CBCS SCHEME

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BCS/BAD/BAI/BDS301

Third Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
Mathematics – III for Computer Science Stream

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. VTU Mathematics Hand Book is permitted.
3. M : Marks , L: Bloom's level , C: Course outcomes.

Module – 1

Q.1 a. A random variable x has the following prob. density function for various values of x. **(07, L2, CO1)**

x	0	1	2	3	4	5	6	7
P(x)	0	k	2k	2k	3k	k^2	$2k^2$	$7k^2+k$

Find the value of k and evaluate $P(x < 6)$, $P(3 < x \le 6)$ and $(x \ge 6)$.

b. Derive the mean and variance of Poisson distribution. **(06, L2, CO2)**

c. In a certain town the duration of a shower is exponentially distributed with mean 5 minutes. What is the probability that a shower will last for? (i) less than 10 minutes (ii) more than 10 minutes and (iii) between 10 and 12 minutes. **(07, L3, CO2)**

OR

Q.2 a. The probability density function of **(07, L3, CO1)**

$$f(x) = \begin{cases} Kx^2, & -3 < x < 3 \\ 0, & \text{elsewhere} \end{cases}$$

Find the value of K and evaluate (i) $P(x < 2)$, $P(x > 1)$ (ii) $P(1 \le x \le 2)$

b. When a coin is tossed 4 times, find the probability of getting (i) exactly one head (ii) atleast three heads and (iii) less than two heads. **(06, L2, CO2)**

c. The marks of 1000 students in an examination follows a normal distribution with mean 70 and S.D 5. Find the number of students whose marks will be (i) less than 65 (ii) more than 75 and (iii) between 65 and 75. **(07, L2, CO2)**

Module – 2

Q.3 a. If the joint probability distribution of x and y is given by **(07, L2, CO2)**

$$f(x, y) = \frac{1}{30}(x+y), \text{ for } x = 0, 1, 2, 3 \ \& \ y = 0, 1, 2$$

Find (i) $P(x \le 2, y = 1)$ (ii) $P(x > y)$

b. Find the unique fixed probability vector of **(06, L2, CO3)**

$$P = \begin{bmatrix} 0 & 1 & 0 \\ 1/6 & 1/2 & 1/3 \\ 0 & 2/3 & 1/3 \end{bmatrix}$$

c. Three boys A, B and C are throwing a ball to each other. A always throw the ball to B. B always throw the ball to A and C is just as likely to throw the ball to A as to B. Find the probability that C has the ball after three throws, if C starts the game. **(07, L3, CO3)**

OR

Q.4 **a.** The joint prob. distribution for the following data, find E(x) and E(y). — **07** | **L2** | **CO2**

X \ Y	-2	-1	4	5
1	0.1	0.2	0.0	0.3
2	0.2	0.1	0.1	0

b. Show that the matrix $P = \begin{bmatrix} 0 & 0 & 1 \\ 1/2 & 0 & 1/2 \\ 0 & 1 & 0 \end{bmatrix}$ is a regular stochastic matrix. — **06** | **L2** | **CO3**

c. A gambler's luck follows pattern. If he wins a game the prob. of winning the next game is 0.6. However, if he loses a game, the prob. of losing the next game is 0.7. There is an even chance of the gambler winning the first game. What is the prob. of he winning the second game. — **07** | **L3** | **CO3**

Module – 3

Q.5 **a.** Define (i) Null hypothesis (ii) A statistic (iii) Standard error (iv) Level of significance (v) Test of significance. — **07** | **L1** | **CO4**

b. A coin was tossed 400 times and head turned up 216 times. Test the hypothesis that the coin is unbiased at 5% LOS. — **06** | **L3** | **CO4**

c. In a city A 20% of a random sample of 900 school boys had a certain slight physical defect. In another city B, 18.5% of a random sample of 1600 school boys had the same defect. Is the difference between the proportions significant at 5% significance level? — **07** | **L3** | **CO5**

