1. Describe the language given by the grammar,

S --> bS | aA | ε

A --> aA | bB | b

B --> bS

$S \to \varepsilon$ allows for termination

$S \to bS$ any # of b

$S \to aA$ a followed by A

$A \to aA$ many a's

$A \to bB$ transitions from A to B

$A \to b$ shows that A ends in B

$B \to bS$ allowing recursion

Any # of leading b's.
A sequence with at least 1 a.

Needs at least 1 b before the last a.

The process can repeat through recursion.

The string can begin with any number of bs. It has to contain at least 1 a and it is followed by at least 1b. It can repeat sequences of a's followed by at least 1b. It can end with any number of b's.

2. Simplify the given grammar,

S → ASA|AC

A → a

S →BSB|BD

B → b

$\cancel{A} \to a$

$\cancel{B} \to b$

$S \to aSa \mid \cancel{aC}$

$S \to bSb \mid \cancel{bD}$

$S \to aSa \mid bSb$

3. Prove that the following is not regular languages, the set of strings of the form 0^i1^j such that

the GCD of i and j is 1.

$w = xyz$

$|xy| \leq p$

$|y| > 0$

$xy^k z \in L$

$w = 0^p 1^{p+1}$

$|xy| \leq p$

$y \neq \varepsilon$

$w' = xy^2z = 0^{p+m} 1^{p+1}$

$w'' = xy^0z = 0^{p-m} 1^{p+1}$

$gcd(p+m, p+1) = gcd(p+m, p+1) = 1$

Can't guarantee that it will be equal to 1.

$L = \{0^i 1^j \mid gcd(i,j) = 1\}$ is not a regular language