1. Prove that the following language is not regular:
DOUBLE= \{the set of all repeated strings, that is, all words of the form SS where S is any string of a’s and b’s\} = \{ aa, bb, aaaa, abab, baba, aaaaaa, aabaab, abbaab, abbabb, \ldots \}.

2. Prove that the following language is not regular:
Equal-sum = \{a^m b^n a^p b^q where m+n = p+q\}.

3. Exercise # 3, 6(i) page 204
Define the language SQUARE as follows:
SQUARE= \{ a, aaaa, aaaaaaaa, \ldots \} = \{a^n, where n=k^2 is a square of an integer\}. Use pumping lemma to show that SQUARE is nonregular.

4. Exercise # 18 page 221
Construct a decision procedure to determine whether a given FA accepts at least one word that starts with an a.

5. Exercise # 11 page 256
Write a CFG to generate the language MOREA of all strings that have more a’s than b’s.
MOREA=\{ a, aa, aab, aba, baa, aaaa, aaab, aabab, \ldots \}.

6. Exercise # 17 page 257
Show that the following CFGs that use \(\Lambda\) are ambiguous:

(i) \( S \rightarrow XAX \)
\( X \rightarrow aX | bX | \Lambda \)

(ii) \( S \rightarrow aSX | \Lambda \)
\( X \rightarrow aX | a \)

(iii) \( S \rightarrow aS | bS | aaS | \Lambda \)

(iv) Find unambiguous CFGs that generate these languages.

(v) For each of these languages, find an unambiguous grammar that generates exactly the same language except for the word \(\Lambda\). Do this by not employing the symbol \(\Lambda\) in the CFGs at all.