OR

Q.6 **a.** Explain the following terms: — **07** | **L1** | **CO4**

(i) Type-I and Type-II errors
(ii) Statistical hypothesis
(iii) Critical region
(iv) Alternate hypothesis

b. The average marks in Engg. Maths of a sample of 100 students was 51 with S.D 6 marks. Could this have been a random sample from a population with average marks 50? — **06** | **L2** | **CO5**

c. One type of aircraft is found to develop engine trouble in 5 flights out of a total of 100 and another type in 7 flights out of a total of 200 flights. Is there a significance difference in the two types of aircrafts so far as engine defects are concerned? Test at 0.05 significance level. — **07** | **L3** | **CO4**

Module – 4

Q.7 **a.** State central limit theorem. Use the theorem to evaluate $P(50 < x < 56)$ where $\bar{x}$ represents the mean of a random sample of size 100 from an infinite population with mean $\mu = 53$ and variance $\sigma^2 = 400$. — **07** | **L2** | **CO4**

b. Suppose that 10, 12, 16, 19 is a sample taken from a normal population with variance 6.25. Find 95% confidence interval for the population mean. Given that Z(0.15) = 0.0596. — **06** | **L2** | **CO5**

c. Fit a Poisson distribution to the following data and test for goodness of fit at 5% LOS. — **07** | **L3** | **CO5**

x	0	1	2	3	4
f	419	352	154	56	19

OR

Q.8	a.	Height of a random sample of 50 college student showed a mean of 174.5 cms and a S.D 6.9 cms. Construct 99% confidence limits for the mean height of all college students.	07	L2	CO4
	b.	A random sample of 10 boys had the following I.Q : 70, 120, 110, 101, 88, 83, 95, 98, 107, 100. DO these data support the assumption of a population mean I.Q of 100 (at 5% LOS)?	06	L3	CO5
	c.	The theory predicts the propositions of beans in the four groups, G_1, G_2, G_3, G_4 should be in the ratio 9 : 3 : 3 : 1. In experiment with 1600 beans the numbers in the groups were 882, 313, 287 and 118. Does the experimental support the theory.	07	L3	CO5

Module – 5

Q.9	a.	The varieties of wheat A, B, C were shown in four plots each and the following yields in quintals per acre were obtained. A 8 4 6 7 B 7 6 5 3 C 2 5 4 4 Test the significance of difference between the yields of varieties, given that 5% tabulated value of F = 4.26 with (2, 9) d.f. Set up one-way ANOVA and using direct method.	10	L3	CO6
	b.	Present your conclusion after doing ANOVA to the following results of the Latin-square design conducted in respect of five fertilizers which were used on plots of different fertility. A(16) B(10) C(11) D(9) E(9) E(10) C(9) A(14) B(12) D(11) B(15) D(8) E(8) C(10) A(18) D(12) E(6) B(13) A(13) C(12) C(13) A(11) D(10) E(7) B(14)	10	L3	CO6

OR

Q.10	a.	Set up two-way ANOVA table for the data given below, using coding method subtracting 40 from the given numbers. Pieces of land | Treatment A B C D P 45 40 38 37 Q 43 41 45 38 R 39 39 41 41	10	L3	CO6
	b.	There are three main brands of a certain power. A set of its 120 sales is examined and found to be allocated among four groups (A, B, C, D) and brands (I, II, III) as follows: Brands | Groups A B C D I 0 4 8 15 II 5 8 13 6 III 18 19 11 13 Is there any significant difference in brands preference? Answer at 5% level, using one-way ANOVA. Take 10 as the code value to subtract it from all given values.	10	L3	CO6

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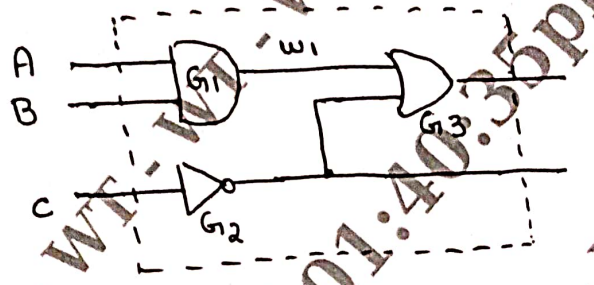
BCS302

Third Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
Digital Design and Computer Organization

