



ADAMAS UNIVERSITY
END-SEMESTER EXAMINATION: JULY 2020

Name of the Program: M.TECH/MCA
Stream: CSE
PAPER TITLE: Computational Complexity
Maximum Marks: 40
Total No of questions: 08

Semester: II
PAPER CODE: ECS61116
Time duration: 3 hours
Total No of Pages: 02

Instruction for the Candidate:

1. At top sheet, clearly mention Name, Univ. Roll No., Enrolment No., Paper Name & Code, Date of Exam.
 2. All parts of a Question should be answered consecutively. Each Answer should start from a fresh page.
 3. Assumptions made if any, should be stated clearly at the beginning of your answer.
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Answer all the Groups

Group A

Answer all the questions of the following

$5 \times 1 = 5$

1. a) What is the dimension of time complexity for the following code:

```
for(i=2;i<n;i=i*2)
    statement;
for sufficiently large n.
```


b) Which class of problems/questions are known as class-NP problems/questions?
c) What does it mean when we say that an algorithm X is asymptotically more efficient than Y?
d) What is the time complexity of the following code:

```
def f():
    int a[N + 1][M + 1][K + 1]
    sum = 0
    for i = 1 to N:
        for j = i to M:
            for k = j to K:
                sum += a[i][j]
    print(sum)
```


e) An algorithm with time complexity $O(f(n))$ and processing time $T(n) = cf(n)$, where $f(n)$ is a known function of n , spends 10 seconds to process 1000 data items. How much time will be spent to process 100,000 data items if $f(n) = n$ and $f(n) = n^3$?

GROUP –B

(Short Answer Type Questions)

Answer any three of the following

$3 \times 5 = 15$

2. Discuss the **Bounded-Error Probabilistic Polynomial time (BPP)**.
3. Prove that the Halting Problem of Turing Machine is Undecidable.
4. Describe what is Turing Machine and how is it differing from Finite Automaton and Pushdown Automaton.

5. Define Undecidability with a suitable example. What are the factors that makes an algorithm non-deterministic?

GROUP –C
(Long Answer Type Questions)
Answer *any two* of the following

$2 \times 10 = 20$

6. Prove that CSAT (Circuit Satisfiability) is NP-Complete.
7. Show that 2SAT is in P but 3SAT is NP-Complete.
8. Prove that SAT (Satisfiability) is NP-Complete. State Cook's Theorem.
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