National University of Computer and Emerging Sciences, Lahore Campus

Course:	Theory of Automata	Course Code:	CS-301
Program:	BS(Computer Science)	Semester:	Fall 2016
Duration:	1 Hour	Total Marks:	20
Paper Date:	04-10-17	Weight	17.5%
Section:	A, B, C, D, E, F	Page(s):	5
		Reg. No	
Exam:	Mid II	Section	

Instruction/Notes:

- All the questions are to be attempted on this question paper in given space
- You can use rough sheet but answers and working should be shown on this question paper.
- Don't attach any extra sheet

Question 1: (2 points)

$(bb)^*a\ (bb)^*$ is a regular expression of L, therefore we know for sure that L is a regular language.

If L is a regular language then it should fulfill the properties of Pumping lemma.

However according to the following Proof by contradiction (Using Pumping lemma) states the L is not a Regular Language. Identify the mistake in this Proof, identify the line/s with the mistake and give reason why you think it is a mistake in one or two sentences.

Proof by contradiction

1. **Let L is regular with n** states
2. Let **x** = $(bb)^{n/2}a(bb)^{n/2}$, **x**ϵ L
3. Let **u**, **v**, **w** be strings such that **x** = **uvw**
4. Taking **u** = $(bb)^{n/2}$, **v** = *a*, **w** = $(bb)^{n/2}$
5. Checking 3 conditions of Pumping lemma
6. i) |**uv**|= 3n/2 <n (True)
7. ii) |**v**|>0 (True)
8. iii) $\mathbf{uv^iw}$ϵ L for all i>=0
9. checking for i = 0
10. $\mathbf{uv^0w}$= $(bb)^{n/2}(bb)^{n/2}$
11. As $(bb)^{n/2}(bb)^{n/2}$ does not belong to L therefore L is not a regular language
12. Question 2:

Answer:

Question 2 (10 Points)

Create a PDA for given language.

L = {$a^i c^k b^j$, where 4i < 8j and (k mod 3) should be 1}

Your PDA has only two stack elements ***A*** and Z_0. Z_0 will act as a delimiter, it is only placed at bottom of stack to indicate end of stack. Therefore you can only push or pop **A**'s (as many **A**'s as you like but you cannot push any other element on stack).

Note: Z_0 is same as **$,** as used in Sipser book

Question 3 (4 Points)

Check if the string w belong to the given CFG using CYK algorithm. Show complete working. (5 points)

S→ AX | AB
Y→ AX| AB
X→ YB
A→ a
B→ b

w= aabb

Show all the working in given table.

Question 4 (4 Points)

Remover null productions from following CFG (2nd step of converting to CNF)

NOTE: you do not have to convert the CFG to CNF, only remove the null productions.

S→ ACAD|^
A→ aAC| DD
C→ aC | a| AD
D→ aaD | bDb| ^