Course Code : CST 201   MARR/RS-13/4577

Third Semester B. E. (Computer Science and Engineering) Examination

DATA STRUCTURE AND PROGRAM DESIGN

Time : 3 Hours] $S - 13$ [Max. Marks : 60

Instructions to Candidates :—
  (1) All questions carry equal marks.
  (2) Due credit will be given to neatness and adequate dimensions.
  (3) Illustrate your answers wherever necessary with the help of neat sketches.

1. (a) Given an array of size [n X n] Write a function to find out "Saddle Point" in the array.
          "Saddle Point" is smallest value of particular row, which is largest in the respective column.   5

    (b) Write a Function to insert an node in circular linked list at start position.   5

OR

2. (a) Use suitable data structure to implement the execution of following jobs according to precedence.
          Find out total time required for execution

Job	$\longrightarrow$	1	2	3	4	5
Precedence	$\longrightarrow$	4	5	1	3	2
Time	$\longrightarrow$	6	3	4	2	5

                                                                5

    (b) Write a function to reverse a string using STACK. The function can use one additional stack.   5

3. (a) Write an algorithm to delete all the occurrences of element "X" from the linked list in single traversal.   5

MARR/RS-13/4577   **Contd.**

(b) Implement insert and delete operation on doubly linked list without using temporary pointer. 5

OR

4. (a) Implement following equation using Generalized list and write a function to perform sum of coefficients

$$5x^4 + 3x^3 + 9x^2 + 4x + 10$$

Sum = 31. 7

(b) Write a function to perform PUSH operation in linked stack. 3

5. (a) Write an recursive function on binary tree to find out smallest leaf node. 5

(b) Prove that if there are 'n' nodes in the binary tree then it require $0 (\log_2 n)$ time to implement search if the structure is BST. 5

OR

6. (a) What is AVL tree ? Explain with example different types of rotations in AVL tree. 6

(b) Write a Function to Insert an node in BST. 4

7. (a) On the following graph implement PRIM's method to design minimum cost spanning tree.
Provide all intermediate data structures used and intermediate results generated.

7
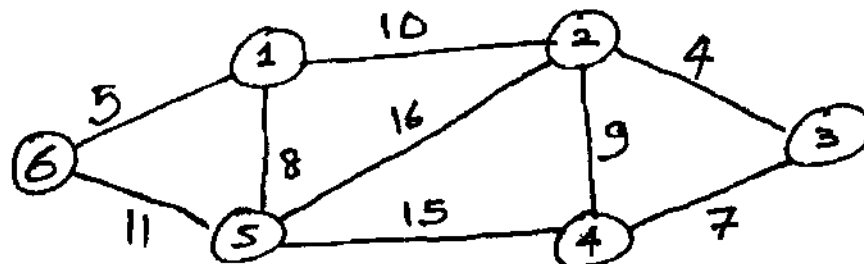
(b) What is indegree and outdegree of a note ? How matrix representation is useful in computing in degree and outdegree of an node ? 3

OR

8.   (a)   Write a function to implement Dijkstra's method for finding shortest path on a given graph G (V, E).   5

    (b)   Given a graph of 'n' vertices, prove that

        — if it is complete undirected graph then

$$\text{number of edges} = \frac{n * (n-1)}{2}$$

        — and if it is complete directed there $= n * (n-1)$.   5

9.   (a)   Write insert, delete and Adjust functions used to implement Heap sort.   6

    (b)   Comment on Best, Average and Worst Case complexity of Quick Sort.   4

OR

10.   (a)   Explain the difference between Bubble, Insertion, and Selection Sort. Write algorithm for any one method.   6

    (b)   Write a function for Radix Sorting.   4

11. Explain the following Hashing Techniques with suitable example :—
    (i)   Division Remainder Method.
    (ii)   Mid Square Method.
    (iii)   Folding with and without reversing.

    Explain any two collision handling methods.   10

OR

12.   (a)   Device an simple and easy to calculate has function for mapping three letter word to integer between 0 to n – 1. Find the values for words

        PAL, LAP, PAM, MAP, PAT, PET, SET, SAT, TAT, BAT
        for n = 11, 13, 17.   5

    (b)   Using Division method, for hash table for size 11 store the following values.

