Course Code : CST 201

CIOU/RS – 16 /3100

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

DATA STRUCTURE AND PROGRAM DESIGN

Time : 3 Hours]

[Max. Marks : 60

Instructions to Candidates :—

(1) All questions carry equal marks.
(2) Assume suitable data wherever necessary.
(3) Illustrate your answers wherever necessary with the help of neat sketches.
(4) Mobile phones are prohibited in examination hall.
(5) **Solve any two subproblems from each questions.**

1. (a) What do you mean by polish notation ? Write an algorithm for converting an infix expression to its equivalent postfix expression. 5

   (b) How will you evaluate the postfix expression ? Write an algorithm. Apply the algorithm to evaluate the following postfix expression.
   5 , 6 , 2 , + , * , 12 , 4 , / , – 5

   (c) What do you mean by abstract data type ? Give an ADT for double ended queue. 5

2. (a) Write an algorithm for inserting a node in circular linked list. Your algorithm must cover all three cases. 5

   (b) Write a function for deleting a node from doubly linked list when
   (a) Very first node is deleted
   (b) Last node is deleted
   (c) Any other node is deleted. 5

   (c) Write an algorithm to find addition of two polynomials represented using linked list. Assume that linked lists are already created. 5

3. (a) Write a recursive algorithm to count the number of nodes having only one child in a binary tree. 5

(b) Write a function for finding balance factor of a node in binary search tree. 5

(c) What do you mean by AVL tree ? Construct AVL tree step by step for the following string : 5

15 , 20 , 24 , 10 , 13 , 7 , 30 , 36 , 25

4. (a) Explain the following terms with proper example in the context of hashing

(1) Hash function

(2) Perfect hash function 5

(3) Minimal perfect hash function.

(b) Demonstrate insertion of the keys 5 , 28 , 19 , 15 , 20 , 33 , 12 , 17 , 10 into a hash table with separate chaining based collision resolution strategy. Let the table have 9 locations and use division hash function. 5

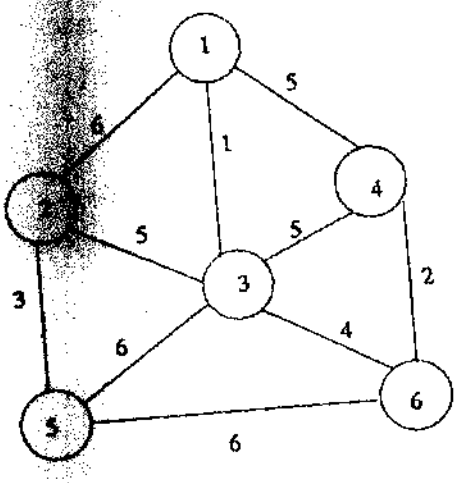
(c) What do you mean by collision resolution techniques ? Explain the followings in brief :

(1) Random Probing

(2) Quadratic Probing 5

(3) Rehashing.

5. (a) What do you mean by minimum cost spanning tree for an undirected graph ? Find minimum cost spanning tree for the following undirected graph using Prim's method.



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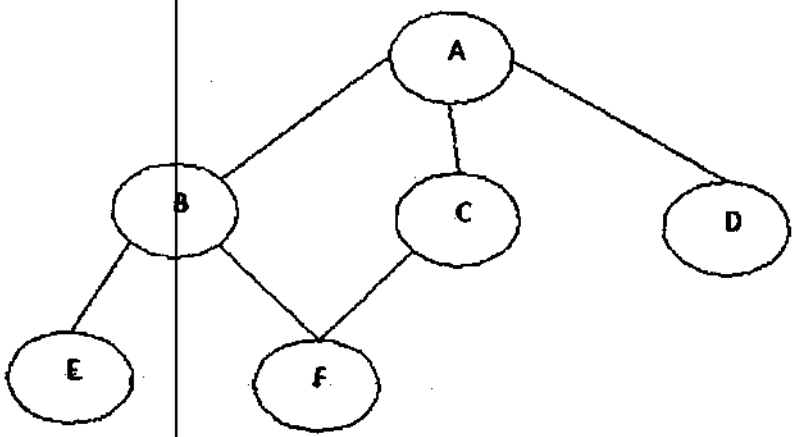
Contd.

(b) Generate breadth first search and depth first search traversal for the following graph. Also compare these two methods for graph traversals.



