



### Sample Question Format

**KIIT Deemed to be University**  
**Online Mid Semester Examination(Autumn Semester-2020)**

**Subject Name & Code:**

**Applicable to Courses:**

**Design & Analysis of Algorithms (DAA)**  
**(CS-2012)**

**Full Marks=20**

**Time:1 Hour**

**SECTION-A(Answer All Questions. All questions carry 2 Marks)**

**Time:20 Minutes**

**(5×2=10 Marks)**

<b><u>Question No</u></b>	<b><u>Question Type (MCQ/ SAT)</u></b>	<b><u>Question</u></b>	<b><u>Answer Key (if MCQ)</u></b>	<b><u>CO Mapping</u></b>
<b><u>Q.No:1(a)</u></b>	<b><u>SAT</u></b>	Rank the following functions by order of growth in increasing sequence? $\log \sqrt{n}$ , $\sqrt{n}$ , $2^{2^n}$ , $\sqrt{n} \log n$		1
	<b><u>SAT</u></b>	Rank the following functions by order of growth in increasing sequence? $\log \sqrt{n}$ , $n$ , $2^{n^2}$ , $n^2 \log n$		1
	<b><u>SAT</u></b>	Rank the following functions by order of growth in increasing sequence? $n^2$ , $n^{2^n}$ , $n \log n$ , 500		1
	<b><u>SAT</u></b>	Rank the following functions by order of growth in increasing sequence? $n^{2^n}$ , $n \log \sqrt{n}$ , $n^3$ , $\sqrt{n}$		1
<b><u>Q.No:1(b)</u></b>	<b><u>SAT</u></b>	What is time complexity of the following function fun1()? int fun1(int n) { int i, j, s=0; for (i = n; i >= n; i /= 2) for (j = 0; j < i; j++) s += 1; return s; }		3
	<b><u>SAT</u></b>	What is time complexity of the following function fun2()? int fun2(int n) { int i, j, s=0; for (j = 0; j < n; j++) for (i = n; i >= n; i /= 2) s += 1; }		3

		<pre> return s; } </pre>		
	<b><u>SAT</u></b>	<p>What is time complexity of the following function fun3()?</p> <pre> int fun3(int n) {     int i, j, s=0;     for (i = 1; i &lt;= n; i++)         for (j = 1; j &lt;= i; j++)             s += 1;     return s; } </pre>		3
	<b><u>SAT</u></b>	<p>What is time complexity of the following function fun4()?</p> <pre> int fun4(int n) {     int i, j, s=0;     for (i = n; i &lt;= n; i++)         for (j = 1; j &lt;= i; j++)             s += 1;     return s; } </pre>		3
<b><u>Q.No:1(c)</u></b>	<b><u>SAT</u></b>	What is the running time of QUICKSORT when all elements of array A have the same value?		4
	<b><u>SAT</u></b>	What is the running time of INSERTION SORT when all elements of array A have the same value?		4
	<b><u>SAT</u></b>	What is the running time of merge sort when all elements of array A have the same value?		4
	<b><u>SAT</u></b>	What is the nature of data set and position of pivot element, so that quick sort exhibits worst case behaviour.		4
<b><u>Q.No:1(d)</u></b>	<b><u>SAT</u></b>	What is the effect of calling MIN-HEAPIFY(A, i) for $i > \text{size}[A]/2$ ?		5
	<b><u>SAT</u></b>	What is the effect of calling MAX-HEAPIFY(A, i) for $i > \text{size}[A]/2$ ?		5
	<b><u>SAT</u></b>	Where in a min-heap might the largest element reside, assuming that all elements are distinct?		5
	<b><u>SAT</u></b>	Where in a max-heap might the smallest element reside, assuming that all elements are distinct?		5
<b><u>Q.No:1(e)</u></b>	<b><u>MCQ</u></b>	<p>What is the solution to the recurrence <math>T(n) = 4T(n/2) + n^2</math>, <math>T(1)=1</math></p> <p>A) <math>T(n) = \Theta(n)</math>  B) <math>T(n) = \Theta(\log n)</math>  C) <math>T(n) = \Theta(n^2 \log n)</math>  D) <math>T(n) = \Theta(n^2)</math></p>	C	2
	<b><u>MCQ</u></b>	<p>What is the solution to the recurrence <math>T(n) = 16T(n/4) + n</math>, <math>T(1)=1</math></p> <p>A) <math>T(n) = \Theta(n)</math>  B) <math>T(n) = \Theta(\log n)</math></p>	D	2

		C) $T(n) = \Theta(n^2 \log n)$ D) $T(n) = \Theta(n^2)$		
	<b>MCQ</b>	What is the solution to the recurrence $T(n) = 6T(n/4) + n^2 \log n$ , $T(1)=1$ A) $T(n) = \Theta(n)$ B) $T(n) = \Theta(\log n)$ C) $T(n) = \Theta(n^2 \log n)$ D) $T(n) = \Theta(n^2)$	C	2
	<b>MCQ</b>	What is the solution to the recurrence $T(n) = 3T(n/3) + \sqrt{n}$ , $T(1)=1$ A) $T(n) = \Theta(n)$ B) $T(n) = \Theta(\log n)$ C) $T(n) = \Theta(n^2 \log n)$ D) $T(n) = \Theta(n^2)$	A	2

**SECTION-B(Answer Any One Question. Each Question carries 10 Marks)**

**Time: 30 Minutes**

**(1×10=10 Marks)**

<b><u>Question No</u></b>	<b><u>Question</u></b>	<b><u>CO Mapping</u></b>
<b><u>Q.No:2</u></b>	Given a set S of n integers and another integer x, determine whether or not there exist two elements in S whose sum is exactly x. Describe a $\Theta(n \log n)$ time algorithm for the above problem.	5
<b><u>Q.No: 3</u></b>	Write HEAPIFY() procedure and derive its time complexity. The elements of a heap structure are given as $\langle 21, 1, 17, 8, 9, 6, 7, 4, 3, 8, 5 \rangle$ . Find the node i, where the procedure HEAPIFY(i) should be applied to convert the given sequence into a max-heap. Show all the steps for performing HEAPIFY(i) operation on the above sequence.	4
<b><u>Q.No:4</u></b>	Write the PARTITION() procedure of QUICK-SORT() algorithm. Show the application of partitioning procedure at each step on the array $A = \{ 99, 88, 77, 66, 55, 44, 33, 22, 11 \}$ . Derive the best case time complexity of QUICK-SORT() algorithm. What is the time complexity of QUICK-SORT() on a sorted array of size 'n'?	4
<b><u>Q.No:5</u></b>	Write the INSERTION-SORT() algorithm and apply to the list $\{2, 7, 5, 1, 2\}$ . Derive the time complexities of INSERTION-SORT() on the data that are sorted & reversely sorted respectively.	6
<b><u>Q.No:6</u></b>	Given an unsorted array $A[1..n]$ where first x ( $x \leq n$ ) elements of the array are sorted in ascending order and rest elements of the array are sorted in descending order. Design an algorithm to sort the array in $O(n)$ worst-case time.	6

**Controller of Examinations**