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Guru	Nanak Dev Engine	ering College, Lu	udhiana
H	Department of Infor	mation Technolo	ogy
rogram	B.Tech.(IT)	Semester	6 th
Subject Code	PCIT-113	Subject Title	Design and Analysis of Algorithms
Mid Semester Examination MSE) No.	MSE -I (Jan-May, 2024)	Course Coordinator	Er. Parminder Kaur Wadhwa
Max. Marks	24	Time Duration	1 hour 30 minutes

Note: Attempt all questions

Roll No. _____

Q. No.			COs, RBT level	Marks							
<u>Q.1</u>	Def	ine the principle	of optimality.		û		CO2, L1	2			
Q.2	For	nulate the θ – n	CO1, L6	2							
Q.3	Illus wor	strate the perform st cases.	nance of Quick	sort algori	thm for its a	verage and	CO1, L3	4			
Q.4	Den solv	emonstrate the application of dynamic-programming approach to CO2, L3 lve all-pairs shortest paths problem.									
Q.5	Con Diji	npare the effic stra's algorithm	iency of Bell to solve single	man and	Ford Algor ths problem	ithm with in a graph.	CO3, L4	4			
Q.6	Des "proj	ign a greedy-al, fit for the follow	gorithmic appr ing fractional K	oach in o Inapsack in	rder to earn	maximum	CO2, L6	8			
5 4	Number of elements = $n = 4$ Maximum Capacity of Knapsack = $m = 15$ Profits = $(p_1, p_2, p_3, p_4) = (10, 16, 20, 18)$ Weights = $(w_1, w_2, w_3, w_4) = (5, 2, 4, 6)$										
Course O	utcom	es (CO) Students w	ill be able to								
<u>\ 1.</u>		Develop an und	erstanding of til	me and spa	ce complexit	ies of an algo	orithm.				
2.		Explore basic a programming.	algorithm desig	n techniqu	es like divi	de and conq	uer, greedy,	dynamic			
3.		Explore the vari	ous problem so	lving techr	iques related	to graphs.					
4.		Solve problems	related to string	s by apply	ing various a	lgorithms.					
5.		Identify the rela	tionship betwee	n P. NP. N	P-hard and N	VP-complete	problems.	A REAL PROPERTY.			
6.	Understand the importance of approximation algorithms										
RBT Classificat	cation Lower Order Thinking Levels (LOTS) Higher Order Thinking Levels (HOTS)										
RBT Level		LI	L2	L3	L4	L5		L6			
RBT Level Remembering Understanding Applying Analyzin				Analyzing	Evaluating	Creatin	18				
15.15	2021	08 7 - 5	6540	. 24	1. C. I						

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Department of Information Technology											
Fograt	ram B.Tech.(IT) Semester 6th										
Subject	Code PCIT-113 Subject Title Design and Analysis of Augorithms							rithms			
Mid Sen	tion (MCE)	1 st MSE	C	Course Er. Parminder I			Kaur Wadhw	1			
Examina No.	nination (MSE) (Jan-June, 2023) Coordinator										
Max. Ma	arks	24	T	ime Duratio	hour 3	Ominu	tes				
Note: Attempt all questions Student's University Pall No. 2 Groups 2.4											
Q. No.			Ouestion	1		0000	COe DBT	Marke			
-		_	C	-			level	Marks			
Q.1	Define the prir	nciple of	optimality.				CO2. L1	2			
Q.2	Test the efficie	ency of th	e following cos	de snippet in	terms of Bi	g Oh	CO1. L4	2			
	notation:-			N • 11		0		~			
	for (i=0	; i < n; i	i++)								
	{										
	fo	r (j=0; j<	< i; j++)								
	İ ,	{ state	ement; }								
03	i Illoctrate the a	Verage ar	vd worst seess	<u>fo</u> :1	1		000.10				
2.5	terms of time	complexi	tv	or Quicksort a	ilgorithm in	8	CO2, L3	4			
0.4	Use greedy method and find an optimal solution to the Known it.										
	instance:- n=	7, $m=15$, (p ₁ , p ₂ ,, t	(10, 5, 1) = (10, 5, 1)	5. 7. 6. 18.	3)	002,15	-			
	(w_1, w_2, \dots, w_n)	(7) = (2, 3)	, 5, 7, 1, 4, 1)	(,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	-, ., ., ., .,.,]			
Q.5	Compare the v	vorking a	nd performance	e of Prim's an	d Kruskal's	;	CO3, L4	4			
	algorithms to e	compute	minimum cost s	panning tree.							
Q.6	Defend the sta	tement th	at Bellman and	Ford algorith	m is superi	or	CO3, L5	8			
	than Dijkstra's	s Algorith	im.								
Course	Dutcomes (CO) S	tudents wil	l be able to	1							
1.	Develop	an under	standing of time	and space com	plexities of a	an algor	ithm.				
2.	 Explore basic algorithm design techniques like divide and conquer, greedy, dynamic 							ic			
3.	 Explore the various problem solving techniques related to graphs. 										
4.	 Solve problems related to strings by applying various algorithms. 										
5.	5. Identify the relationship between P, NP, NP-hard and NP-complete problems.										
6.	6. Understand the importance of approximation algorithms.										
RBT Classific	Lower C	order Thin	king Levels (LO)	rs)	Higher Orde	er Thinl	king Levels (H	OTS)			
RBT Le	vel L	1	L2	L3	L4	L	5	L6			
RBT Le	vel Remen	bering	Understanding	Applying	Analyzing	Evalu	ating C	reating			
								a second s			

