**4.1 *Give context-free grammars generating the following sets***

1. ***The set of palindromes (strings that read the same forward as backward) over alphabet (a,b)***

G= (N, T, S, P)

N = {S}

T= {a,b}

S = S (Simbolo inicial)

P = {S -> aSa, bSb,

S-> a

S-> b

S-> Σ }

1. ***The set of all strings over alphabet {a, b} with exactly twice as many a´s and b´s.***

G= (N, T, S, P)

N = {S}

T= {a, b}

P = { S -> SaSbSaS,

S -> SaSaSbS

S -> SbSaSaS

S -> Σ }

***4.8* Let G be the gramar**

***S-> aB|bA***

***A-> a|aS|bAA***

***B->b|bS|aBB***

**For the string aaabbabbba find a:**

1. **leftmost derivation.**

S -> aB -> aaBB -> aaaBBB -> aaabSBB -> aaabbABB -> aaabbaBB -> aaabbabB

-> aaabbabbS -> aaabbabbbA -> aaabbabbba

1. **rightmost derivation.**

S -> aB -> aaBB -> aaBbS -> aaBbbA -> aaBbba -> aaaBBbba -> aaaBbSbba

-> aaaBbaBbba -> aaaBbabbba -> aaabbabbba

1. **Parse tree.**

S

a

B

a

B

B

a

B

B

S

b

S

b

b

b

A

a

b

A

a