

CS-3005: Theory of Automata

Serial No:

Final Exam

Total Time: 2 Hours

Total Marks: 100

Wednesday, 30th Dec, 2021

Course Instructors

Dr Waseem Shehzad, Dr Labiba Fahad and Dr
Mehreen Alam, Shafaq Riaz

Signature of Invigilator

Student Name

Roll No.

Section

Signature

DO NOT OPEN THE QUESTION BOOK OR START UNTIL INSTRUCTED.

Instructions:

1. This is Part II, the design part of the exam.
2. Attempt all of them. Read the question carefully, understand the question, and then attempt it.
3. No additional sheet will be provided for rough work. Use the back of the last page for rough work.
4. After asked to commence the exam, please verify that you have **fourteen (14)** different printed pages including this title page. There are total of **eight (8)** questions.
5. Use permanent ink pens only. Any part done using soft pencil will not be marked and cannot be claimed for rechecking.

	1	2	3	4	5	6	7	8	Total
Total Marks	20	20	10	10	10	10	10	10	100
Marks Obtained									

Question 1 [20Marks]

Computable Functions - Even Parity Generator: Design a Turing Machine to calculate the parity of a binary number, i.e., add a 0 at the end if the number of 1's in the input string is even or a 1 if this number is odd. You should append the parity bit at the extreme right of the binary number and leave the tape head in the beginning of the binary number, i.e., the extreme right.

Question 2 [20Marks]

Turing Machine: Construct a Turing machine to perform the multiplication operation $f(m,n)=m*n$. You must leave your tape head at the first letter of the output and the final TM should only have the answer on it and nothing else.

Question 3 [20Marks]

2PDA: Design a 2PDA for $a^n b^m c^n d^m$.

Question 4 [10Marks]

PM: Design a PM for the language $a^n b^n a^{2n}$ for $n \geq 0$.

Question 5 [10Marks]

PDA: Construct a PDA for language $L = \{0^n 1^m \mid n, m \geq 1, m > n+2\}$

Question 6 [1+2+2+1+1+3 = 10Marks]

CNF: Convert the following CFG to CNF

$S \rightarrow ASA \mid aB$

$A \rightarrow B \mid S$

$B \rightarrow b \mid bD \mid \Delta$

$C \rightarrow CC \mid aa \mid AB$

$D \rightarrow DD$

Question 7 [10Marks]

CFG=PDA: Convert the resultant CNF of the last question to its equivalent PDA using the method CFG=PDA.

Question 8 [10Marks]

Pumping Lemma: Prove using Pumping Lemma if the language $a^n b^n c^n$ is a context-free language.

Extra Sheet