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/	Guru	Nanak Dev Engine	ering College, Lu	idhiana			
/	Ľ	epartment of Infor	mation Technolo	ogy			
Progran	1	Semester 6			of		
Subject	Subject Code PCIT-113		Subject Title	Algorithm			
Mid Sen (MSE) N	nester Examination No.	MSE -II (Jan-May, 2023)	Course Coordinator	Er. Parminder Kaur Wadhwa			
Max. M	arks	24	Time	1 hour 30 minutes			
Note: At	tempt all questions	i	R	koll No			
Q. No.		Question	5. I V.		COs, RBT level	Marks	
Q.1	What are ε – approx	imate algorithms?	0		CO6, L2	2	
Q.2	Appraise the effectivity in 2023 in dealing w	veness of the anticip ith hard-optimization	ated debut of IBI problems.	M Condor	CO5, L5	2	
Q.3	Illustrate the dynam Warshal algorithm in	ic programming app order to solve all-pa	roach used by the transformed by	he Floyd- problem.	CO2, L3	4	
	backtracking algorith generation:-	Windowski with a second with a second	e and demonstration	e the tree-			
Total pa	ges are 02	1	P	age 01 of	02	P.T.O.	

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Q.5	Assess the importance of using greedy method and relaxing the condition of $x_i = 0$ or 1 to $0 \le x_i \le 1$ while computing optimal solution for 0/1 Knapsack problem using a recursive backtracking
Q.6	algorithm. Image: Color of the state of
Course	Complexity. Outcomes (CO) will be able to time and space complexities of an algorithm.
Student. 1. 2.	Swith be used Develop an understanding of thine and operating of the and conquer, greedy, dynamic Explore basic algorithm design techniques like divide and conquer, greedy, dynamic programming. programming. the various problem solving techniques related to graphs.
3. 4.	Explore the various 1 Solve problems related to strings by applying various algorithms. Light the relationship between P, NP, NP-hard and NP-complete problems.
5	Understand the importance of approximate Understand the importance of approxim

	Guru	Nanak Dev Engli	ormet'	mege, Lu	umana			
		Department of Inf	ormation	Technolog	gy			
Program		B.Tech.(IT)	Seme	ster	6 ^m	I A alunia		
Subject C	ode	PCIT-113	Subje	ct Title	Design and Algorithm	s Analysis		
Mid Seme (MSE) No	ester Examination	MSE -11 (Jan-May, 2024)) Cour	se dinator	Er. Parmi	nder Kaur	Wadhwa	
Max. Ma	rks	24	Time Dura	tion	1 hour 30			
Note: Atte	empt all questions			R	oll No	210451	4	
Q. No.		Question	n			COs, RBT level	Marks	
Q.1	Illustrate the conce	ept of $f(n)$ and ε -ap	proximate	algorithm	S.	CO6, L3	2	
Q.2⁄	Compare the perfo Moore Horspool a	ompare the performance of Boyer-Moore algorithm and Boyer- CO4, L4 2 oore Horspool algorithm.						
0.3	Demonstrate the w	nonstrate the working of Knuth-Morris-Pratt (KMP) algorithm.						
Q.4	Elaborate how the backtracking technique is applied to solve 0/1 Knapsack problem.						4	
Q.5	Design a backtrac in a graph.	Design a backtracking algorithm to find all the Hamiltonian cycles C in a graph.						
Q.6	Judge the correct problem is alway incorrect, give a c	otness of the state ys NP-complete." detailed <i>evidence</i> to	the statement that "NP-hard decision CO5, L5 8 complete." If you judge it as correct or <i>vidence</i> to support your answer.					
Course O	utcomes (CO) Student	ts will be able to	al de la companya de		Seattle			
1.	Develop an u	understanding of tim	ne and space	e compley	ities of an al	a oniti-		
2.	Explore bas programmin	ic algorithm design g.	n techniqu	es like div	ide and cor	iquer, gree	dy, dynamic	
3.	Explore the	various problem sol	ving techn	iques relate	d to grante			
4.	Solve proble	ems related to string	s by apply	ing various	algorithme			
5.	Identify the	relationship between	n P, NP, N	P-hard and	NP complete	e problema		
6.	Understand	the importance of a	pproximati	on algorith	ms	e problems.		
RBT Classifica	Lower Orden	r Thinking Levels (LC	OTS)	Higher Or	der Thinking	Levels (HO	ſS)	
RBT Lev No.	el Ll	L2	L3	L4	LS	8	L6	
RBT Lev	vel Remembering Understanding Applying Analyzing Evaluating Creating					ating		

Please check that this question paper contains_09____ questions and _02__ printed pages within first ten minutes.

