewness and Kurtosis? Calculate the value of γ_1 and γ_2 from the data and interpret them. **(20)**

Class interval	10-20	20-30	30-40	40-50	50-60
Frequency	18	20	30	22	10

6. (a) Find the regression equation of capacity utilisation on production from the data where $r = 0.62$ **(20)**

	Average	Standard deviation
Production	35.6	10.5
Capacity utilisation	84.8	8.5

Also estimate the production when the capacity utilisation is 70 percent.

(b) A group of 20 students went on a picnic. Among them 5 got sun burnt, 8 got bitten by mosquitoes and 10 returned home safely without any mishap. What is the probability that (i) a boy, who got sun burnt was ignored by the mosquitoes? and (ii) a mosquito bitten boy also got sun burnt? **(15)**

7. (a) What is density function? What condition must a density function satisfy? Suppose that the distribution function of a random variable X is as follows **(20)**

$$F(x)=\begin{cases}0, & x\le 0\\ \frac{x}{8}, & 0<x<2\\ \frac{y^2}{16}, & 2\le x<4\\ 1, & x\ge 4\end{cases}$$

(i) Find the probability density function of X.

(ii) Find $p(x\ge 1.5)$ and $p(x\ge 1\,|\,x\le 3)$.

Contd P/3

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Contd... Q. No. 7

(b) A lot containing 7 components is sampled by a quality inspector, the lot contains 4 good components and 3 defective components. A sample of 3 is taken by the inspector. Find the expected value of the number of good components in this sample taken by the inspector? **(15)**

8. (a) A new factory installed 1000 tube lights with a mean life of 120 days and their length of life is normally distributed with standard deviation 20 days. (i) How many tube lights will expire in less than 90 days? (ii) If it is decided to replace all the tube lights together, what interval should be allowed between replacements if not more than 10 percent should expire before replacement? **(18)**

(b) The mean and standard deviation of GPA scores obtained from a random sample of 40 students of a college were 2.8 and 0.35 respectively. Can we conclude that the sample has come from the entire group of students, which has a mean score of 2.4? Use a 1% level of significance. Compute 99% confidence interval for the mean score in the population. (Given that, at 1% level of significance; $z = \pm 2.58$.) **(17)**

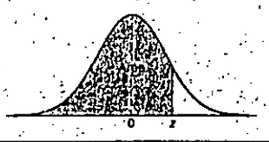

Table A.3 Areas under the Normal Curve

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
−3.4	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0002
−3.3	0.0005	0.0005	0.0005	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0003
−3.2	0.0007	0.0007	0.0006	0.0006	0.0006	0.0006	0.0006	0.0005	0.0005	0.0005
−3.1	0.0010	0.0009	0.0009	0.0009	0.0008	0.0008	0.0008	0.0008	0.0007	0.0007
−3.0	0.0013	0.0013	0.0013	0.0012	0.0012	0.0011	0.0011	0.0011	0.0010	0.0010
−2.9	0.0019	0.0018	0.0018	0.0017	0.0016	0.0016	0.0015	0.0015	0.0014	0.0014
−2.8	0.0026	0.0025	0.0024	0.0023	0.0023	0.0022	0.0021	0.0021	0.0020	0.0019
−2.7	0.0035	0.0034	0.0033	0.0032	0.0031	0.0030	0.0029	0.0028	0.0027	0.0026
−2.6	0.0047	0.0045	0.0044	0.0043	0.0041	0.0040	0.0039	0.0038	0.0037	0.0036
−2.5	0.0062	0.0060	0.0059	0.0057	0.0055	0.0054	0.0052	0.0051	0.0049	0.0048
−2.4	0.0082	0.0080	0.0078	0.0075	0.0073	0.0071	0.0069	0.0068	0.0066	0.0064
−2.3	0.0107	0.0104	0.0102	0.0099	0.0096	0.0094	0.0091	0.0089	0.0087	0.0084
−2.2	0.0139	0.0136	0.0132	0.0129	0.0125	0.0122	0.0119	0.0116	0.0113	0.0110
−2.1	0.0179	0.0174	0.0170	0.0166	0.0162	0.0158	0.0154	0.0150	0.0146	0.0143
−2.0	0.0228	0.0222	0.0217	0.0212	0.0207	0.0202	0.0197	0.0192	0.0188	0.0183
−1.9	0.0287	0.0281	0.0274	0.0268	0.0262	0.0256	0.0250	0.0244	0.0239	0.0233
−1.8	0.0359	0.0351	0.0344	0.0336	0.0329	0.0322	0.0314	0.0307	0.0301	0.0294
−1.7	0.0446	0.0436	0.0427	0.0418	0.0409	0.0401	0.0392	0.0384	0.0375	0.0367
−1.6	0.0548	0.0537	0.0526	0.0516	0.0505	0.0495	0.0485	0.0475	0.0465	0.0455
−1.5	0.0668	0.0655	0.0643	0.0630	0.0618	0.0606	0.0594	0.0582	0.0571	0.0559
−1.4	0.0808	0.0793	0.0778	0.0764	0.0749	0.0735	0.0721	0.0708	0.0694	0.0681
−1.3	0.0968	0.0951	0.0934	0.0918	0.0901	0.0885	0.0869	0.0853	0.0838	0.0823
−1.2	0.1151	0.1131	0.1112	0.1093	0.1075	0.1056	0.1038	0.1020	0.1003	0.0985
−1.1	0.1357	0.1335	0.1314	0.1292	0.1271	0.1251	0.1230	0.1210	0.1190	0.1170
−1.0	0.1587	0.1562	0.1539	0.1515	0.1492	0.1469	0.1446	0.1423	0.1401	0.1379
−0.9	0.1841	0.1814	0.1788	0.1762	0.1736	0.1711	0.1685	0.1660	0.1635	0.1611
−0.8	0.2119	0.2090	0.2061	0.2033	0.2005	0.1977	0.1949	0.1922	0.1894	0.1867
−0.7	0.2420	0.2389	0.2358	0.2327	0.2296	0.2266	0.2236	0.2206	0.2177	0.2148
−0.6	0.2743	0.2709	0.2676	0.2643	0.2611	0.2578	0.2546	0.2514	0.2483	0.2451
−0.5	0.3085	0.3050	0.3015	0.2981	0.2946	0.2912	0.2877	0.2843	0.2810	0.2776
−0.4	0.3446	0.3409	0.3372	0.3336	0.3300	0.3264	0.3228	0.3192	0.3156	0.3121
−0.3	0.3821	0.3783	0.3745	0.3707	0.3669	0.3632	0.3594	0.3557	0.3520	0.3483
−0.2	0.4207	0.4168	0.4129	0.4090	0.4052	0.4013	0.3974	0.3936	0.3897	0.3859
−0.1	0.4602	0.4562	0.4522	0.4483	0.4443	0.4404	0.4364	0.4325	0.4286	0.4247
−0.0	0.5000	0.4960	0.4920	0.4880	0.4840	0.4801	0.4761	0.4721	0.4681	0.4641

For Question No. 8(a)

Table A.3 (continued) Areas under the Normal Curve

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990
3.1	0.9990	0.9991	0.9991	0.9991	0.9992	0.9992	0.9992	0.9992	0.9993	0.9993
3.2	0.9993	0.9993	0.9994	0.9994	0.9994	0.9994	0.9994	0.9995	0.9995	0.9995
3.3	0.9995	0.9995	0.9995	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9997
3.4	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9998

For Question No. 8(a)