        25, 42, 96, 101, 102, 162, 197, 201

        Use suitable method for collision handling.   5

Third Semester B. E. (Computer Science and Engineering) Examination

BUSINESS DATA PROCESSING

Time : 3 Hours]   [Max. Marks : 60

Instructions to Candidates :—
(1) Due credit will be given to neatness and adequate dimensions.
(2) Assume suitable data wherever necessary.
(3) Illustrate your answers wherever necessary with the help of neat sketches.
(4) Questions carry marks as indicated.

1. (a) Explain all types of editing characters used in PIC clause with example.   8

   (b) What are the rules for following a data – name ?   2

OR

2. (a) What are literals ? Explain all types of literals with suitable example.   6

   (b) Explain in detail the DATA DIVISION. Also write about the importance of various sections in it.   4

3. (a) Explain various types of conditions used in COBOL control structures.   5

   (b) What is the function of USAGE clause ? Explain all options of the clause with example.   5

OR

4. (a) Write DATA DIVISION entries to define a table having 12 elements and to initialize the table to contain the number of days in each of the 12 months of a year. (assume 28 for February)   3

(b)   The following is PROCEDURE DIVISION statement.

PERFORM PARA – AGAIN VARYING I FROM

1 BY 1 UNTIL I > 4

AFTER J FROM 0 BY –1 UNTIL J < –2

AFTER K FROM 1 BY 2 UNTIL K > 8

(a) What combinations of values will I, J and K have in the loop ?

(b) How many times is the procedure named PARA–AGAIN executed ?

(c) Which data name varies least rapidly and which one most rapidly ?

4

(c) What are the differences among a subscript, an index and an index data item ?

3

5.   (a)   Each record of a disk file to be created is of 270 characters. Each sector of the disk pack on which the file being created can contain 180 character. Write an appropriate BLOCK CONTAINS clause.

4

(b) Explain the following for sequential files in detail. Give example.

(i) Record size.

(ii) Block size.

(iii) Inter Record gap.

6

OR

6. Write a COBOL program to create an updated stock file from available Master stock file and daily transaction file. Keep the contents of master stock file as it is, Master stock file contains the part records.

The part record format is as follows :—

Part Code, Part Quantity, Part Price,
Both the Master Stock File and Transaction File are organized sequentially.

Assume the suitable record names for daily transaction file and updated stock file.

10

7. An indexed sequential file is created for the guests staying in a hostel. As soon as a guest makes a request for a room in the hotel and if the room is available, the request record is entered into the file. The guest name is taken as the key.

The format of the records in the indexed sequential file is as follows :

Item	Position
Name	1–15
Room–Number	16–20
Date–last–Enquiry	21–26
Unused	27–30

Write an interactive COBOL program which display the room number by specifying the name of the guest.

When the person at the console asbs for such information, the program should place the current date into the record. **10**

OR

8. (a) Write a program to create a relative file on a disk from the available sequential file on tape. The first 4 characters of a record represent the year which ranges from 1901 to 2012. The next 26 characters on the record contain the data related to that year. The data for all the years is not available. The relative record number 1 is to be given to the record, Where year is 1901, relative record no. 2 is to be given for the year 1902 and so on. Assume suitable data name, PIC clause, file name etc., for the same. **8**

    (b) What is the difference between Relative key and Record key ? **2**

9. Write a program in COBOL to sort the given sequential file available on disk. The records stored on the file is of the following format :—

Item	Description
ROLL – NO	999
NAME	X (20)
ADDRESS	X (30)
MOB. NO	9 (10)

The file is to be sorted on the ascending order of Roll-No. **10**

OR

10. Write a COBOL program to merge the given two files. Given files are related to the students data. Student record consists of branch name, student name, roll no, percentage. Merged file should be available for further reference. Assume suitable data width, file name etc. 10

11. Explain the following verbs with example (any **three**) :—

    (i)   STRING verb.

    (ii)   UNSTRING verb.

    (iii)   INSPECT verb.

    (iv)   COPY verb. 10

OR

12.   (a)   Write a COBOL subroutine that receives a table of integer from the calling program and returns the count of elements with zero values. State the assumption you make while venting the subroutine. 6

    (b)   The calling program contains the statement

        CALL "SUBA" USING A, B, C, and the procedure division header of the called subroutine (named SUBA)

        is

        PROCEDURE DIVISION USING C, B, A.

