PERFAIT AKAKA SHISOKA

17G01ACS059

<div align="center">

AUTOMATA THEORY ASSIGNMENT 3

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1.

S→aXbX
X→aY|bY
Y→X|c

Step 1:

No start symbol appears on the right, so we move to step 2

Step 2:

It has no null productions, so we move to step 3

Step 3:

Remove the Unit production Y→X

S→aXbX
X→aY|bY
Y→aY|bY|c

Step 4:
Remove productions with more than 2 variables on
the right-hand side**.**
S→aXbX

S→EF
X→aY|bY
Y→aY|bY|c
E→ax
F→bx

Step 5:
Remove productions with one terminal
and variable together.

X→ay   X→by   Y→aY   Y→bY   E→aX   F→bX

S→EF
X→AY|BY
Y→AY|BY|c
E→Ax
F→Bx
A→a
B→b

2. a) Left most derivation

E
→E * E
→F * E
→a * E
→a * (E)
→a * (E + E)
→a * (F + E)
→a * (aF + E)
→a * (abF + E)
→a * (ab + E)
→a * (ab + F)
→a * (ab + 1F)
→a * (ab + 10F)
→a * (ab + 10)

b) Parse tree