Department of Computer Technology
Madras Institute of Technology, Anna University, Chennai
CS6105 - Digital Fundamentals and Computer Organization

Mid - Semester Assessment Test - 3rd Semester / II Year

Time:- 90 Mins

Date:- 13th September 2019

Part - I

(5 * 2 = 10)

Answer all questions

1. Convert $(82C.11)_{16}$ to its base-2 and base-8 equivalents.
2. State and Prove the "Consensus theorem".
3. Define minterm and maxterm.
4. It is required to pass a resolution in a meeting that is attended by three people. The resolution is passed only when three is a 2/3 majority in favour of the resolution. Design a combinational circuit that will indicate whether the resolution is passed or not.
5. Draw the logic diagram and write the Function Table of SR latch.

Part - II

(4 * 8 = 32)

Answer any FOUR questions

6. (a) Perform the subtractions with the following decimal number: $12 - 8$ using 1's complement and 2's complement. (4)

   (b) What is Binary code? List out the types of binary codes. Explain with an example how BCD addition is carried out? (4)

7. A staircase light is controlled by two switches, one is at the top of the stairs and the other at the bottom of the stairs:
   (a) Make a truth table for this system. (2)
   (b) Write the logic equation in SOP form. (2)
   (c) Realize the circuit using AOI logic. (2)
   (d) Realize the circuit using mininum number of NAND gates and NOR gates. (2)

8. (a) Find the Complement of the following expression $f(r, s, t) = r + st + rs$ (4)
   (b) Draw the 2 - bit Magnitude Comparator and List out the major applications of Magnitude Comparator? (4)

9. (a) Obtain the simplified Boolean expressions for outputs F and G in terms of the input variables in the circuit of Figure. 1.

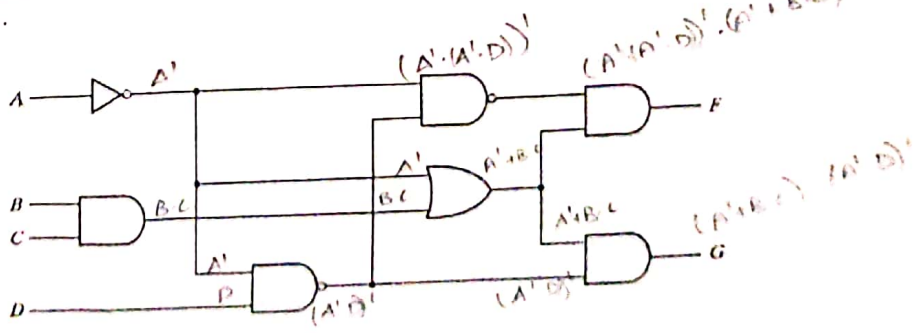


Figure 1:

(b) Write down the procedure to design a combinational circuit. (3)

10. (a) What is a carry look ahead generator? What is its importance? Draw a circuit for a 3-bit binary adder using a look ahead carry generator and other gates. (6)

(b) Write the HDL dataflow description of 4-bit adder. (2)

11. (a) Explain a 3-to-8 decoder with logic diagram. (4)

(b) Implement the following function with a multiplexer. $f(A, B, C, D) = \sum_m (0, 1, 3, 4, 8, 9, 15)$. (4)

Part - III

(1 * 8 = 8)

Answer all questions

12. (a) Using the Karnaugh map method obtain the minimal sum of the products expression for the function $F(A,B,C,D)=\sum_m(0,2,3,4,5,7,8,10,11,12,13,15)+d(1,6,9)$ (5)

(b) Show for a 3 - input logic circuit that $\sum_m(0, 3, 4, 6) = \prod_M(1, 2, 5, 7)$ using Boolean Alegbra only. (3)

ALL THE BEST

DEPARTMENT OF COMPUTER TECHNOLOGY

Mid Term Test

CS6104 DATA STRUCTURES AND ALGORITHMS

Time 1.30Hrs **Marks 50**

Part A (10 x 2 = 20)
Answer All Questions

1. Which is the exclusive property of any algorithm? Why is it regarded so?
2. How the tight bound time complexity of any algorithm is defined? Is it applicable for all algorithms? Justify.
3. Assume a stack of integers is implemented in an array of integers named *iStack*. The *top* of the stack is stored in *iStack[0]*. Write the necessary lines of statements to find whether the stack is empty or not and push an integer onto the stack.
4. A large integer is in a linked list with one digit per node and the least significant digit occupies the first position in the linked list. Write a function that increments the integer represented in the linked list.
5. A tree is said to be skewed if no node has left or no node has right. Write the necessary code segment to check whether the given tree is skewed or not.
6. Name any two data structures used for representing graphs. What are their respective advantages?
7. Write the recurrence relations representing the time complexities of conventional matrix multiplication and Strassen's matrix multiplication of matrices of order nxn using divide and conquer strategy. How much of overhead is added to Strassen's algorithm while saving one multiplication?
8. Differentiate Greedy approach from Dynamic programming for algorithm designs.
9. What is memoization? Where is it used? What it contributes?
10. State the reasons for why and when Quick sort performs better than merge sort.