        Show how the actual and formal parameters will be connected. 4

Course Code : CST 202   **MARR/RS – 13/4578**

Third Semester B. E. (Computer Science and Engineering) Examination

DIGITAL CIRCUITS AND FUNDAMENTALS OF MICROPROCESSOR

Time : 3 Hours]   [Max. Marks : 60

Instructions to Candidates :—
   (1)   All questions carry equal marks.
   (2)   Due credit will be given to neatness and adequate dimensions.
   (3)   Illustrate your answer wherever necessary with the help of neat sketches.

1.   (a)   Each of the following five numbers has a different base. Which of the five numbers have the same value in decimal ?

$(12011)_3$, $(3312)_4$, $(2022)_5$, $(2A7)_{11}$ and $(19A)_{12}$ 5

   (b)   Demonstrate by means of truth table the validity of the following identities.

   (a) $\bar{x}y + \bar{y}z + x\bar{z} = x\bar{y} + y\bar{z} + \bar{x}z$

   (b) $y + \bar{x}z + x\bar{y} = x + y + z$ 5

OR

2.   (a)   Implement the following expression with help of NAND gates only.

$(AB + \bar{A}\bar{B}) \cdot (C\bar{D} + \bar{C}D)$ 5

   (b)   Find the minterms of the following expression by first plotting each expression on a map and simplify it.

   (a) $xz + \bar{w}x\bar{y} + wxy + \bar{w}yz + w\bar{y}z$ 5

3.   (a)   Design a 4 input priority encoder with inputs and outputs in which D_0 has the highest priority and input D_3 has the lowest priority.   6

   (b)   Perform BCD addition and subtraction.

   (i) $(39.73)_D + (58.39)_D$

   (ii) $(345)_D - (297)_D$

4.   (a)   Implement 3 input EX-NOR operation using 4:1 MUX.   5

        (b)   Design a combinational circuit for the substraction of 4 bit binary number using 2's complement form.   5

5.   (a)   Give the procedure used for the design of sequential circuit other than D type Flip Flop.   5

        (b)   Which flip flop function is realized by the following circuit.
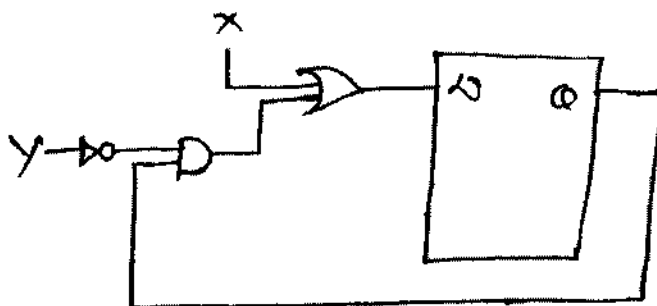

                                                                       6

OR

6.   (a)   We wish to design a sequence detector circuit, which detects three or more consecutive 1's in a string of bits coming through an input line, make the o/p equals to 1, if you detect three or more consecutive 1's otherwise 0.

            (a)   Find the state diagram.

            (b)   Implement the circuit using D-FF   10

7.   (a)   Define the terms related to Flip Flops :

            (i)   Lockout in counter.

            (ii)   Modulus of counter.

            (iii)   Register.

            (iv)   Counter.

            (v)   Direct inputs.   5

(b) Give the design for a 5 bit register which will shift its content towards left serially after the application of clock input clearly mention how many clock pulses are required to store the information and to shift the information from this register. 5

<div align="center">OR</div>

8. (a) Design the following self started counter by T Flip Flop.

8
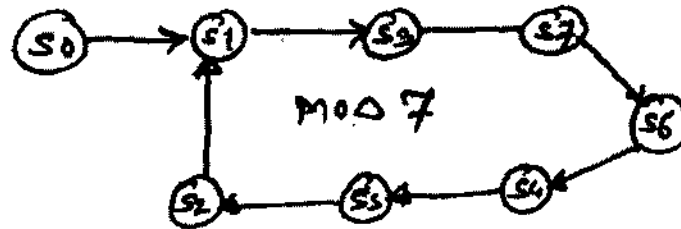
(b) If a counter having 10 flip flops is initially at 0, what count will it hold after 2060 pulses. 2

9. (a) Tabulate the truth table for an 8 x 4 ROM, that implements the following four Boolean function.