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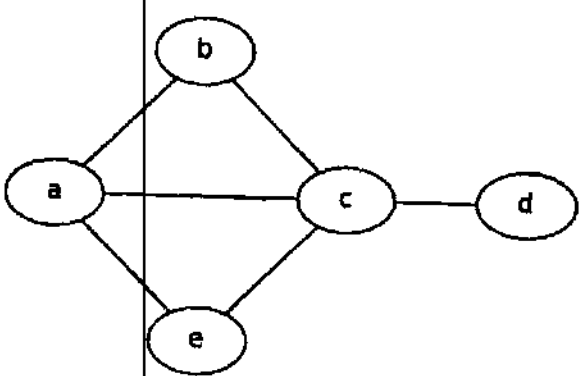
(c) Represent the following undirected graph using

(1) Adjacency matrix

(2) Adjacency list

(3) Adjacency multilist.



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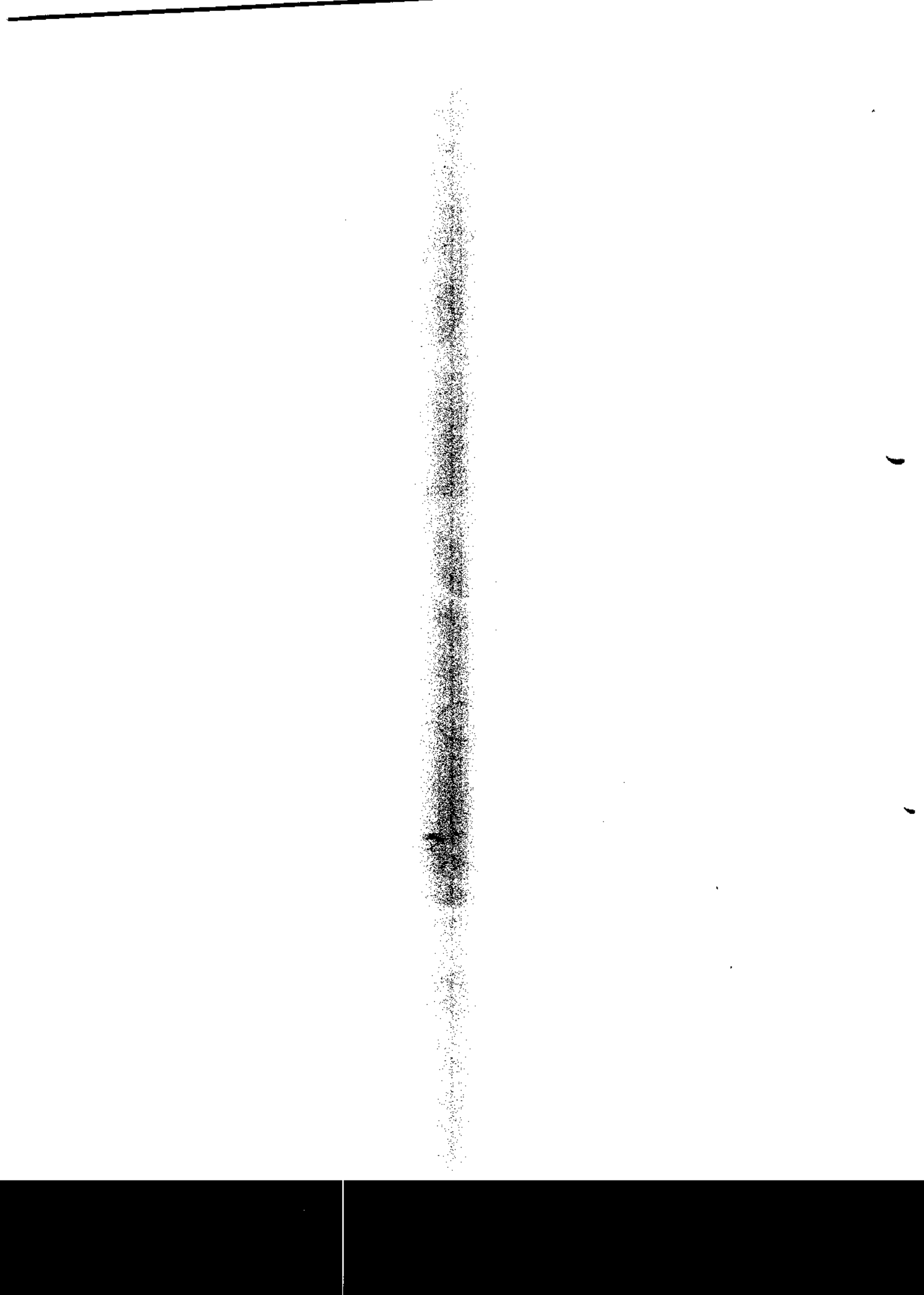
6. (a) Write a function for implementing shell sort. Also explain with proper example. 5

