Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SEVENTH SEMESTER B.TECH DEGREE EXAMINATION(S), MAY 2019

Course Code: CS469

Course Name: COMPUTATIONAL COMPLEXITY

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries 4 marks. Marks

1		Give the formal definition of Turing machine	(4)
2		List out any three asymptotic notations.	(4)
3		Define Universal Turing Machine.	(4)
4		Define the classes NTIME[t] and NP.	(4)
5		State and prove Cook-Levin Theorem.	(4)
6		Define the classes DSPACE and PSPACE.	(4)
7		Define the complexity class BPP with example.	(4)
8		Define probabilistic Turing machine	(4)
9		Define the TRAVELLING SALES MAN Problem.	(4)
10		Let P be an optimization problem. Then define P using maximization and minimization problems.	(4)

PART B

Answer any two full questions, each carries 9 marks.

11	a)	Prove that for every multi tape Turing Machine there exist an equivalent single tape Turing Machine.	(6)
	(b)	Let M be multi Tape Turing machine with O(n) computing steps and there exist an equivalent single tape Turing Machine D. Then calculate the maximum number of computing steps for D on an input x with length n such that M(x)=D(x).	(3)
12	(a)	State Rice's Theorem for computing models.	(4)
	(b)	Whether there exists a Turing Machine M that can decide the property "Accept a binary string with exactly five bits" on another Turing Machine N. Justify your answer.	(5)
13	a)	Differentiate the features of decision problem with optimization problems.	(4)
	b)	Design an algorithm to solve the 2-colourability problem in polynomial time.	(5)

PART C

Answer any two full questions, each carries 9 marks.

14	(a)	State the 3-colourability problem.	(1)
	(b)	Prove that 3-colourability is an element of class NP	(2)
	(c)	Prove that 3-colourability problem is NP-Complete.	(6)
15	(a)	What is Totally Quantified Boolean Formula (TBQF).Write an Example?	(3)
	(b)	Prove that TBQF is PSPACE-Complete.	(6)
16	(a)	Define the PATH Problem in Graph theory.	(2)
	(b)	Prove that NL=CO-NL using PATH problem	(7)

PART D

Answer any two full questions, each carries 12 marks.

17	(a)	Define the complexity classes BPP.	(2)
	(b)	Prove that the problem PRIME={n|n is a prime number in binary} is in the complexity class BPP.	(10)
18	(a)	Write short note on Interactive proof system.	(6)
	(b)	Design a randomized algorithm to solve K-SAT problem.	(6)
19	(a)	Define the VERTEX COVER Problem.	(4)
	(b)	Design a polynomial time approximation algorithm for VERTEX COVER	(8)

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