$A(x, y, z) = \Sigma m(3, 6, 7)$

$B(x, y, z) = \Sigma m(0, 1, 4, 5, 6)$

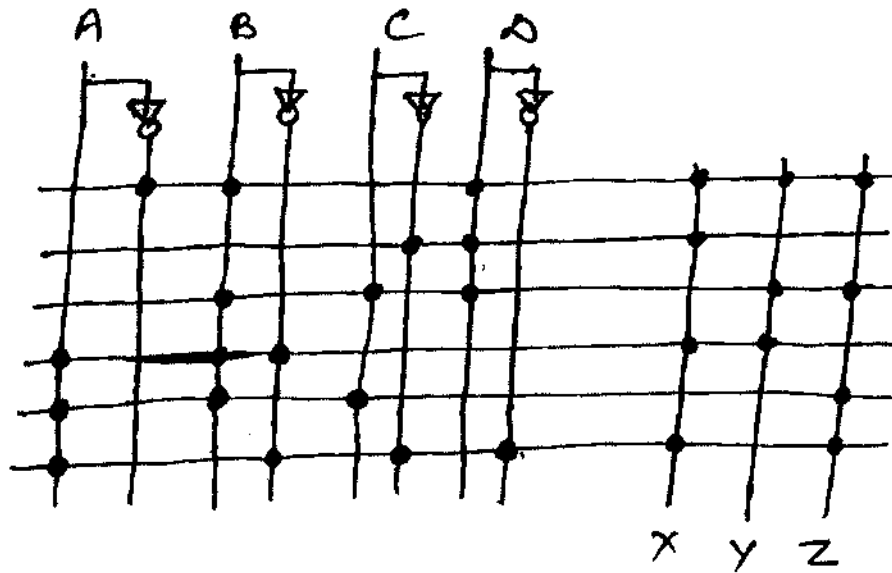$C(x, y, z) = \Sigma m(2, 3, 4)$

$D(x, y, z) = \Sigma m(2, 3, 4, 7)$ 4

(b) Design the memory system for RAM size 128 k X 8 using a RAM of 64 k X 4 6

<div align="center">OR</div>

10. (a) The internal connection diagram for a PLA is given below.

(a) Write the equations realized by the PLA.

(b) Specify the truth table for a ROM which would realize the same function.

(Fig on page no 4)

(b) Write a short note on Flash memories and its type. 4

11. (a) Explain the requirement of a program counter, a stack pointer and status flags in a microprocessor. 6

(b) Compare the action of microprocessor for the following pair of instruction.

(a) LDA C200H and LHLD 2400H.

(b) SUB B and cmp B.

(c) NOP and HLT. 4

OR

12. (a) Write a program to exchange the Data stored at memory locations C501H and C502H. Using indirect addressing mode. 5

(b) What is the difference bet ween INR and INX instructions ? 2

(c) If the 8085 adds 87H and 79H, specify the contents of the accumulator and the status of the s, z and cy flags. 3

Course Code : CST 204

Third Semester B. E. (Computer Science and Engineering) Examination

COMPUTER ARCHITECTURE AND ORGANIZATION

Time : 3 Hours]

[Max. Marks : 60

Instructions to Candidates :—
- (1) All questions carry marks as indicated.
- (2) Due credit will be given to neatness and adequate dimensions.
- (3) Assume suitable data wherever necessary.
- (4) Illustrate your answers wherever necessary with the help of neat sketches.

