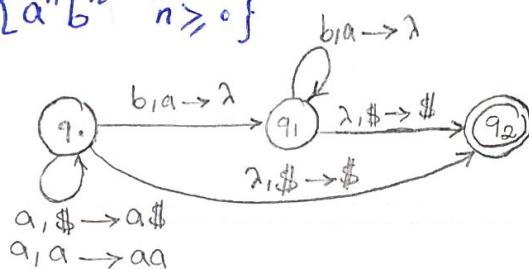
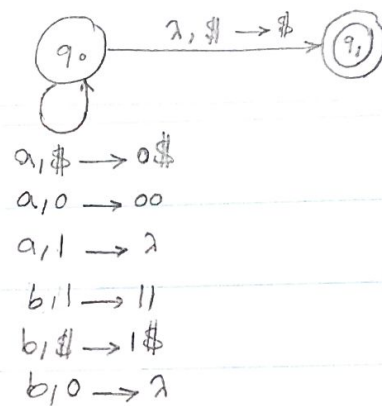


Draw NPDAs for:

1) $\{a^n b^n \mid n \geq 0\}$



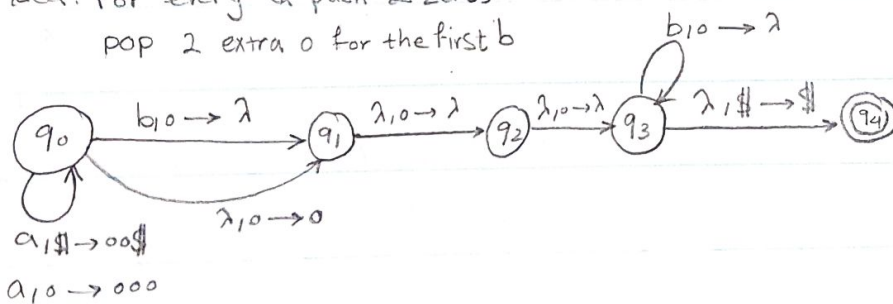
2) $L = \{w \in \{a, b\}^* \mid n_a(w) = n_b(w)\}$



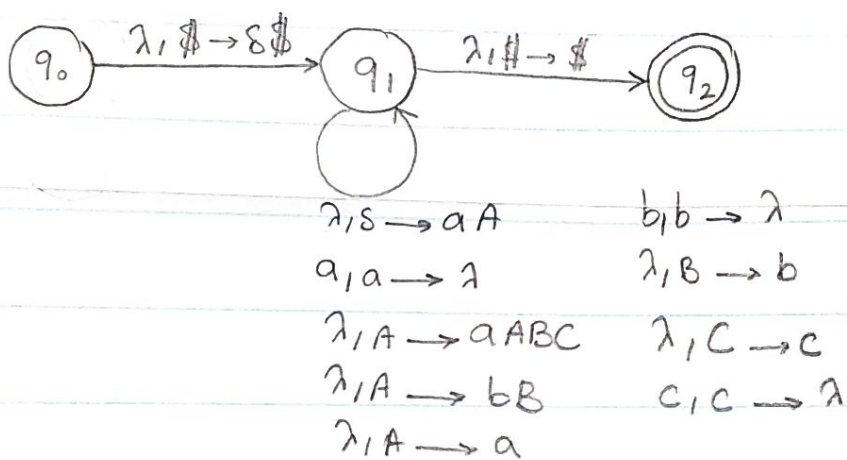
3) $S \rightarrow aSbb|a$

$L = a^{n+1} b^{2n}$

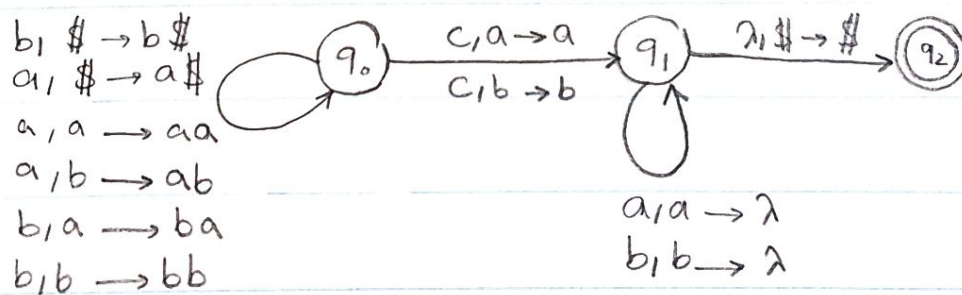
idea: for every a push 2 zeros
pop 2 extra 0 for the first b



