FAST School of Computing

Fall-2020

Islamabad Campus

CS-301: Theory of Automata

Wednesday, 10th February, 2021

Course Instructors

Dr Waseem Shahzad, Mehreen Alam.

Final	Exam

Section II

Total Time: 2 Hours

Total Marks: 80

(Part II)

Serial No:

Wascelli Silanzaa,		Signa	ature of Invigilator
Student Name	Roll No.	Section	Signature

- 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.
- 4. After asked to commence the exam, please verify that you have **thirteen** (13) different printed pages including this title page. There are total of 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	10	10	10	10	10	10	10	10	80
Marks Obtained									

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Q1. [10 pts] Design CFG for the language of balanced parenthesis = $\{\Delta, (), ()(), (()), (())()...\}$

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Q3. [1+2+2+3+2 = 10 pts] Convert to CNF and you must show all the intermediary four steps in the order studied to score full marks:

S -> SS | AB | B

A -> aAAa

 $B \rightarrow bBb \mid bb \mid \Delta$

C -> CC | a

D -> aC | bb

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Islamabad Campus Q4. [5+5 = 10 pts] Convert to GNF. You must convert to intermediary grammar to get full marks.

S -> AB

A -> AB | a

B -> AB | a

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Q5. [10 pts] Prove if anbncndn is a non-CFL. Fall-2020 **Islamabad Campus**

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Q6. [10 pts] Let L be some regular language in which all the words happen to have an even length.

Let us define the new language Twist(L) to be the set of all the words of L twisted, whereby twisted we mean the first and second letters have been interchanged, and so on. For example, if

L = { ba abba babb}
Twist(L) = { ab baab abbb}

Build a Turing Machine that accepts Twist(L). You are also **allowed** to use the sub programs of **INSERT** and **DELETE**. You may assume after **INSERT** operation, tape head points at the newly added cell while after **DELETE** operation, tape head points at the same location. You may leave the tape head at any location on the output string when the computation is done.

Sta	tus	of t	ape	on	inp	ut is	S:						S	tatu	s of	f tap	oe a	<u>it th</u>	e oı	utpu	<u>ıt is</u>	:				
#	а	b	b	b	а	b	а	Α	Δ	Δ	Δ			#	b	а	b	b	b	а	а	а	Δ	Δ	Δ	•
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FAST School of Computing Fall-2020 Islam Q7. [10 pts] For the language $\mathbf{a}^n\mathbf{b}^{2n}\mathbf{c}^{2n}\mathbf{d}^n\mathbf{e}^n$, where $n \ge 0$, design a 2-PDA. **Islamabad Campus**

FAST School of Computing Fall-2020 **Islamabad Campus** Q8. [10 pts] Design a Post Machine for the language EVEN-EVEN.

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