1. (a) Explain subroutine linkage and parameter passing with suitable example. 5

   (b) With suitable example, explain the need for indirect and index addressing mode. Also list other addressing modes. 5

OR

2. (a) With the help of block diagram, explain how CPU communicates with memory. 3

   (b) State advantages and disadvantages of using Link Register for subroutines. 3

   (c) Write one address instructions, two address instruction format for the following operation.
   $$Z = (A + B) * (C - D) / (E + F)$$
   4

3. (a) What are the limitations of short word length machine ? 4

   (b) Explain how conditional and unconditional branch instructions are executed in computer. 6

OR

4. (a) Giving example of field encoded micro–instruction, explain why grouping of control signal is required. 5

(b) Compare and contrast hardwired and microprogrammed control units. 5

5. (a) Explain the concept of Booth's algorithm and multiply the following using booth's algorithm.

$$-4 * 9$$ 5

(b) Using non–restoring division algorithm, perform division of 11/3. 5

OR

6. (a) Represent $(1.25)_{10}$ and (-11.25) in IEEE single precision and double precision formats. 4

(b) Describe the implementation of 4 bit carry look ahead adder.

Explain how it can be extended to higher number of bits. 6

7. (a) A block set associative cache consists of a total 64 blocks divided into four block sets. The MM contains 4096 block each consisting of 128 words.

(i) How many bits are there in an MM address ?

(ii) How many bits are there in each of the TAG, SET and WORD fields ? 6

(b) What is virtual memory ? Explain virtual to physical address translation in virtual memory. 4

OR

8. Write in brief about the following :—

(i) Set–Associative memory mapping.

(ii) Memory Hierarchy.

(iii) LRU page replacement Algorithm.

(iv) Memory Interleaving. 10

9. (a) Describe various functions performed by Disk controller. Which information must be exchanged between CPU and disk controller for data transfer ? 7

(b) What do you mean by vectored interrupt ? 3

OR

10. What are handshaking signals ? Explain the handshake control of data transfer during input and output operations. What are the sequences of events during an input operation using handshake scheme ?   10

11.   (a)   Write a descriptive note on Array processor.   5

      (b)   State and explain essential characteristics of CISC processors.   5

OR

12. Write short notes on (any **three**) :—

    (i)   RISC processor.

    (ii)   Data dependency in pipeline.

    (iii)   Parallel processing.

    (iv)   Pipeline hazards.   10

Course Code : MAT 202   MARR / RS – 13 / 4581/4607

Third Semester B. E. (Computer Science and Engineering / Information Technology) Examination

ENGINEERING MATHEMATICS – III

Time : 3 Hours]   [Max. Marks : 60

Instructions to Candidates :—
    (1)   All questions carry equal marks.
    (2)   Use of Non programmable calculator is permitted.
         Use of Normal distributiontable is permitted.

1.   (a)   Show that the following system of equation is consistent if a, b, c are in arithmetic progression.

$$3x + 4y + 5z = a$$

$$4x + 5y + 6z = b$$

$$5x + 6y + 7z = c$$

           Find solution when $a = 1$, $b = 2$, $c = 3$ 5

    (b)   State the Cayley Hamilton theorem and use it to evaluate sin A, where

$$A = \begin{bmatrix} 2 & 5 \\ 1 & -2 \end{bmatrix}$$

           5

OR

2.   (a)   Use Sylvester's theorem to show that

$$e^A = e^x \begin{bmatrix} \cosh x & \sinh x \\ \sinh x & \cosh x \end{bmatrix}, \text{ where } A = \begin{bmatrix} x & x \\ x & x \end{bmatrix}$$

           5

    (b)   Find the largest eigen value and corresponding eigen vector of the matrix.

$$\begin{bmatrix} 1 & 3 & -1 \\ 3 & 2 & 4 \\ -1 & 4 & 10 \end{bmatrix}$$

           With initial approximation $[1 \ 1 \ 0]^T$ 5

MARR / RS – 13 / 4581/4607   **Contd.**

3. (a) If $z\{f_n\} = f(z)$ then prove that
$z\{f_{n-k} u_{n-k}\} = z^{-k} f(z)$
Hence find inverse z-transform of $\dfrac{1}{(z-9)^2}$ 5

(b) State convolution theorem on z-transform. Hence find z-transform of $f_n * g_n$, where $*$ denotes convolution operation of the following function.
$f_n = \left(\dfrac{1}{2}\right)^n$, $g_n = \cos\left(\dfrac{n\pi}{2}\right)$, $n \geq 0$.   5

OR

4. (a) Find the inverse z-transform of $\log\left(\dfrac{z}{z+1}\right)$ by power series method.   5