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

			M	L	C
		Module – 1			
Q.1	a.	Determine the complement of the following function: (i) F = xy′+ x′y (ii) F = x′yz′ + x′y′z	06	L3	CO1
	b.	Describe map method for three variables.	04	L2	CO1
	c.	Apply K map technique to simplify the following function: (i) F(x, y, z) = Σ(0, 2, 4, 5, 6) (ii) F(x, y, z) = x′y + yz′ + y′z′	10	L3	CO1
		OR			
Q.2	a.	Apply K map technique to simplify the function : F(w, x, y, z) = Σ(1, 3, 7, 11, 15) and d(w, x, y, z) = Σ(0, 2, 5)	06	L3	CO1
	b.	Determine all the prime implicants for the Boolean function F and also determine which are essential F(w, x, y, z) = Σ(0, 2, 4, 5, 6, 7, 8, 10, 13, 15)	10	L3	CO1
	c.	Develop a verilog gate-level description of the circuit shown in Fig.Q2(c).  Fig.Q2(c)	04	L3	CO1
		Module – 2			
Q.3	a.	Explain the combinational circuit design procedure with code conversion example.	10	L2	CO2
	b.	Design a full adder circuit. Also develop data flow verilog model for full adder.	10	L3	CO2
		OR			
Q.4	a.	Describe 4 × 1 MUX with block diagram and truth table. Also develop a behavioral model verilog code for 4 × 1 MUX.	10	L2	CO2
	b.	What are storage elements? Explain the working of SR and D latch along with logic diagram and function table.	10	L2	CO2
		Module – 3			
Q.5	a.	Explain the basic operational concepts between the processor and memory.	10	L2	CO3
	b.	Describe the following: (i) Processor clock (ii) Basic performance equation (iii) Clock rate (iv) SPEC rating	10	L2	CO3
		OR			
Q.6	a.	Define addressing mode. Explain any four types of addressing mode with example.	10	L2	CO3

	b.	Mention four types of operations to be performed by instructions in a computer. Explain the basic types of instruction formats to carry out. $C \leftarrow [A] + [B]$	10	L2	CO3
		Module – 4			
Q.7	a.	With a neat diagram, explain the concept of accessing I/O devices.	10	L2	CO4
	b.	What is bus arbitration? Explain centralized and distributed arbitration method with a neat diagram.	10	L2	CO4
		OR			
Q.8	a.	With neat sketches, explain various methods for handling multiple interrupts requests raised by multiple devices.	10	L2	CO4
	b.	What is cache memory? Explain any two mapping function of cache memory.	10	L2	CO4
		Module – 5			
Q.9	a.	Draw the single bus architecture and write the control sequence for execution of instruction ADD (R_3), R_1.	10	L3	CO5
	b.	With suitable diagram, explain the concept of register transfer and fetching of word from memory.	10	L2	CO5
		OR			
Q.10	a.	With a neat diagram, explain the flow of 4-stage pipeline operation.	10	L2	CO5
	b.	Explain the role of cache memory and pipeline performance.	10	L2	CO5

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Third Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025

Operating Systems

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	Define Operating System. Explain dual mode of operating systems with a neat diagram.	06	L1 L2	CO1
	b.	Distinguish between the following terms: i) Multiprogramming and Multitasking ii) Multiprocessor and Clustered system	06	L2	CO1
	c.	Explain with a neat diagram VM-WARE Architecture.	08	L1 L2	CO1
		OR			
Q.2	a.	List and explain the services provided by OS for the user and efficient operation of system.	06	L2	CO1
	b.	Explain the different computing equipments.	06	L2	CO1
	c.	What are systems calls? List and explain the different types of systems calls.	08	L1 L2	CO1
		Module – 2			
Q.3	a.	What is process? Explain process state diagram and process control block with a neat diagram.	10	L1 L2	CO2
	b.	What is interprocess communication? Explain direct and indirect communication with respect to message passing system.	10	L1 L2	CO2
		OR			
Q.4	a.	List and explain the different types of multithreading models.	06	L1 L2	CO2
	b.	Calculate the average waiting time and average turnaround time by drawing the Gantt-chart using FCFS, SJF, RR (Q = 4ms) and priority scheduling (Higher Number is having highest priority). Process / B.T.(ms) / Priority: P_1 — 24 — 1 P_2 — 03 — 2 P_3 — 03 — 3	14	L3	CO2
		Module – 3			
Q.5	a.	What is critical section? Give the Peterson's solution to 2 processes critical section problem.	05	L1 L2	CO3
	b.	Explain Reader's and Writer's problem in detail.	07	L2	CO3
	c.	What is semaphore? Discuss the solution to the classical dinning philosopher problem.	08	L1 L2	CO3

