1. Let $\Sigma = \{a, b\}$. For the language, L that are defined by each of the following grammars

   (i) $S \to aS \mid Sb \mid \varepsilon$

   (ii) $S \to aS \mid bS \mid \varepsilon$

   Do each of the following:

   (a) List TWO strings that are in L.

   Solution: ab, abb

   (b) List TWO strings that are not in L.

   Solution: There are no strings that are not in L.

   (c) Describe L consisely. You can use regular expressions or set theoretic expressions.

   Solution: The grammar of the language L can be described as $G = (V, \Sigma, P, S)$, where $V = \{a, b, S\}$, $\Sigma = \{0, 1\}$, starting symbol S and productions P described as above.

   The language generated by the grammar, L can be described with the regular expression $L(G) = (a + b)^*$.

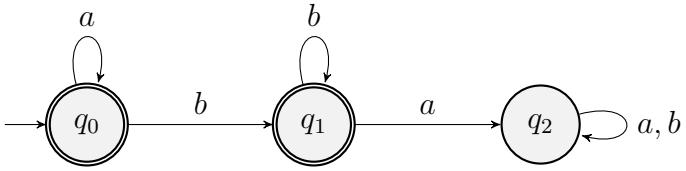
   (d) State whether L is a regular language or not.

   Solution: L is a regular language.

2. Draw a FA diagram for each of the regular grammar below.

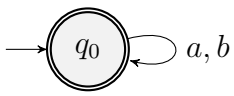
   (a) $S \to aS \mid bA \mid \lambda$
   $A \to bA \mid \lambda$

   Solution:



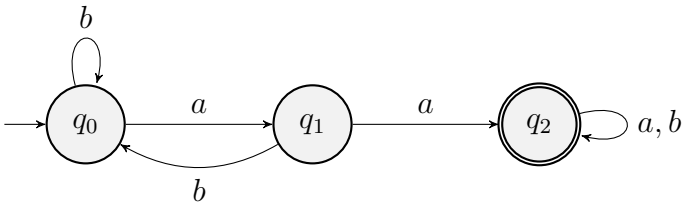
   (b) $S \to aS \mid bA \mid \lambda$
   $A \to aS \mid bA \mid \lambda$

   Solution:



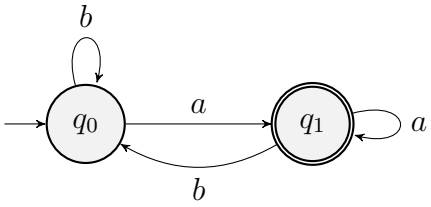
(c) $S \to aA \mid bS$
$A \to aB \mid bS$
$B \to aB \mid bB \mid \lambda$

Solution:



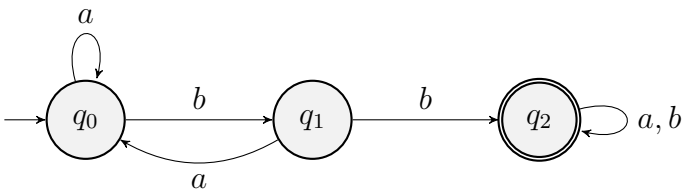
(d) $S \to aA \mid bS$
$A \to aA \mid bS \mid \lambda$

Solution:



(e) $S \to aS \mid bA$
$A \to aS \mid bB$
$B \to aB \mid bB \mid \lambda$

Solution:



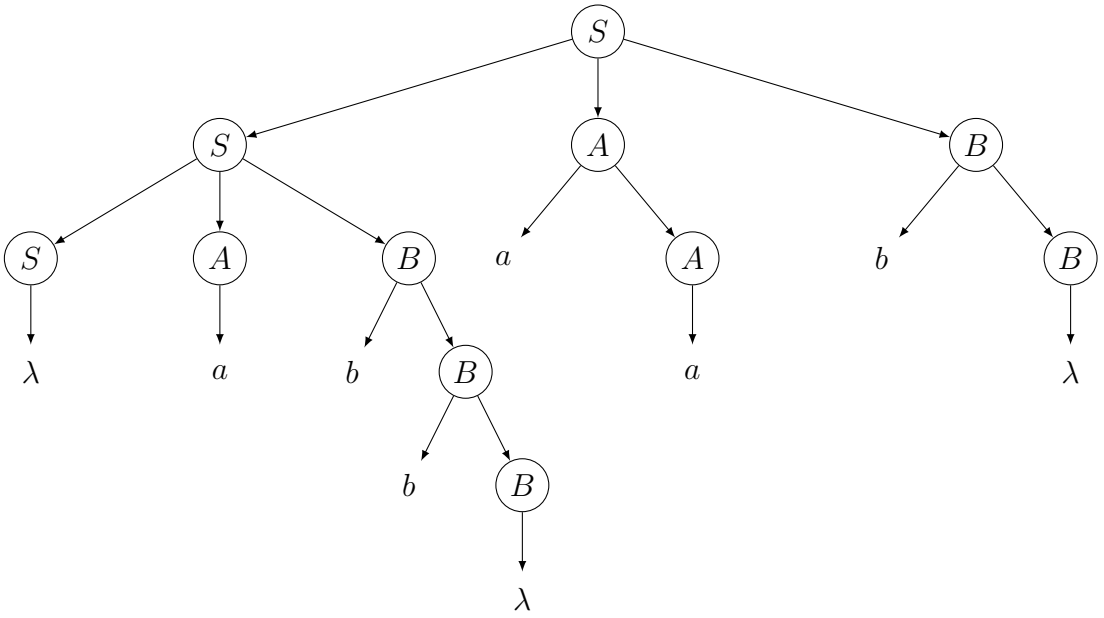
1. Let G be the grammar $S \to SAB \mid \lambda$
$A \to aA \mid a$
$B \to bB \mid \lambda$

   (a) Give a leftmost derivation of string *abbaab*.

   Solution: $S \to SAB \to SABAB \to ABAB \to aBAB \to abBAB \to abbBAB \to abbAB \to abbaAB \to abbaaB \to abbaabB \to abbaab$

   (b) Build the derivation tree for the derivations in part (a).

   Solution:



   (c) Generate TWO other possible strings of the language $L(G)$.

   Solution:
   1) *aabbab*
   (Derivation: $S \to SAB \to SABAB \to ABAB \to aABAB \to aaBAB \to aabBAB \to aabbBAB \to aabbAB \to aabbaB \to aabbabB \to aabbab$)

   2) *aaaabb*
   (Derivation: $S \to SAB \to AB \to aAB \to aaAB \to aaaAB \to aaaaB \to aaaabB \to aaaabbB \to aaaabb$)

   (d) Give a regular expression for $L(G)$.

   Solution: $L(G) = (aa^*b^*)^*$

2.

No.	Language
1	$(a+b)^*$
2	$(a+b)^+$
3	$(a+b)$
4	(ab)
5	a^*bb
6	aa^*bb^*
7	a^*bba^*
8	$a(a+b)^*b$
9	$(a+b)^*bb(a+b)^*$
10	$(a+b)^*aa(a+b)^*$

Matched No	Grammars	CFG or RG
6	$S \to SAB \mid \lambda$ $A \to aA \mid a$ $B \to bB \mid \lambda$	CFG
5	$S \to Abb$ $A \to aA \mid \lambda$	CFG
2	$S \to aS \mid bS \mid a \mid b$	RG
10	$S \to AaaA$ $S \to aA \mid bA \mid \lambda$	CFG
4	$S \to aA$ $A \to b$	RG
9	$S \to aS \mid bS \mid bA$ $A \to bB$ $B \to aB \mid bB \mid \lambda$	RG
8	$S \to aA$ $A \to aA \mid bA \mid b$	RG
1	$S \to aS \mid bS \mid \lambda$	RG
7	$S \to aS \mid bA$ $A \to bB$ $B \to aB \mid \lambda$	RG
3	$S \to a \mid b$	RG