(b) Solve, $y_{n+3} + 6y_{n+2} + 11y_{n+1} + 6y_n = \delta(n)$,
$y(0) = y(1) = y(2) = 0$ 5

5. (a) Obtain a second degree polynomial approximation to $f(x) = (1+x)^{1/2}$,
$x \in [0, 0.1]$
Using Taylor series expansion about $x = 0$
Use the expansion to approximate $f(0.05)$ and find a bound of the truncation error.   5

(b) Find a root of the equation
$x \sin x + \cos x = 0$, by Newton – Raphson method.   5

OR

6. (a) Apply Crout's method to solve the equations.
$2x - 6y + 8z = 24$
$5x + 4y - 3z = 2$ ·
$3x + y + 2z = 16$ 5

(b) Use modified Euler's method to solve the equation.
$\dfrac{dy}{dx} = -xy^2$ for $x = 0.2$. Given $y(0) = 2$ and $h = 0.1$ 5

7. (a) A random variable X has density function

$$f(x) = \frac{c}{x^2 + 1} \ , \quad -\infty < x < \infty$$

Find (i) The constant C

(ii) $P\left(\frac{1}{3} \leqslant x^2 \leqslant 1\right)$

(iii) The distribution function. 5

(b) A fair coin is tossed three times. Let X denotes 0 or 1 according as a head or tail occurs on the first toss and Y denotes the number of heads which occurs.
Determine :—

(i) The marginal probability functions of X and Y.

(ii) The joint distribution of X and Y. 5

OR

8. (a) Two independent random variables X and Y have respective density functions.

$$f(x) = \begin{cases} c_1 \ e^{-2x} \ , & x > 0 \\ 0 \ , & x \leqslant 0 \end{cases} , g(y) = \begin{cases} c_2 y e^{-3y}, & y > 0 \\ 0 \ , & y \leqslant 0 \end{cases}$$

Find :—

(i) C_1 and C_2

(ii) $P(X + Y > 1)$

(iii) $P(1 < x < 2, Y \geqslant 1)$ 5

(b) Let X and Y be continous random variables having joint density function.

$$f(x, y) = \begin{cases} c(x^2 + y^2) \ , & 0 \leqslant x \leqslant 1, \ 0 \leqslant y \leqslant 1 \\ 0 \ , & \text{otherwise} \end{cases}$$

Determine :—

(i) C

(ii) Conditional density functions.

(iii) $P\left(\frac{1}{4} < x < \frac{3}{4} \Big| y \leqslant \frac{1}{2}\right)$ 5

9. (a) If t is any positive real number, show the function defined by

$P(x) = e^{-t}(1-e^{-t})^{x-1}$ can represent a probability function of a random variable assuming the values 1, 2, 3,....
Find the E(x) and Var(x) of the distribution. 5

(b) If X represents the outcome when a fair die is thrown, find the moment generating function of X and hence find first four moments about origin. 5

OR

10. (a) Let X and Y be random variable having joint probability function.

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

Determine :—

(i) C

(ii) Cov (X,Y)

(iii) Conditional expectation of Y given X = 2. 5

(b) Find the coefficient of skewness and Kurtosis for the distribution with density function.

$$f(x) = \begin{cases} \lambda e^{-\lambda x} & , \ x \geq 0 \\ 0 & , \ x < 0 \end{cases}$$ 5

11. (a) Out of 2000 families with 4 children each, how many would you expect to have.

(i) at least 1 boy

(ii) 2 boys

(iii) 1 or 2 girls.

(iv) no girls ? 5

(b) If the diameter of ball bearing are normally distributed with mean 0.6140 inches and standard deviation 0.0025 inches, determine the percentage of

ball bearing with diameters (i) between 0.610 and 0.618 inches inclusive (ii) greater than 0.617 inches. 5

OR

12. (a) A bag contains 1 red and 7 white marbles. A marble is drawn from the bag and its colour is observed. Then the marble is put back into the bag and the contents are thoroughly mixed. Using

   (i) The binomial distribution

   (ii) The Poisson approximation to the binomial distribution, find the probability that in 8 such drawings, a red ball is selected exactly 3 times. 5

   (b) Verify the central limit theorem for a random variable X that is binomially distributed and thereby establish the validity of the normal approximation to the binomial approximation. 5