

University of Mumbai

Examinations Commencing from 23rd December 2020 to 6th January 2021 and from 7th January 2021 to 20th January 2021

Program: Computer Engineering

Curriculum Scheme: 2016

Examination: TE V

Course Code: CSDL5013 and Course Name: Advanced Algorithms

Time: 2 hour

Max. Marks: 80

Q1. Choose the correct option for following questions. All the Questions are compulsory and carry equal marks 40 marks

Q1.	Which of the following problems can't be solved using recursion?
Option A:	Factorial of a number
Option B:	Nth fibonacci number
Option C:	Length of a string
Option D:	Problems without base case
Q2.	Which of the following is not the types of amortized analysis?
Option A:	Aggregate
Option B:	Potential
Option C:	Accounting
Option D:	Integration
Q3.	Consider a data structure where n operations are performed. The ith operation costs i if i is an exact power of two and 1 otherwise. Determine the amortized cost of each operation using the aggregate method.
Option A:	O(1)
Option B:	O(n)
Option C:	O(logn)
Option D:	O(nlogn)
Q4.	An indicator random variable is a special kind of random variable associated with the occurrence of an event. The indicator random variable IA has value
Option A:	1
Option B:	0
Option C:	1 and 0
Option D:	1 or 0
Q5.	What are the operations that could be performed in O(logn) time complexity by red-black tree?
Option A:	insertion, deletion, finding predecessor, successor
Option B:	only insertion
Option C:	only finding predecessor, successor
Option D:	for sorting
Q6.	When it would be optimal to prefer Red-black trees over AVL trees?
Option A:	when there are more insertions or deletions
Option B:	when more search is needed
Option C:	when tree must be balanced
Option D:	when log(nodes) time complexity is needed
Q7.	_____ is the class of decision problems that can be solved by non-deterministic polynomial algorithms?
Option A:	NP
Option B:	P

Option C:	Hard
Option D:	Complete
Q8.	The main distinguishable characteristic of a binomial heap from a binary heap is that _____
Option A:	it allows union operations very efficiently
Option B:	does not allow union operations that could easily be implemented in binary heap
Option C:	the heap structure is not similar to complete binary tree
Option D:	the location of child node is not fixed i.e child nodes could be at level (h-2) or (h-3), where h is height of heap and $h > 4$
Q9.	What is order of resultant heap after merging two tree of order k?
Option A:	$2 * k$
Option B:	$k + 1$
Option C:	$k * k$
Option D:	$k + \log k$
Q10.	To which type of problems does quick hull belong to?
Option A:	numerical problems
Option B:	computational geometry
Option C:	string problems
Option D:	graph problems
Q11.	Who formulated quick hull algorithm?
Option A:	Eddy
Option B:	Andrew
Option C:	Chan
Option D:	Graham
Q12.	The average worst cast analysis of a hash table can be carried out using
Option A:	Amortized Analysis
Option B:	Asymptotic Analysis
Option C:	Mortal Analysis
Option D:	Probabilistic Analysis
Q13.	In binomial heap ,which of these operations have same complexities?
Option A:	Insertion, find_min
Option B:	Find_min, union
Option C:	Union, Insertion
Option D:	Deletion, Find_max
Q14.	What does Maximum flow problem involve?
Option A:	finding a flow between source and sink that is maximum
Option B:	finding a flow between source and sink that is minimum
Option C:	finding the shortest path between source and sink
Option D:	computing a minimum spanning tree
Q15.	A simple acyclic path between source and sink which pass through only positive weighted edges is called?
Option A:	augmenting path
Option B:	critical path
Option C:	residual path
Option D:	maximum path
Q16.	What is the other name for quick hull problem?

Option A:	convex hull
Option B:	concave hull
Option C:	closest pair
Option D:	path compression
Q17.	Which of the following is the maximum ratio of the table size to the number of elements in the case of dynamic tables which doubles its size when an overflow occurs
Option A:	2
Option B:	3
Option C:	4
Option D:	1
Q18.	Suppose we perform a sequence of stack operations on a stack whose size never exceeds k. After every k operations, we make a copy of the entire stack for backup purposes. What is the amortized cost of n stack operations, including copying the stack.
Option A:	O(n)
Option B:	O(1)
Option C:	O(logn)
Option D:	(nlogn)
Q19.	Let S be an NP-complete problem and Q and R be two other problems not known to be in NP. Q is polynomial time reducible to S and S is polynomial-time reducible to R. Which one of the following statements is true?
Option A:	R is NP-complete
Option B:	R is NP-hard
Option C:	Q is NP-complete
Option D:	Q is NP-hard
Q20.	In which of the following approximation algorithms is not needed
Option A:	Searching
Option B:	TSP
Option C:	Subset sum
Option D:	Maximum clique

Q2 (20 Marks)	Solve any Two Questions out of Three 10 marks each
A	Explain closest pair of points using divide and conquer.
B	Explain travelling salesman problem in detail.
C	What is binomial heap ? Draw a binomial heap for the following elements. 3 ,1 ,2 ,9 ,0 ,6 ,4 ,8 ,5 ,10

Q3(20 Marks)	Solve any Two Questions out of Three 10 marks each
A	Create a red-black after successive insertion of the elements 82, 9, 95, 16, 34, 12, 57, 64, 83, 41 and then successive deletion of the keys 16 and 82.
B	Explain Graham Scan algorithm steps in detailed. Find out convex hull with graham scan.(with suitable example.)
C	Find Maximum flow for a complete directed graph using Ford-Fulkerson Algorithm and explain terminologies used algorithm