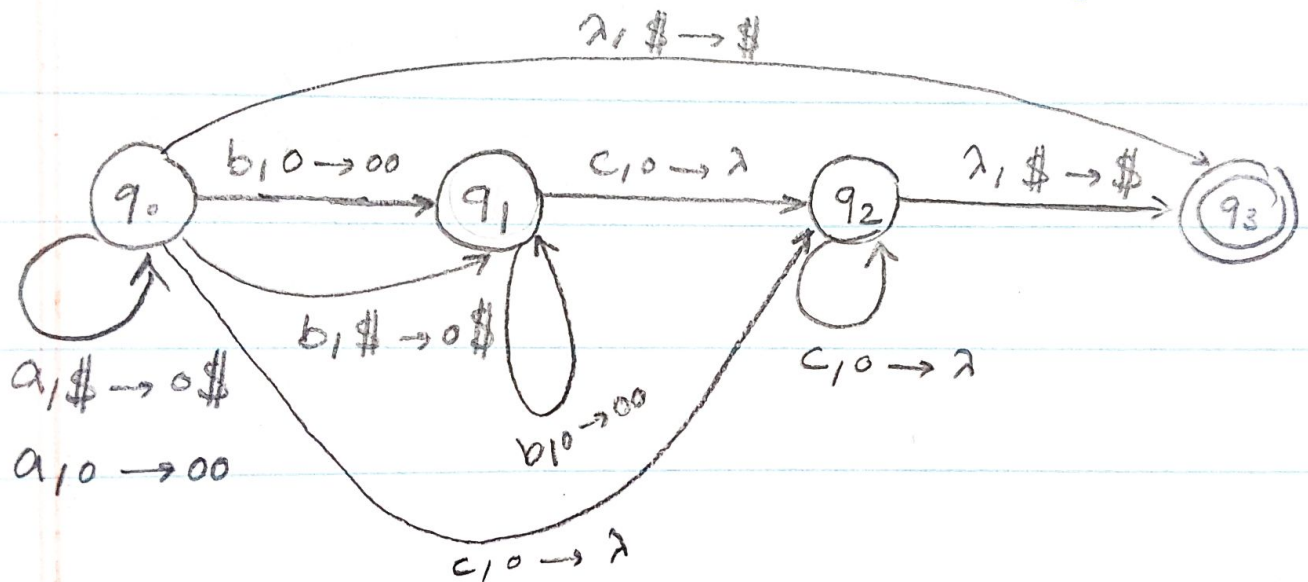
4) $S \rightarrow aA$ $A \rightarrow aABC \mid bB \mid a$ $B \rightarrow b$ $C \rightarrow c$