(b) Write an algorithm build heap for constructing min heap. Comment on the time complexity of the algorithm. 5

(c) What are the differences between sorting based on comparisons of keys and sorting based on properties of keys ? Explain with example. 5



Course Code : CST 202

CIOU/RS – 16 / 3101

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

DIGITAL CIRCUIT AND FUNDAMENTAL OF MICROPROCESSOR

Time : 3 Hours]

[Max. Marks : 60

Instructions to Candidates :—

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

1. (a) Write down the result for

(a) $60_D + F1_{16} - 1001001_2$

(b) $FE_{16} - 88_{16}$

6

(b) Simplify the following Boolean expression using K-map
$Y = A + BC' + ABD' + ABCD$

4

OR

(c) The number of 1's in the 1's complement of binary representation of the expression is : $15 \times 256 + 5 \times 16 + 3$

4

2. (a) Design a combinational circuit whose input is a four bit binary number and whose output is negative of the input number in sign magnitude form.

7

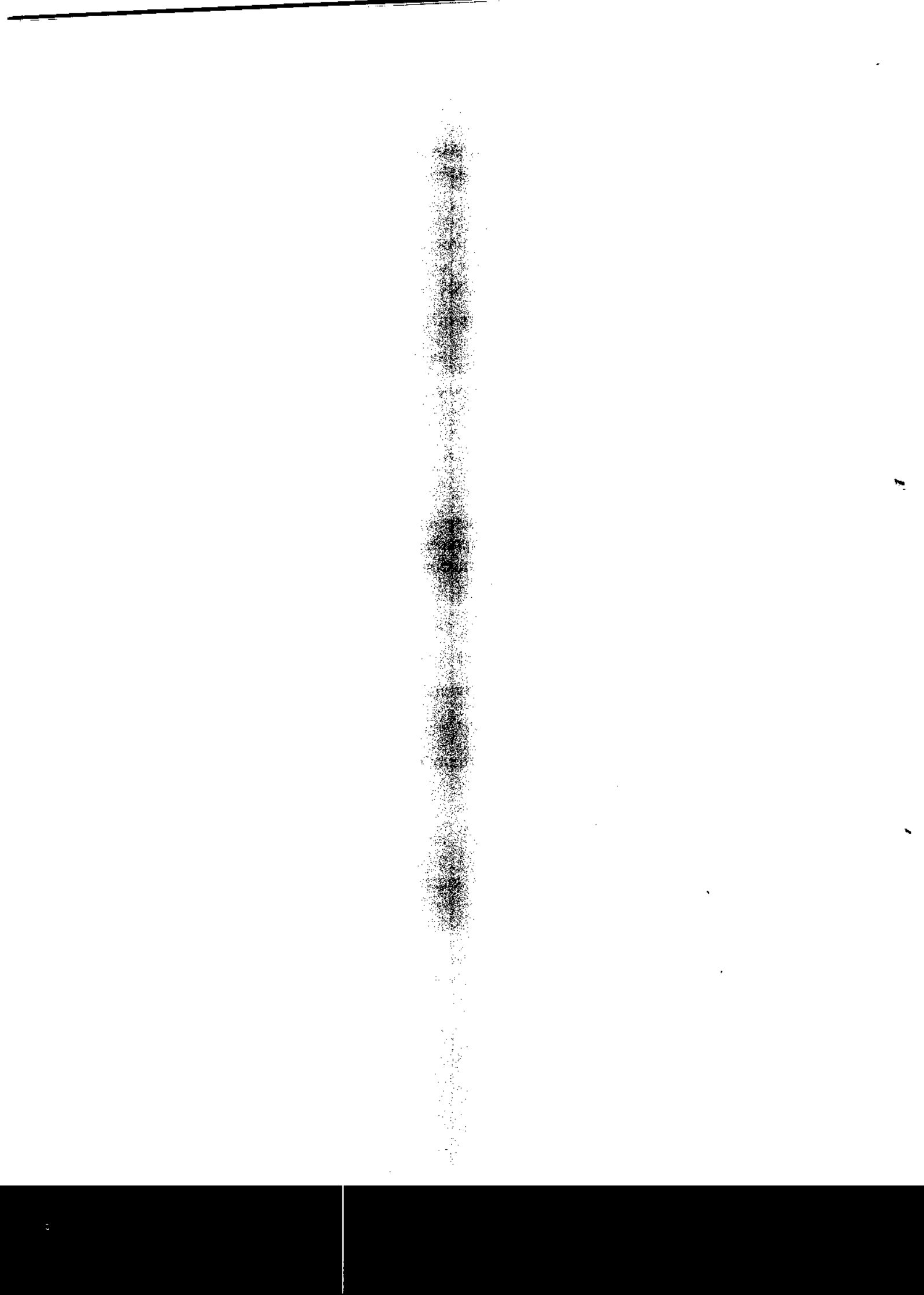
OR

(b) Construct an N to 40 line Decoder with the help of suitable no. of Decoder. Use block diagram for construction.

7

(c) Give the Design of 4 bit binary substractor circuit.

3



Course Code : CST 203 **CIOU/RS – 16 / 3102**

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

BUSINESS DATA PROCESSING

Time : 3 Hours] [Max. Marks : 60

Instructions to Candidates :—

(1) Attempt ALL questions.
(2) The questions carry marks as indicated against them.
(3) Illustrate your answers wherever necessary with the help of neat sketches.
(4) Assume suitable data wherever necessary.
(5) Due credit will be given to neatness and adequate dimensions.
(6) Mobile phones are prohibited in examination hall.

1. Attempt any **two** :—

(a) What are figurative constants ? Describe the figurative constants available in COBOL. Write DATA DIVISION entries and PROCEDURE DIVISION to print aggregate and average marks in one line in addition to input data, when student roll and marks of 3 subjects are entered at the console. (Do not use COMPUTE statement). 2+3

(b) A worker is paid for overtime hours at a rate which is twice the normal rate. The hours worked in excess of 48 hours in a week is considered to be overtime hours. Write a COBOL program to compute the total wages of the worker, when normal rate per hour and the hours worked are entered at the console. The wages must be rounded. It noted that no worker is allowed to work beyond two shifts in a day. 5

(c) For the date of birth (dd–mm–yy) entered at the console, print the lucky number. The lucky number is calculated by adding all digits. If the resultant sum is a two–digit number then adding them into a lucky number. Apply necessary data validation on day and month. 5