OR

Q.6	a.	What is a Deadlock? What are the necessary conditions for the deadlock to occur?	06	L1 L2	CO3
	b.	Consider the following snap shot of the system. Process | Allocation (A B C) | Max (A B C) | Available (A B C) P_0 0 1 0 | 7 5 3 | 3 3 2 P_1 2 0 0 | 3 2 2 P_2 3 0 2 | 9 0 2 P_3 2 1 1 | 2 2 2 P_4 0 0 2 | 4 3 3 Answer the following questions: i) What is the content of the matrix need? ii) Is the system on a safe state? If so, find safe sequence. iii) If P_1 requirements for (1, 0, 2) additional resources can P_1 be granted.	14	L3	CO2

Module – 4

Q.7	a.	What is paging? Explain with a neat diagram paging hardware with TLB.	10	L1 L2	CO4
	b.	Explain the different strategies used to select a free hole from available holes.	05	L1	CO4
	c.	What is Fragmentation? List and explain its types.	05	L2	CO4

OR

Q.8	a.	What is page fault? With a neat diagram explain steps in handling page fault.	08	L2	CO4
	b.	Consider the page reference string for a memory with 3 frames determine the number of page faults using FIFO, optimal and LRU replacement algorithms. Which algorithms is more efficient? 7 0 1 2 0 3 0 4 2 3 0 3 2 1 2 0 1 7 0 1	12	L3	CO4

Module – 5

Q.9	a.	Define File. List and explain different file operations and file attributes.	10	L1	CO5
	b.	Explain the different file allocation methods.	10	L2	CO5

OR

Q.10	a.	What is Access Matrix? Explain the implementation of Access Matrix.	10	L2	CO5
	b.	A drive has 5000 cylinders numbered 0 to 4999. The drive is currently servicing at a request 143 and previously served a request at 125. The queue of pending request in FIFO order. 86, 1470, 913, 1774, 948, 1509, 1022, 1750, 130 starting from current head position. What is the total distance travelled (in cylinders) by a disk arm to satisfy the request using FCFS, SSTF, SCAN, LOOK and C-Look algorithm	10	L3	CO5

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BCS304

Third Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
Data Structures and Applications

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	Define Data Structures. Explain the classification of data structures with a neat diagram.	8	L2	CO1
	b.	Write a C Functions to implement pop , push and display operations for stacks using assays.	7	L2	CO2
	c.	Differentiate structures and unions.	5	L2	CO1
		OR			
Q.2	a.	Write an algorithm to evaluate a postfix expression and apply the same for the given postfix expression. 6 2 / 3 – 4 2 * +.	7	L3	CO2
	b.	Explain the dynamic memory allocation function in detail.	8	L2	CO1
	c.	What is Sparse matrix? Give the triplet form of a given matrix and find its transpose $A = \begin{bmatrix} 0 & 0 & 3 & 0 & 4 \\ 0 & 0 & 5 & 7 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 2 & 6 & 0 & 0 \end{bmatrix}$	5	L3	CO1
		Module – 2			
Q.3	a.	Define Queue. Discuss how to represent a queue using dynamic assays.	8	L2	CO2
	b.	Write a C Function to implement insertion ( ) , deletion ( ) and display ( ) operations on circular queue.	6	L3	CO2
	c.	Write a note on Multiple stacks and queues with suitable diagram.	6	L2	CO2
		OR			
Q.4	a.	What is a linked list? Explain the different types of linked list with neat diagram.	6	L2	CO3
	b.	Write a C function for the following on singly linked list with example : i) Insert a node of the beginning ii) Delete a node at the front iii) Display.	8	L3	CO3
	c.	Write the C function to add two polynomials.	6	L2	CO3