Part B (6 x 5 = 30)
Answer ANY SIX Questions

11. Analyze the following code segment and derive its worst case and best case time complexities with appropriate justification.

```
for j = 2 to n do
        x = a [ j ]
        i  = j -1
        while i > 0 and a [ i ] > x do
                a [ i + 1 ] = a [ i ]
                i = i – 1
        a [ i + 1] = x
```

12. Write the necessary functions to *insert*, *delete* and *search* an element in a circular queue whose implementation is in an array of size N.

13. A list values is said to be palindrome list if the respective values from first to last and last to first are same. Write a function that checks whether the given linked list is palindrome list or not. Does your algorithm incur space overhead and if so, how much?

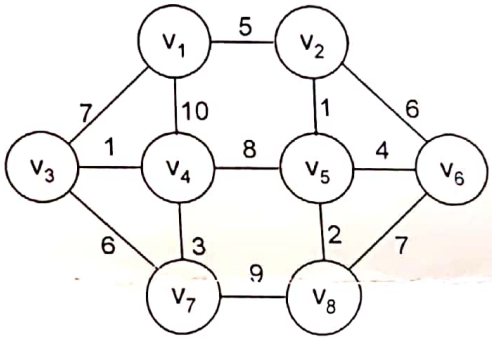
14. Write a function that finds the smallest and largest values from the given linked list and place them in the first and last nodes respectively using minimum number of interchanges. What is the time and space complexity of your method? Is it optimal? Justify.

15. Construct a binary search tree from the list of values (*23, 40, 70, 12, 50, 19, 15*). Convert the resulting tree into a threaded binary tree by replacing the NULL links. Write a non-recursive routine that will return the inorder successor of the given value.

16. For the graph G given here with 8 vertices and 13 edges, construct

    a. the spanning tree by using depth first traversal starting from vertex v_1. Assume the adjacent vertices are returned in the increasing order of the cost to reach those adjacent vertices without any ambiguity.

    b. the minimum cost spanning tree using Prim's algorithm with starting vertex v_1.



17. An instance of a Knapsack problem is given as [P = (p_1, p_2, p_3, ... p_n), W = (w_1, w_2, w_3, ... w_n), n, m], where P has the profits, W has the weights, n is the problem size and m is the Knapsack size. Define a greedy strategy which is expected to give maximum profit. Write an algorithm for your greedy strategy.

18. How many distinct possible ways are there to compute the product of a sequence of n matrices A_1, A_2, A_3, ... A_n. Consider the list $p_{0..4}$ = (15, 5, 10, 20, 25) denoting the dimensions of 4 matrices, where the order of A_i is $p_{i-1} \times p_i, 1 \le i \le 4$. Compute the optimal order of the matrix multiplications and the number of scalar multiplications required for the optimal order.

19. X = < x_1, x_2, x_3, ... x_m> and Y = < y_1, y_2, y_3, ... y_n> are any two sequences of values. Define the optimal sub structure for finding the longest common sub sequence from X and Y. Design an algorithm to compute only the length of the longest common sub sequence. The algorithm has to compute the length in top-down and should take advantage of the overlapped sub structure of this problem.

ANNA UNIVERSITY

DEPARTMENT OF MATHEMATICS

B.E. (Computer Science) - III Semester

MA6351 PROBABILITY AND STATISTICS

RUSA 2018 - Common to CEG nd MIT

Mid Semester Examination

Time: 90 Minutes

18th September, 2019

Max Marks: 50

PART A ($5 \times 2 = 10$ Marks)

1. Find the constant c so that $p(m,n) = c(m^2+n^2), m = -1,0,1,3,\ n = -1,2,3$ serves as a joint probability mass function of (X,Y).

2. If the joint cummulative distribution function of (X,Y) is $F(x,y) = (1-e^{-x})(1-e^{-y}), x > 0, y > 0$. Find $P(1 < X < 3, 1 < Y < 2)$.

3. Given the $Cov(X,Y) = 1/36$, find the $Cov(U,V)$ where $U = 2(X-3)$ and $V = \dfrac{Y-5}{4}$.

4. Depict the two lines of regression of X on Y and that of Y on X, when the random variables X and Y are uncorrelated.

5. The security department of a factory wants to know whether the true average time required by the night guard to walk his round is 30 minutes. If, in a random sample of 32 rounds, the night guard averaged 30.8 minutes with a standard deviation of 1.5 minutes, compute the value of the test statistics to test the null hypothesis $\mu = 30$ minutes.