2. Attempt any **one** :—

(a) Explain why use of GO TO should be avoided ? Write a menu–driven program to implement a simple calculator which supports arithmetic operations (+, –, *,/ and %). The operands may be fractional numbers. The input is a string of the form <operand–1 operator operand–2>. (Do not use GO TO statement). 2+8

(b) Explain different types of conditions in COBOL with syntax and examples. A table stores academic evaluation details for a class of 25 students. Each row of the table contains–roll number (3 digits) branch (2 characters), and marks scored in 5 subjects. Write a COBOL program to print result record for every student which in addition to input data has a 4–character field to store remark. The remark would be "PASS", if a student scores a minimum of 45 marks in every subject; otherwise "FAIL". 5+5

3. Attempt any **two** :—

(a) What are the principal considerations in selecting a file organization ? Distinguish between a file name and a file–id. 3+2

(b) Describr relative file organization. How is it different from indexed file organization ? 3+2

(c) The distributor has delivered a consignment of 200 kinds of parts to a garage. Write a COBOL program to crete a magnetic tape file, PART–FL interactively. The tape record is composed as–part number, part name, unit price, quantity in stock, supply zone (N, S, E, W). The garage ensures that it always has all parts in adequate numbers (not less than 20). 5

4. Attempt any **one** :—

(a) "An indexed file is actually two files", Justify. An indexed file stores information about students. Each file record contains roll number, name (further split into first name and last name), city of residence, year of birth. Roll number is prime key. A table contains the list of roll number in arbitrary sequence. Write a COBOL program to display the record corresponding to every roll number in the table. 3+7

(b) Write a COBOL program to create a relative file, STUDENT–REL from available magnetic tape file. Each tape record is composed as –roll (4 digit), name (25 characters), gender (1 character), year of study (1 digit) and tuition fee. The relative file record contains all information on tape records except roll. It is known that there are not more than 50 students in the class. Use division–remainder method for randomization. In case of multiple records colliding on a cell, list all such collisions. 10

5. Attempt any **two** :—

(a) A company operates stores its sales data of four zones in individual zone files. It is required to aggregate records on these file into a master sales file. But it should be noted that some invoices does not have number. Write a COBOL program print a report of such invoices. 5

(b) Write note on :—

(i) SORT with OUTPUT PROCEDURE.

