



**NAVRACHANA
UNIVERSITY**

a UGC recognized University

School: School of Engineering and Technology
Program/s: B. Tech - Computer Science and Engineering
 Department
Year: 3rd **Semester:** 5th
Examination: End Semester Examination
Examination year: December - 2021

Course Code: CS312 **Course Name:** Design and Analysis of Algorithms
Date: 06/12/2021
Time: 11:30 am to 01:30 pm

Total Marks: 40
Total Pages: 02

Instructions:

- Write each answer on a new page.
- Use of a calculator is permitted/not permitted.
- * COs=Course Outcome mapping. # BTL=Bloom's Taxonomy Level mapping

Q. No.	Details	Marks	COs*	BTL#
Q.1	Attempt any five. Each question carries 5 marks. [05 * 05 = 25 marks].	25		
Q.1 A	Fermat primality test is applied on number 11 with 3 randomly chosen values 3,4, and 6. Test the number 11 for primality and comment on the probability of correctness.		CO2, CO3,	BT3, BT4
Q.1 B	Discuss and compare the time complexity of 'closest pair problem' using randomized algorithm and matrix approach with suitable example.		CO2, CO3	BT4, BT5
Q.1 C	Create the binary max heap for the elements 12, 9, 14, 16, 8, 20, and 5. These elements are received in the same order. Draw the creation of heap by adding one element at a time and find the number of swaps required to create this heap.		CO4	BT3, BT4
Q.1 D	The binary heap is created following certain properties. List and discuss these properties with suitable example.		CO3 CO5	BT2, BT3 BT4
Q.1 E	Derive the relationship for the time complexity of bubble sort technique.		CO3	BT3
Q.1 F	Solve the following recurrence relation and find the time complexity equation in terms of 'n'. $F_n = 5.F_{n-1} - 6.F_{n-2}$, $F_0 = 1$ and $F_1 = 4$		CO4 CO5	BT4, BT5,
Q.1 G	(a) Write a short note on 3 notations used to describe the time complexity of algorithms. (03 Marks) (b) Arrange the following in ascending order of time complexity. (02 marks) Constant, Log-linear, Logarithmic, Polynomial, Linear, Quadratic, Factorial, and Exponential		CO3, CO4	BT2, BT3
Q.2	Attempt any five. Each question carries 1 mark. [05 * 01 = 05 marks].	05		
Q.2 A	The order of recurrence relation for Fibonacci series is ____ .		CO3	BT3
Q.2 B	Probability of correctness in Fermat primality test will be ____ for the value of 'k' is 4.		CO4	BT4, BT5
Q.2 C	The worst case time complexity of the selection sort is ____ .		CO4	BT4
Q.2 D	The time complexity to solve the "closest pair problem" using 2 dimensional matrix method is ____.		CO1, CO2	BT2,
Q.2 E	The best case time complexity of binary search is ____.		CO3	BT3
Q.2 F	____ notation is used to express lower bound on complexity of algorithm.		CO1	BT1

Q. 3	Attempt any ten. Each question carries 1 mark. [10 * 01 = 10 marks].	10		
Q.3 A	After examination it is expected to find first 3 top scorers from the class of 100 students. The scores of examination are ordered in terms of student_IDs and not scores. Which of the following sorting techniques will be more efficient in this case? (a) Merge Sort (b) Bubble sort (c) Heap sort (d) Quick sort		C05	BT6,
Q.3 B	Which of the following recurrence relations will have highest order? (a) $F_n = F_{n-1} + F_{n-2}$, with $F_0=0$ and $F_1=1$ (b) $F_n = F_{n-1} + F_{n-2} - F_{n-3}$ with $F_0=1, F_1=3$ and $F_2=4$ (c) $F_n = F_{n-1} + 2.F_{n-2} + 4.F_{n-3}$ with $F_0=5, F_1=3$ and $F_2=8$ (d) $F_n = F_{n-1} + 3.F_{n-2} - 3.F_{n-3} + 2.F_{n-4}$ with $F_0=1, F_1=3, F_2=6$ and $F_3=8$		C04	BT4
Q.3 C	Which one of the following represents exact (tight) bound? (a) Big-Oh (O) (b) Big Omega (Ω) (c) Big Theta (Θ) (d) Big Gamma (Υ)		C01	BT1
Q.3 D	Which one of the following is a binary max-heap if max-heap is implemented using an array? (a) 30, 17, 21, 18, 15, 13, 19 (b) 30, 17, 21, 18, 15, 13, 19 (c) 30, 19, 21, 18, 15, 13, 17 (d) 30, 19, 17, 18, 15, 13, 21		C02 C03	BT2, BT3
Q.3 E	For the recurrence relation given below, $F_n = 5.F_{n-1} - 6.F_{n-2}$, with $F_0=8$ and $F_1=6$, the characteristic equation is ____. (a) $x^2 + 5x - 6 = 0$ (b) $x^2 + 5x + 6 = 0$ (c) $x^2 - 5x + 6 = 0$ (d) $x^2 - 5x - 6 = 0$		C03	BT2
Q.3 F	The formula to calculate the probability of correctness in Fermat Primality test is ____. (a) $1-(2^k)$ (b) $1-(2^{-k})$ (c) $1-(K^{-2})$ (d) $1-(K^2)$		C03	BT1
Q.3 G	Time complexity of recursive implantation of Merge sort is ____ . (a) Logarithmic (b) Exponential (c) Polynomial (d) Linear Logarithmic		C03, C04	BT3, BT4
Q.3 H	The efficient algorithm is designed to merge two sorted lists of size m and n into a single sorted list of size m+n. This efficient algorithm will make ____ number of comparisons in worst case. (a) $O(m)$ (b) $O(n)$ (c) $O(m+n)$ (d) $O(\log m + \log n)$		C04, C05	BT5, BT6
Q.3 I	Which of the following statement is false about randomized algorithms? (a) Randomized algorithms are time efficient		C04	BT3,

	(b) Randomized algorithms produce output accurately (c) Randomized algorithms produce output inaccurately (d) Randomized algorithms are of two types - optimization and decision			
Q.3 J	Which of the following statements is true for optimization problems? (a) Average case time-complexity is more important than the worst case time-complexity (b) Worst case time-complexity is more important than the average case time-complexity (c) Time analysis is not important (d) Best case time complexity is important		C03, C04	BT4
Q.3 K	The order 'k' of the recurrence relation can be decided depending upon ____. (a) Number of past output terms in relation (b) Number of 'k' values given for initial 'k' terms of relation (c) Either (a) or (b) (d) Neither (a) nor (b)	05	CO2, CO3	BT1, BT2

*****End of Question Paper*****