PART B ($4 \times 8 = 32$ Marks)

(ANSWER ANY FOUR)

6. The joint probability density function of (X,Y) is given is $f(x,y) = 24y(1-x-y), x > 0, y > 0, x+y < 1$, check if X and Y are independent.

7. Given the joint probability density function of (X,Y) as

$$f(x,y) = \begin{cases} \frac{2}{3}(x+2y), & 0 < x < 1, 0 < y < 1 \\ 0, & \text{otherwise} \end{cases}$$

Find $P\left(X \leq \frac{1}{2} | Y = \frac{1}{2}\right)$.

8. Given the joint probability mass function of (X, Y) as

X / Y	-1	0	1	
-1	1/6	1/3	1/6	2/3
0	0	0	0	0
1	1/6	0	1/6	1/3
	1/3	1/3	1/3	

find the covariance between X and Y. Are X and Y independent?

9. Let X and Y be two continuous random variable with joint probability density function given by

$$f(x,y) = \begin{cases} 4xy, & 0 < x < 1, 0 < y < 1 \\ 0, & \text{otherwise} \end{cases}$$

Find the probability density function of $U = X^2$ and $V = XY$.

10. If $X_1 X_2, \cdots, X_n$ are Poisson variates with parameter $\lambda = 2$, use central limit theorem to estimate $P(120 < S_n < 160)$ where $S_n = X_1 + X_2 + \cdots + X_n$ and $n = 75$.

11. An examination was given to two classes consisting of 40 and 50 students respectively. In the first class, the mean grade was 74 with a standard deviation of 8, while in the second class the mean grade was 78 with a standard deviation of 7. Test whether $\mu_1 - \mu_2 = 0$ against $\mu_1 - \mu_2 \neq 0$ at 1% level of significance.

PART C ($1 \times 8 = 8$ Marks)

12. Let X and Y be two independent random variables with means 2 and 3 respectively and standard deviation 2 and 3 respectively. Obtain the correlation coefficient between U and V where $U = 3X + 4Y$ and $V = 3X - Y$.

DEPARTMENT OF COMPUTER TECHNOLOGY

MADRAS INSTITUTE OF TECHNOLOGY, ANNA UNIVERSITY CHENNAI

EE 6351 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

MID ASSESSMENT – (3/8 - CSE)

PART A 5 X 2 =10

1. State the maximum power transfer theorem.
2. Why 3 phase is preferred over single phase?
3. List the comparison between EMOS and DMOS.
4. Define CMRR and Slew Rate.
5. Draw the π equivalent model of CE amplifier. Also write the expression for voltage gain.

PART B (ANY 4) 4 X 8 =32

6. a) Write in detail about the load saturation curve of D.C. Generators. (4)
   b) What are the different types of generators , draw the electrical circuit diagram of them and write one application of each.
7. a) A 230V,50Hz A.C. Supply is applied to a coil of 1mH inductance and 25 Ω resistance connected in series with a 10microF capacitor. Calculate impedance, current, power factor angle, power factor and draw the phasor diagram. (4)
   b) Write in detail about the relation between the line and phase voltage and currents in balanced star connection. (4)
8. What is FWR? Derive the following parameters. (4)
   i) Output Current iii) Output Voltage v) Ripple Factor
   ii) Efficiency ~~iv) Efficiency~~ rms value vi) Transformer Utilization Factor
9. Explain the working principle of CE configuration? Also derive the hybrid parameters.
10. What is an Integrator and Differentiator of an Op-amp? Derive the gain of it.
11. Derive the voltage gain of First order low pass filter of an opamp.

PART C 1 X 8 = 8

12. a) Find the equivalent resistance across AB nodes in figure 1. (3)

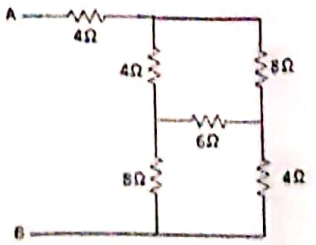


Figure 1

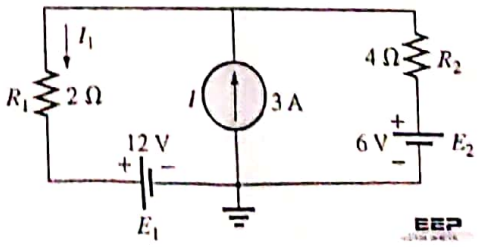


Figure 2

b) Using Superposition theorem find the current I_1 through 2 ohm resistor in figure 2. (5)