(ii) The SEARCH statement. 3+2

(c) Academic information of students exists as a file of records. Each record is composed as–Roll Number (4 digits) Name (organized as Last Name and First Name), Gender, Birth Year (YYYY). Write a COBOL program which will print all records having Last Name as "ALMIGHTY" such that girls appear before boys and that they are listed from youngest to oldest in each category. 5

6. Attempt any **two** :—

(a) Write a COBOL propgram that finds the largest and the smallest element in a list using subroutine, LRGSML. The list consists of 10 integers and is defined using OCCURS clause in the main routine. The subroutine should return the position of the smallest and the largest element in the table. The main routine shall display the result. 5

(b) State the purpose of **NEXT** GROUP clause. Explain different options used with this clause. 5

(c) In our punching keyboard, the numeric characters appear as upper case. The lower case characters corresponding to the digits 0,1,2,3,4,5,6,7,8 and 9 are Q,W,E,R,T,Y,U,I,O and P respectively. Suppose the data in card columns 1 to 10 and 45 to 50 should have contained numeric digits, but out of mistake they have been punched wrongly with corresponding lower case letters. Remaining positions have been punched correctly. Write a COBOL program to create a sequential disk file containing information on these cards. Your program should restore the wrongly punched data. 5

Course Code : CST 204

CIOU/RS – 16/3103

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

COMPUTER ARCHITECTURE AND ORGANIZATION

Time : 3 Hours] [Max. Marks : 60

Instructions to Candidates :—

(1) Due credit will be given to neatness.

(2) Illustrate your answers wherever necessary with neat diagrams.

1. Solve any **two** :—

   (A) Explain indirect, relative, index, auto increment and auto decrement addressing modes with example and neat diagram. 5

   (B) Explain how processor is connected with memory with neat diagram. Also explain the steps how data or instruction is transferred from memory to processor. 5

   (C) (i) Consider a computer that has byte addressable memory organized in 32-bit words according to big-endian scheme. A program read ASCII characters entered at keyboard and stores them in successive bytes, starting at location 1000. Show the contents of memory words at 1000 and 1004 after name "Johnson" has been entered.

   (ii) Write a program to evaluate expression

   A * B + C * (D + E)

   In single accumulator processor. Assume that processor has LOAD, STORE, MULTIPLY and ADD instruction. 2+3

2. Solve any **two** :—

   (A) Explain 3 bus architecture with suitable diagram. 5

   (B) Explain how branch instructions are executed for single bus architecture. Why is WMFC needed ? 5

(C) Write control instructions for executing the instruction : 5

"Add contents of memory location whose address is NUM to R1." Assume single bus, 32 bit instructions.

3. Solve any **two** :—

(A) Explain the concept of carry lookahead adder. What is the maximum gate delay generated by a 4 bit parallel binary adder and how can it be minimized by carry look ahead adder ? 5

(B) Explain restoring division method with suitable example. How can restoring division algorithm improved ? 5

(C) Multiply the following signed 2's compliment numbers using booths algorithm 01010101 and 110000. 5

4. Question **4** is compulsory :—

(A) If a disk spins at 10,000 rpm what is the average rational latency time of a request ? If a given track on the disk has 1024 sectors, what is the transfer time for a sector ? 2

(B) (1) How many 128 x 8 RAM chips are needed to provide a memory capacity of 2048 bytes ?

(2) How many lines of the address bus must be used to access 2048 bytes of memory ? How many of these lines will be common to all chips ?

(3) How many lines must be decoded for chip select ? Specify the size of decoder. 3

(C) Explain with neat diagram how data is stored and retrieved from optical disk. 5

5. Solve any **two** :—

(A) Explain program controlled IO with example.

(B) Explain any two interrupt handling mechanisms.

