ADVANCED THEORY OF COMPUTER SCIENCE

SCSJ5023/MCSS2093/MECS1013

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TUTORIAL 2

CFG QUESTIONS

Question 1

Construct a context-free grammar that generate the language of (3 marks each)

$\{a^m b^m | n < m\}$

$\{a^{3n} b^{2n} | n \geq 0\}$

$\{a^{3m+1} b^{2n} | n \geq 0\}$

Question 2

Design the CFG rules for (a+b)*aa(a+b)* (5 marks)

Question 3

Consider following grammar

S → aSa | aBa

B → bB | b

a) Use the set notations to define the language generated by the grammar (3 marks)

b) What is the shortest string that can be produced from the grammar? (1 mark)

c) Write another possible strings that can be generated from the language (2 marks)

Question 4

Let G be the grammar

a) Give a leftmost derivation of string aabbb (3 marks)

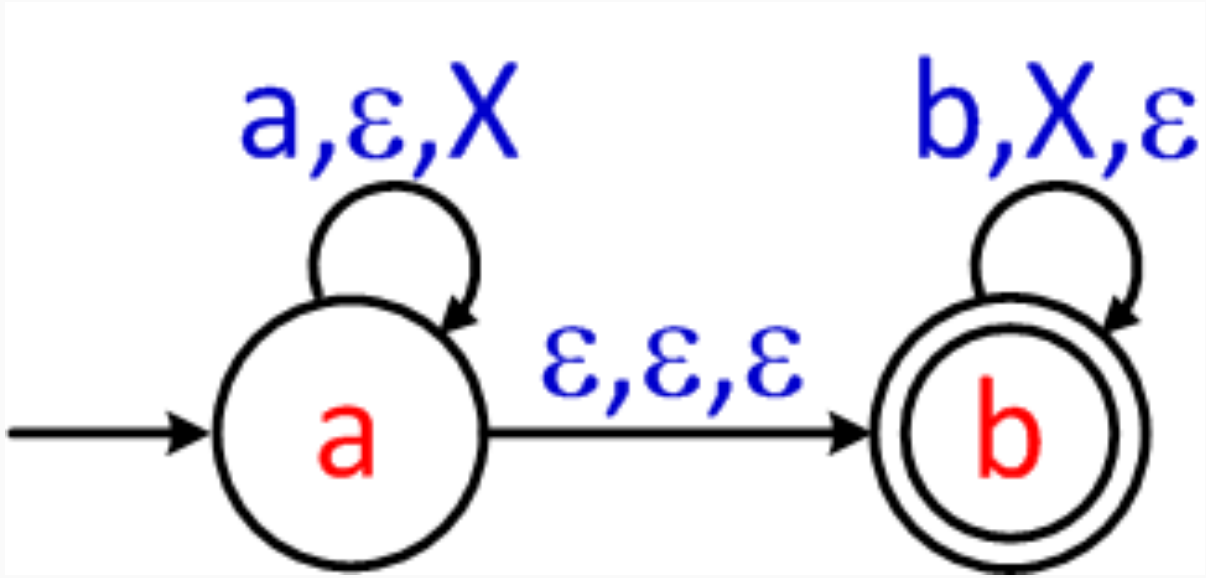
b) Give rightmost derivation of string abbbb (3 marks)

c) Build the derivation tree for the derivations in par (a) and (b) (6 marks)

PDA QUESTIONS

Question 1

- What is the language of the following PDA? (3 Marks)



Question 2

- Let $\Sigma = \{a, b\}$. (5 marks x 2)
- Design a PDA that accepts the language $\{wcw^R \mid w \in \Sigma^*\}$.
- Design a PDA that accepts the language $\{ww^R \mid w \in \Sigma^*\}$.