		Module – 3			
Q.5	a.	Discuss how binary trees are represented using : i) Assay ii) Linked list.	6	L2	CO4
	b.	Define Threaded binary tree. Discuss In – threaded binary tree.	6	L2	CO4
	c.	Write the C function for the following additional list operation : i) Inverting Singly linked list ii) Concatenating Singly linked list.	8	L3	CO3
		OR			
Q.6	a.	Discuss Inorder , Preorder , Postorder and Level order traversal with suitable function for each.	8	L3	CO4
	b.	Define the threaded binary tree. Construct threaded binary tree for the following element : A, B, C, D, E, F, G, H, I.	6	L2	CO4
	c.	Write a C function for the following : i) Insert a node at the beginning of doubly linked list. ii) Deleting a node at the end of the doubly linked list.	6	L3	CO3
		Module – 4			
Q.7	a.	Define Forest . Transform the forest into a binary tree and traverse using inorder , preorder and postorder traversal with an example.	8	L1	CO5
	b.	Define Binary search tree. Construct a binary search tree for the following elements : 100 , 85 , 45 , 55 , 120 , 20 , 70 , 90 , 115 , 65 , 130 , 145.	6	L2	CO5
	c.	Discuss Selection tree with an example.	6	L2	CO5
		OR			
Q.8	a.	Define Graph. Explain adjacency matrix and adjacency list representation with an example.	8	L2	CO5
	b.	Define the following terminology with example : i) Digraph ii) Weighted graph iii) Self loop iv) Connected graph.	6	L2	CO5
	c.	Briefly explain about Elementary graph operations.	6	L3	CO5
		Module – 5			
Q.9	a.	Explain in detail about Static and Dynamic Hashing.	6	L2	CO5
	b.	What is Collision? What are the methods to resolve collision?	7	L2	CO5
	c.	Explain Priority queue with the help of an examples.	7	L2	CO5
		OR			
Q.10	a.	Define Hashing. Explain different hashing functions with suitable examples.	12	L2	CO5
	b.	Write short note on : i) Leftist trees ii) Optimal binary search tree.	8	L3	CO5

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BCS306A

Third Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
Object Oriented Programming with JAVA

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	List and explain any three features of object oriented programming.	6	L1	CO1
	b.	What do you mean by type conversion and type casting? Give examples.	8	L2	CO1
	c.	How to declare and initialize 1-D and 2-D arrays in Java. Give examples.	6	L2	CO1
		OR			
Q.2	a.	List the short circuit operators and show the concept using few examples.	4	L2	CO1
	b.	With a java program, illustrate the use of ternary operator to find the greatest of three numbers.	6	L3	CO1
	c.	Develop a Java program to demonstrate the working of for each version of for loop. Initialize the 2D array with values and print them using for each.	10	L2	CO1
		Module – 2			
Q.3	a.	Develop a program in Java to implement a stack of integers.	12	L3	CO2
	b.	What are constructors? Give the types and explain the properties of constructors. Support with appropriate examples.	8	L2	CO2
		OR			
Q.4	a.	Illustrate with an example program to pass objects as arguments.	10	L2	CO2
	b.	Explain different access specifies in Java with example program.	10	L2	CO2
		Module – 3			
Q.5	a.	Define inheritance. List and explain different types of inheritance in Java with code snippets.	10	L2	CO3
	b.	Compare and contrast between overloading and overriding in Java with example program for each.	10	L2	CO3
		OR			
Q.6	a.	Analyze an interface in Java and list out the speed of an interface. Illustrate with the help of a program the importance of an interface.	10	L2	CO3
	b.	List the different uses of final and demonstrate each with the of code snippets.	10	L2	CO3

		Module – 4			
Q.7	**a.**	Define a package. Explain how to create user defined package with example.	7	L2	CO4
	b.	Discuss about exception handling in Java. Give the framework of the exception handling block. List the types of exception.	8	L2	CO4
	c.	Develop a Java program to raise a custom exception for division by zero using try, catch, throw and finally.	5	L3	CO4
		OR			
Q.8	**a.**	Compare throw and throws keyword by providing suitable example program.	10	L2	CO4
	b.	Explain about the need for finally block.	5	L2	CO4
	c.	Discuss about chained exceptions.	5	L2	CO4
		Module – 5			
Q.9	**a.**	Define thread. Demonstrate creation of multiple threads with a program.	10	L2	CO5
	b.	Explain the two ways in which Java threads can be instantiated. Support your explanation with a sample program.	10	L2	CO5
		OR			
Q.10	**a.**	What is enumeration? Explain the methods values( ) and valueof( ).	10	L2	CO5
	b.	Explain about type wrappers and auto boxing.	10	L2	CO5

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