Cont

(C) How is synchronous data transfer carried out on bus ? Explain with timing diagram. 5

6. Solve any **two** :—

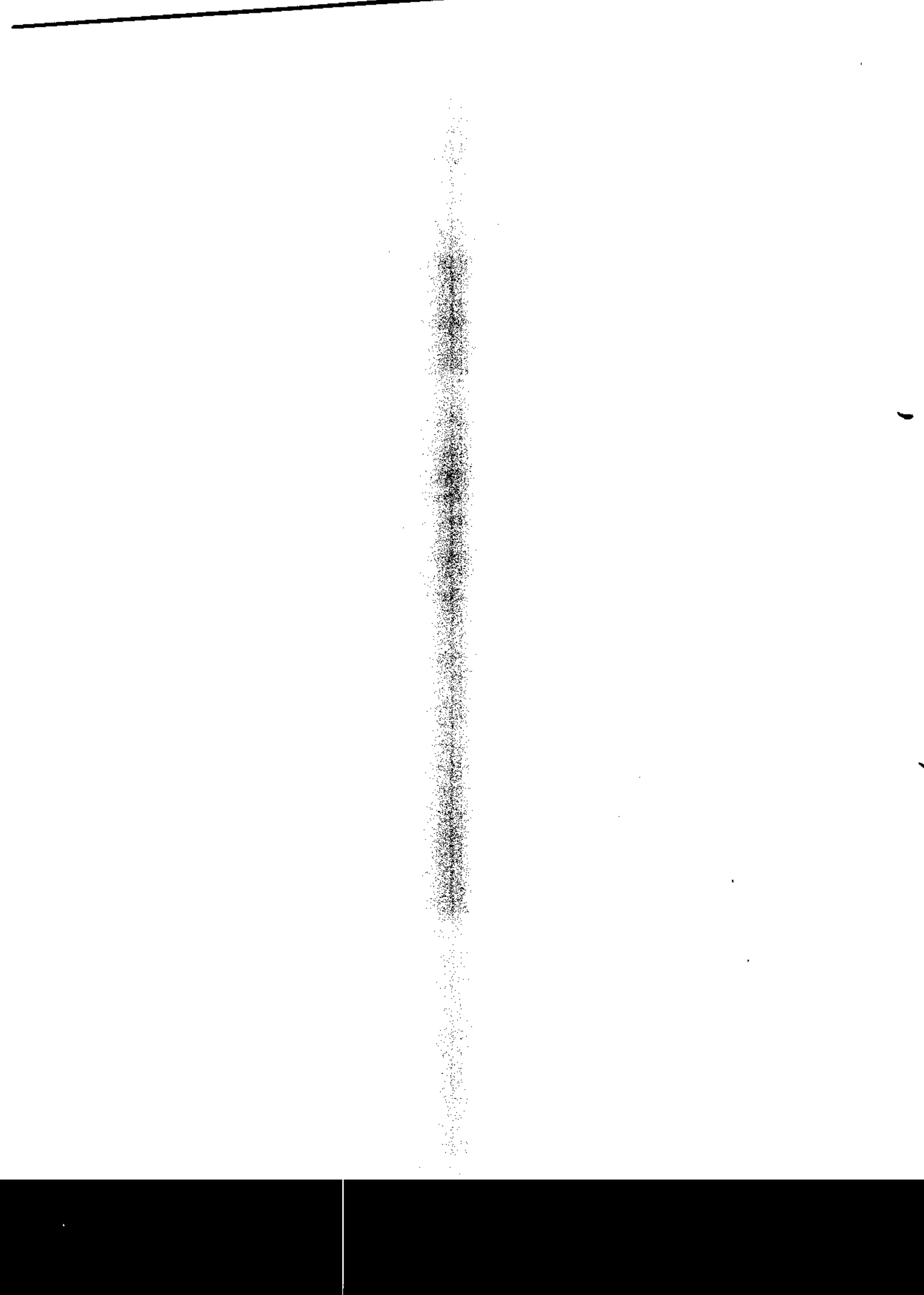
(A) Explain with neat sketch, the utility of memory interleaving. How is it different from cache memory ? 5

(B) Assume 128 K word of main memory, 4 K words of cache and cache block consists of 16 words :

(i) If a cache has a capacity of 16 KB and a line length (block size) of 128 bytes, how many sets does the cache have if it is 2-way or 4-way set associative.

(ii) For a block associative mapping cache with 4 blocks per set, find the main memory address format and show with neat diagram the mapping for main memory and cache. Also give the main memory address format for direct and associative mapping. 5

(C) Explain the concept of pipelining. Also explain how speedup is achieved through pipelining. 5



Course Code : MAT 202

CIOU/RS – 16 / 3104

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 normal distribution table is permitted.
(3) Use of calculator is permitted.