Question 3

i. Design a PDA whose language is $\{a^m b^n \mid 0 \leq m < n\}$. (5 marks)

ii. Design a PDA whose language is $\{a^m b^n \mid 0 \leq n < m\}$. (5 marks)

Question 4 (5 marks each)

i. Design a PDA whose language is

$$\{a^m b^n c^n d^m \mid m \geq 0, n \geq 0\}.$$

ii. Design a PDA whose language is

$$\{a^m b^m c^n d^n \mid m \geq 0, n \geq 0\}.$$

iii. Design a PDA whose language is

$$\{a^m b^n c^p d^q \mid m + n = p + q\}.$$

iv. Design a PDA whose language is

$$\{a^m b^n c^k \mid m = n \text{ or } m = k\}.$$

Question 5

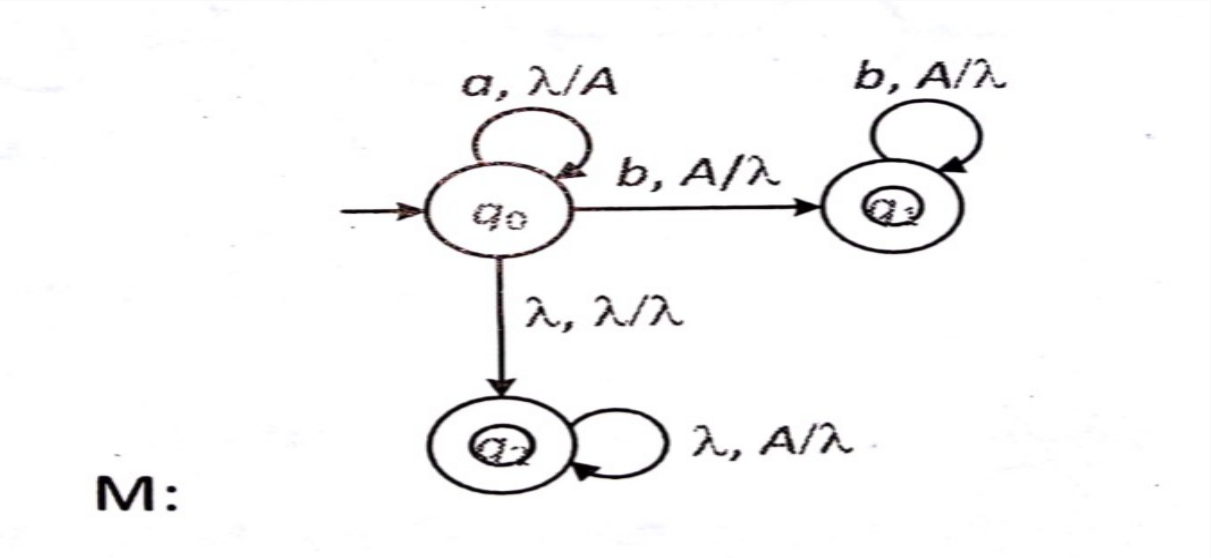
Given $L = \{a^m b^m | m \geq 0\}$

- Derive the transformation for the following string :

i. aaabbb (3 marks)

ii. abb (3 marks)

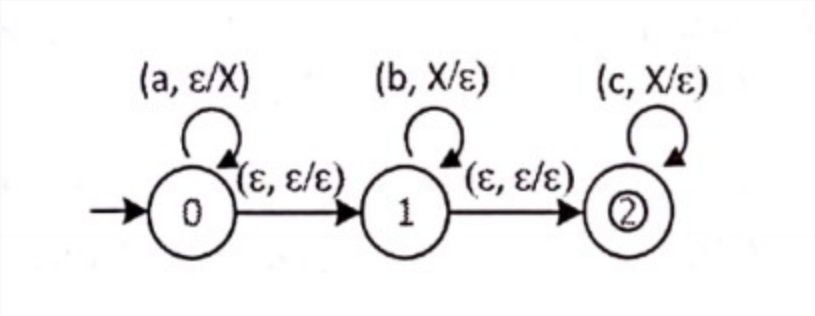
Question 6



Show the transition **abab, abba, aabba (6 marks).**
What is the language for this machine? (3 marks).

Question 7

- Given pda for $\{a^i b^j c^k \mid i = j + k\}$



Draw a PDA for $\{a^i b^j c^k \mid i > j + k\}$

Draw a PDA for $\{a^i b^j c^k \mid i < j + k\}$

(5 marks each)

THANK YOU

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