[Total No. of Pages: 02]

Program: B.Tcch. (Batch 2018 onward) Semester: 6th Name of Subject: Design and Analysis of Algorithm Subject Code: PCIT-113

Paper ID: 17205

Scientific calculator is Allowed

Detail of allowed codes/charts/tables etc. NIL Time Allowed: 03 Hours

Max. Marks: 60

NOTE:

- 1) Parts A and B are compulsory
- 2) Part-C has Two Questions Q8 and Q9. Both are compulsory, but with internal choice
- 3) Any missing data may be assumed appropriately

Part – A

[Marks: 02 each]

Q1.

Provide a scenario where understanding asymptotic notations is crucial for designing and analyzing algorithms effectively.

- by Define dynamic programming and explain its significance in algorithm design. How does it differ from other algorithm design techniques?
- A sorting method is said to be stable if at the end of the method, identical elements occur in the same order as in the original unsorted set. Are the merge sort and quick sort are stable sorting methods?
- Define the chromatic number of a graph. Show that the chromatic number of a bipartite graph is always 2.
- e) Contrast the concepts of NP-complete and NP-hard. How do they differ?
- f) In a complete graph with 6 vertices, how many distinct Hamiltonian cycles are there?

Part - B

[Marks: 04 each]

Define backtracking and explain its significance in algorithm design. How does backtracking differ from other algorithmic techniques?

Page 1 of 2

P.T.O.

- Q3. What are the characteristics of a good approximation algorithm?
- Q4. What are the steps involved in implementing a greedy algorithm for the Knapsack problem?
- - Implement and demonstrate binary search algorithm to find the position of the element 35 in the array [5, 10, 15, 20, 25, 30, 35, 40, 45, 50]. Outline the main steps of the Rabin-Karp algorithm. Discuss the time complexity of
 - Q6. the Rabin-Karp algorithm for searching for a substring of length m within a text of length n. 100



Solve the recurrence relation $a_n = a_{n-1} + n$ with initial term $a_0 = 4$.

Part - C

[Marks: 12 each]

What problem does the Boyer-Moore algorithm aim to solve? How does the Boyer-**O**8. Moore algorithm differ from other string matching algorithms?

OR

What is the concept of absolute approximation in algorithm analysis? How do Eapproximations differ from absolute approximations?

Describe the quicksort algorithm and its basic steps. What is the time complexity of 09. quicksort in the average case and worst case scenarios? Perform a quicksort on the array [12, 9, 3, 7, 14, 11, 6, 2]. Show each step and the sorted array.

OR

Write down Kruskal Algorithm to find minimal spanning tree. Apply and demonstrate the steps of the Kruskal algorithm to find the minimal spanning tree for the following graph.



Page 2 of 2

Please check that this question paper contains 9 questions and 2 printed pages within first ten

[Total No. of Questions: 09] Uni. Roll No.

[Total No. of Pages: ..2....]

Program: B.Tech. (Batch 2018 onward) Semester: 6th Name of Subject: Design and Analysis of Algorithm Subject Code: PCIT-113 Paper ID: 17205

Time Allowed: 03 Hours

Max. Marks: 60

NOTE:

- 1) Parts A and B are compulsory
- 2) Part-C has Two Questions Q8 and Q9. Both are compulsory, but with internal choice
- 3) Any missing data may be assumed appropriately
 - Part A

[Marks: 02 each]

Q1.

- a) Describe the characteristics of algorithm.
- b) Which Big-O notation has the worst time complexity?
- c) What are limitations of Dijkstra's Algorithm?
- d) Define the principle of Optimality.
 - e) Differentiate NP-hard and NP-complete problems with suitable example.
 - f) Explain Graph-coloring problem.

Part - B

[Marks: 04 each]

- Q2. Illustrate the dynamic programming approach used by Floyd-Warshal Algorithm in order to solve all pairs shortest path algorithm.
- Q3. Examine the best and worst cases of Quicksort Algorithm by performing its detailed time complexity analysis.
- Q4. Differentiate Divide-and- Conquer and Greedy Method.

Q5. For the given set of items and the knapsack capacity of 10 kg, find the subset of me items to be added in the knapsack such that the profit is maximum.

Items	1	2	3	4	5
Weights (in kg)	3	3	2	5	1
Profits	10	15	10	12	8

- **Q6.** Solve the following Recurrence Relation: $T(n) = T(n-1) + \log n$.
- Q7. Demonstrate how backtracking can be used to solve 8-Queens Problem.

Part - C

Q8. Describe the working and performance of Prim's Algorithm to compute Minimum co Spanning tree.

OR

[Marks: 12 each]

Explain the working of Rabin-Karp Algorithm and Knuth-Morris Pratt Algorithm.

Q9. Solve Travelling Salesperson Problem using Branch and Bound Algorithms.

OR

Consider the sum-of-subset problem, n = 4, Sum = 13, and $w_1 = 3$, $w_2 = 4$, $w_3 = 5$ at $w_4 = 6$. Find a solution to the problem using backtracking. Show the state-space tr leading to the solution. Also, number the nodes in the tree in the order of recursi