1. Solve any **two** of the following :—

(a) Test the consistency and hence solve the following system of equations $2x - 3y + 7z = 5$

$3x + y - 3z = 13$, $2x + 19y - 47z = 32$ 5

(b) Diaginalize the matrix $A = \begin{bmatrix} 0 & 1 \\ -4 & 0 \end{bmatrix}$. 5

(c) Compute the largest Eigen value and corresponding Eigen vector for the matrix A using iterative method if

$$A = \begin{bmatrix} 3 & 2 & 4 \\ 2 & 0 & 2 \\ 4 & 2 & 3 \end{bmatrix} \text{ given } X_0 = \begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix}$$ 5

2. Solve any **two** of the following :—

(a) Find rate of convergence of method of False position. 5

(b) Using Gauss–Seidal method solve the following system of equations:

$27x + 6y - z = 85$, $6x + 15y + 2z = 72$, $x + y + 54z = 110$. 5

(c) Using Runge–Kutta fourth order method find the values of y when $x = 1{\cdot}2$ and $x = 1.4$ for the differential equation.

$\frac{dy}{dx} = \sqrt{xy} + 2$, with $y(1) = 1$ and $h = 0.2$ 5

3. Solve any **two** of the following :—

(a) Find : 5

(i) $Z\{e^{-3n}\}$ (ii) $Z\{(-3)\}^n\}$

(b) If $Z\{f_n\}=F(z)$ then prove that $Z\{n\ f_n\} = -z\ \frac{d}{dz}\ F(z)$ Hence determine $Z\{n\}$ and $Z\{n^2\}$ 5

(c) Solve : $y_{n+2} - 2\text{Cos}\ \alpha\ y_{n+1} + y_n = 0$; $y_0 = 1$, $y_1 = \text{Cos}\ \alpha$ using Z–transform. 5

4. Solve any **two** of following :—

(a) If the density function for the random variable X is :

$$f(x) = \begin{cases} Cx & ; 0 \leq x \leq 2 \\ 0 & ; \text{otherwise} \end{cases}$$

Find :

(i) Constant c, (ii) $P(x > 1)$,

(iii) The distribution function (iv) $P\left(\frac{1}{2} < x < \frac{3}{2}\right)$ 5

(b) The joint probability function of two discrete random variables X and Y is given by :

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

Find :

(i) Constant c

(ii) $P(x \geq 1,\ Y \leq 2)$

Contd.

(iii) Marginal probability function.

(iv) Also determine whether x and y are independent. 5

(c) If $f(x, y) = \begin{cases} \frac{xy}{36}, & x = 1, 2, 3 \quad y = 1, 2, 3 \\ 0 & \text{Otherwise} \end{cases}$ be the joint density Function of X, Y. Find the conditional density function of :

(i) X given Y (ii) Y given X. 5

5. Solve any **two** of the following :—

(a) Let X be the random variable giving the number of heads in 3 tosses of a fair coin. Find E(x), Variance (x) and σ_x. 5

(b) If x and y be random variable having probability function:

$$f(x) = \begin{cases} e^{-(x+y)} & x \geq 0, \quad y \geq 0 \\ 0 & \text{Otherwise} \end{cases}$$

Find :

(i) Variance (x) (ii) Variance (y).

(iii) σ_{xy}.

(c) Find : 5

(i) The range.

(ii) Semi–interquartile range.

(iii) Mean deviation for

$$f(x) = \begin{cases} 2(1-x) & 0 \leq x \leq 1 \\ 0, & \text{Otherwise} \end{cases}$$

5

6. Solve any **two** of the following :—

(a) Assume that on the average one telephone number out of 15 called between 2 pm and 3 pm on week days is busy. What is the probability

that if 6 randomly selected telephone numbers are called :

(i) Not more than 3 of them will be busy.

(ii) At least 3 of them will be busy. 5

(b) If X be a Poisson variate such that $P(x=2) = 9\ P(x=4)+90\ P(x=6)$

Find :

(i) λ the mean of x.

(ii) The Coefficient of Skewness. 5

(c) The life of army shoes is normally distributed with mean 8 months and standard deviation 2 months. If 5000 pairs are issued, how many pairs would be expected to need replacement after 12 months ? 5