

Reg No.: \_\_\_\_\_

Name: \_\_\_\_\_

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**  
SEVENTH SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2018

**Course Code: CS469**

**Course Name: COMPUTATIONAL COMPLEXITY**

Max. Marks: 100

Duration: 3 Hours

**PART A**

*Answer all questions, each carries 4 marks.*

		Marks
1	Write short note on Turing Machine and its varieties.	(4)
2	State the halting problem of Turing Machine	(4)
3	Let P,Q be two problem then write about any two reduction methods that can reduce problem P to problem Q.	(4)
4	Differentiate the complexity class NP-Hard and NP-complete with the help of diagram.	(4)
5	Define the classes L and NL.	(4)
6	Give the definition of PSPACE Completeness	(4)
7	Define the properties of class IP problems.	(4)
8	Define the complexity class ZPP with example.	(4)
9	Write short note on Bin-Packing Problem.	(4)
10	Define VERTEX COVER Problem in graph theory.	(4)

**PART B**

*Answer any two full questions, each carries 9 marks.*

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| 11 | a) Given a non-deterministic Turing Machine M with $O(n)$ computing steps. If there exist an equivalent deterministic single tape Turing Machine D ,then prove that $M(x)=D(x)$ for all input x. | (6) |
|    | b) Find out the maximum number of computing steps for the Turing Machine D in the above problem. Justify.  | (3) |
| 12 | (a) Define 2-satisfiability problem in computational complexity.   | (2) |
|    | (b) Prove that 2-satisfiability is in class P.   | (7) |
| 13 | (a) “There exists some un-computable problems/function in the Universe”. Is it True or False?  | (1) |
|    | (b) Justify the above said answer with the help of counting and diagonalization method.  | (8) |

**PART C**

*Answer any two full questions, each carries 9 marks.*

- 14 a) Problem P="A graph G is given, find an ordering S, of vertices in G such that, S contains all vertices in G exactly once". Identify the problem P and prove that the problem P is in class NP (3)
- b) Prove that the above said problem P is NP-Complete. (6)
- 15 (a) State the Clique problem in graph theory. (1)
- (b) Prove that Clique problem is an element of class NP (2)
- (c) Prove that Clique problem is NP-Complete. (6)
- 16 a) Write short note on configuration graph of a Turing Machine. (5)
- b) Draw the diagram showing the relation between the complexity classes L, NL, P, NP, PSPACE, CO-NP and CO-NL. (4)

**PART D**

*Answer any two full questions, each carries 12 marks.*

- 17 a) Write short note on Interactive proof system. (2)
- b) Define the class BPTIME. (2)
- c) Design a randomized polynomial time algorithm for primality testing of an integer number. (8)
- 18 a) Write an Interactive proof for graph non-isomorphism (9)
- b) Define the classes RTIME and ZTIME. (3)
- 19 a) Define the TRAVELLING SALES MAN Problem. (4)
- b) Design a polynomial time approximation algorithm for TRAVELLING SALES MAN Problem. (8)

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