Cairo University
Faculty of Computers & Artificial Intelligence
Theory of Computations

Assignment 3 (CFG & PDA)

Instructions

- The assignment is submitted in groups of **minimum 2 and maximum 4** students from the **same lab** or the **same TA**.
- The Deadline for submission is on saturday **11/5 at 11:59 pm.**
- Submission will be on Google Classroom. No late submission, or through e-mail submission is allowed.
- Please submit one compressed folder containing 4 files (PDF file for CFG rules, Java code for CFG, PDF file for PDA diagrams, Java code for PDA). The folder name should follow this structure: GROUP_ID1_ID2_ID3_ID4.zip.
- In case of Cheating, you will get a negative grade whether you give the code to someone, take the code from someone/internet, or even send it to someone for any reason.

Requirements

- Solve all of the PDA & CFG problems in **Java Language.**
- For each problem in CFG part, you should submit the **CFG rules** and **Java code** that solves it.
- For each problem in PDA part, you should submit the **drawn PDA** and **Java code** that solves it.
- The Java program will take ONE input text file containing the input values for each problem, the program must save the output of each problem
- in ONE output text file following the required format for each problem.
- No coding is required in the conversion from CFG to PDA.

CFG

1. Write a CFG for accepting an equal number of a's and b's.
2. Write a CFG for accepting a number of a's is twice the number of b's.
3. Write a CFG for accepting a palindrome $\Sigma = \{a,b\}$.
4. Write a CFG for accepting a language $\{a^{2n+3} b^n \mid n>=0\}$.

**Notes

- empty string is accepted for all previous CFGs.
- CFG rule's will be hardcoded in your program.
- Input & output structure should be like that:

Input: output: Input: output:

1	True
ababab	True
babaaabb	False
bab	False
aaaabbb	
end	

2	True
aab	False
abb	False
aabb	True
ababaa	
end	

PDA

1. Design a PDA for accepting a language $\{a^n b^n\ n>=0\}$

   Input string: Output:

1	1
aabb	accepted
aaabbb	accepted
aab	not accepted
aabbb	not accepted
end	end

2. Design a PDA for accepting a language $\{a^{2n} b^{3n}\ n>=1\}$.

   Input string: Output:

2	2
aabbb	accepted
aaaabbbbbb	accepted
abbb	not accepted
aabb	not accepted
end	end

3. Design a PDA for accepting a language that consists of strings of balanced left and right brackets.

   Input string: Output:

3	3
{{}}	accepted
{}{{}{}}	accepted
{}{{}	not accepted
{{}	not accepted
end	end

4. Design a PDA for accepting a language $\{a^{n+m} b^n c^m|\ n\ ,\ m>=1\}$.

Input string: Output:

4 aabc aaabbc aabbbcc end	4 accepted accepted not accepted end

Convert the following CFG to PDA: (2 Marks bonus)

1. S → aS | aSbS | a

2. S → XaaX

   X → aX | bX | λ