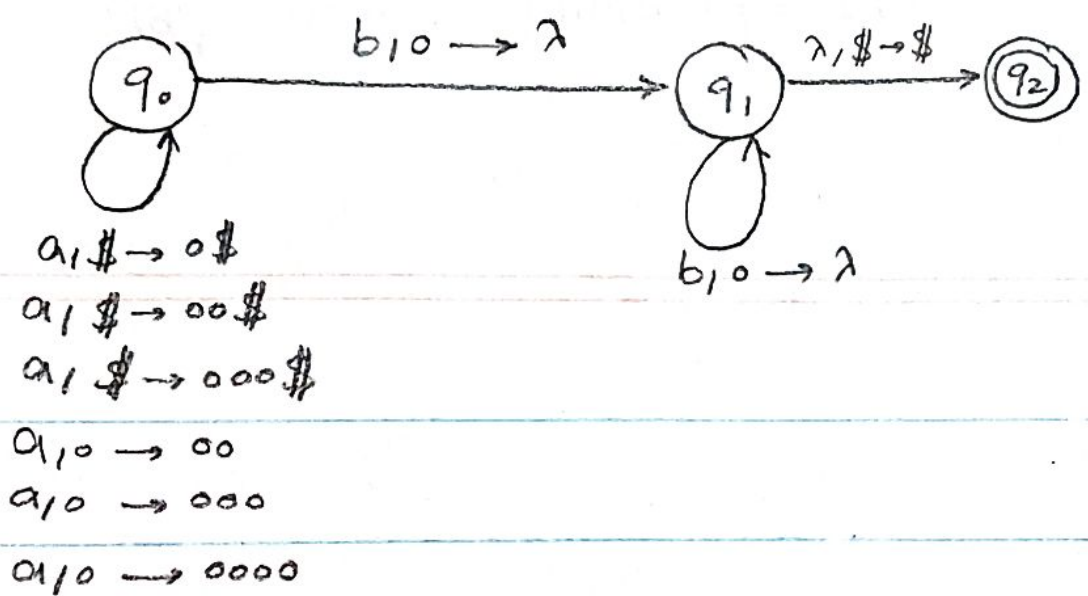
5) $L = \{wcw^R \mid w \in \{a,b\}^*\}$



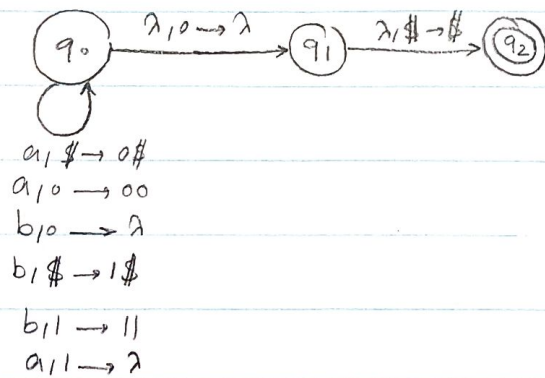
6) $L = \{ a^n b^m c^{n+m} : n \geq 0, m \geq 0 \}$



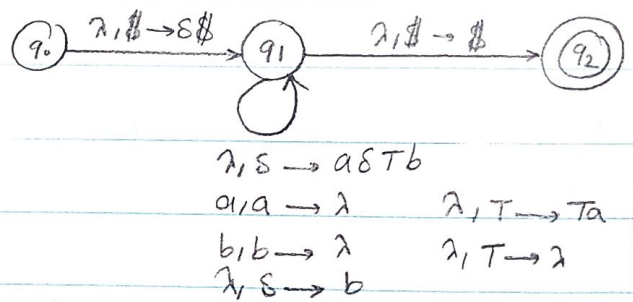
$$7) L = \{a^n b^m \mid n \leq m \leq 3n, n \geq 0\}$$



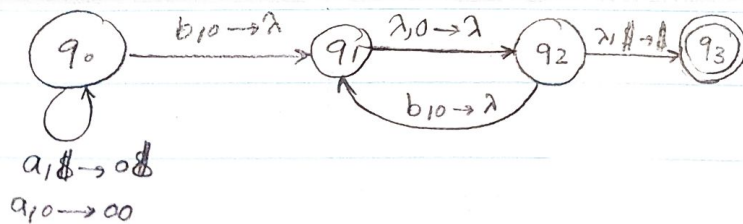
8) $L = \{ w : n_a(w) = n_b(w) + 1, \Sigma = \{a, b\} \}$



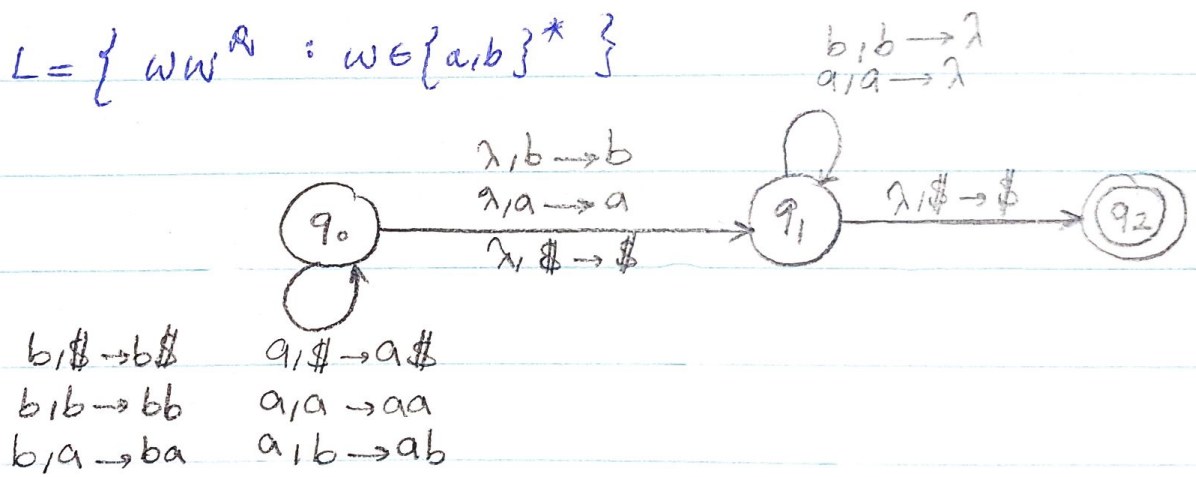
9) $S \rightarrow aSTb, S \rightarrow b, T \rightarrow Ta, T \rightarrow \lambda$



10) $L = \{ a^{2n} b^n : n \geq 0 \}$



11) $L = \{ ww^R : w \in \{a,b\}^* \}$



12) $L = \{a^n b^m \mid n > m\}$

$a, \$ \rightarrow a \$$

$a, a \rightarrow aa$

