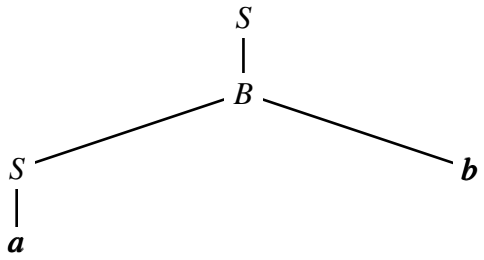
CS 301: Some randomly selected sample questions for midterm 2

Problem Show a derivation tree for the string *ab* with the following grammar (start symbol is *S*):

$$\begin{aligned} S &\rightarrow B\,|\,a\,|\,\varepsilon \\ B &\rightarrow Sb \end{aligned}$$

Solution:



Problem Give an equivalent grammar for the following context free grammar that has no ε-production:

$$\begin{aligned} S &\rightarrow aB \\ B &\rightarrow bS\,|\,\varepsilon \end{aligned}$$

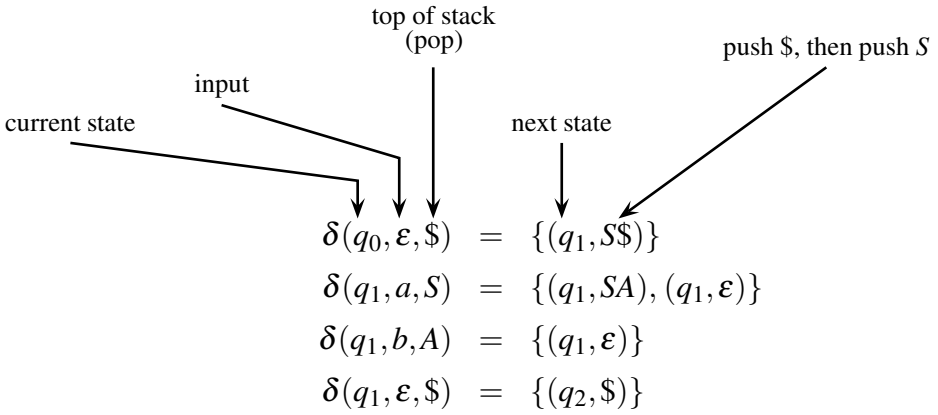
Solution:

$$\begin{aligned} S &\rightarrow aB\,|\,a \\ B &\rightarrow bS \end{aligned}$$

Problem 6 Consider the following push-down automata (PDA):

$$M = \big(\underbrace{\{q_0,q_1,q_2\}}_{\text{set of states}},\ \underbrace{\{a,b\}}_{\substack{\text{input}\\ \text{alphabet}}}\ ,\ \underbrace{\{S,A,\$\}}_{\substack{\text{stack}\\ \text{alphabet}}}\ ,\delta,\ q_0,\ \underbrace{\$}_{\substack{\text{stack}\\ \text{start}\\ \text{symbol}}}\ ,\ \underbrace{\{q_2\}}_{\substack{\text{set}\\ \text{of}\\ \text{final}\\ \text{states}}}\ \big)$$

where the transition function δ is given by:



For the input *ab*, give a sequence of instantaneous descriptions of M from the beginning until *ab* is accepted.

Solution: