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25  $S \rightarrow aSa \mid bSb \mid a \mid b \mid \lambda$  generates  
 $PAL = \{w \in \{a,b\}^* \mid w = w^R\}$

i)  $S \rightarrow \lambda$

ii)  $S \rightarrow a$

iii)  $S \rightarrow b$

iv)  $S \rightarrow aSa \rightarrow aqa$

v)  $S \rightarrow bSb \rightarrow bbb$

vi)  $S \rightarrow aSa \rightarrow aba$

vii)  $S \rightarrow bSb \rightarrow bab$

viii)  $S \rightarrow aSa \rightarrow abSba \rightarrow ababq$

ix)  $S \rightarrow aSa \rightarrow abSba \rightarrow abbba$

x)  $S \rightarrow aSa \rightarrow abSba \rightarrow abba$

xi)  $S \rightarrow bSb \rightarrow bbSbb \rightarrow bbbbb$

xii)  $S \rightarrow bSb \rightarrow bbSbb \rightarrow bbabb \rightarrow bbbb$

xiii)  $S \rightarrow bSb \rightarrow bbSbb \rightarrow bbabbb$

xiv)  $S \rightarrow bSb \rightarrow baSab \rightarrow baabab \rightarrow baab$

xv)  $S \rightarrow bSb \rightarrow baSab \rightarrow baqaab$

xvi)  $S \rightarrow bSb \rightarrow baSab \rightarrow baabab$

xvii)  $S \rightarrow aSa \rightarrow qaSaqa \rightarrow qaabaqa$

xviii)  $S \rightarrow aSa \rightarrow qaSaqa \rightarrow qaabSbaqa \rightarrow qaababaqa$

xix)  $S \rightarrow aSa \rightarrow qaSaqa \rightarrow qaqaSaqa \rightarrow qaqaqaqa$

xx)  $S \rightarrow aSa \rightarrow qaSaqa \rightarrow qaabSbaqa \rightarrow qaabababaqa$

26 i)  $S \rightarrow aS \mid bS \mid a$

$S \rightarrow a$

$S \rightarrow aS \rightarrow aa$

$S \rightarrow bS \rightarrow ba$

$S \rightarrow aS \rightarrow abS \rightarrow ab^2$

$S \rightarrow bS \rightarrow baS \rightarrow ba^2$

$S \rightarrow aS \rightarrow aaS \rightarrow aa^2$

$S \rightarrow bS \rightarrow bbS \rightarrow bb^2$

$L(G) = \{ a, aa, ba, aba, baa, \dots \}$

ii)  $S \rightarrow aSa | bSb | aSb | \lambda$

$S \rightarrow \lambda$

$S \rightarrow aSa \rightarrow aa$

$S \rightarrow bSb \rightarrow bb$

$S \rightarrow aSb \rightarrow a\lambda b \rightarrow ab$

$S \rightarrow aSa \rightarrow abSba \rightarrow ab\lambda ba \rightarrow abba$

$S \rightarrow bSb \rightarrow baSab \rightarrow ba\lambda ab \rightarrow baab$

$S \rightarrow aSa \rightarrow aaSba \rightarrow aa\lambda ba \rightarrow aaaba$

$S \rightarrow aSb \rightarrow aaSab \rightarrow aa\lambda ab \rightarrow aaab$

$L(G) = \{ \lambda, aa, bb, ab, abba, baab, \dots \}$

iii)  $S \rightarrow aAb | aBb | aSb$

$A \rightarrow aA | a$

$B \rightarrow bB | b$

$S \rightarrow aAb \rightarrow a$

$S \rightarrow aAb \rightarrow aaAb \rightarrow aaab$

$S \rightarrow aBb \rightarrow abb$

$S \rightarrow aBb \rightarrow abBb \rightarrow abbb$

$S \rightarrow aSb \rightarrow aaAbb \rightarrow aaabbb$

$S \rightarrow aSb \rightarrow aaBbb \rightarrow aaabbb$

$L(G) = \{ a, aaab, abb, abbb, \dots \}$

$$27) S \rightarrow aAb$$

$$A \rightarrow aA \mid bA \mid \lambda$$

$$S \rightarrow aAb \rightarrow a\lambda b \rightarrow ab$$

$$S \rightarrow aAb \rightarrow aAAb \rightarrow aab$$

$$S \rightarrow aAb \rightarrow abAb \rightarrow ab\lambda b \rightarrow abb$$

$$S \rightarrow aAb \rightarrow aAAb \rightarrow aabAb \rightarrow aab\lambda b \rightarrow aabb$$

$$S \rightarrow aAb \rightarrow abAb \rightarrow abAAb \rightarrow abA\lambda b \rightarrow ababb$$

$$S \rightarrow aAb \rightarrow aAAb \rightarrow aabAb \rightarrow aabbAAb \rightarrow aabbA\lambda b \rightarrow aabba$$

$$a(ab)^m b \mid m \geq 0$$

$$ii) S \rightarrow aSb \mid ab$$

$$S \rightarrow ab$$

$$S \rightarrow aSb \rightarrow aabb$$

$$a^n b^n \mid n > 0$$

$$iii) S \rightarrow aSc \mid aAc$$

$$A \rightarrow aAb \mid ab$$

$$S \rightarrow aAc \rightarrow aabcc$$

$$S \rightarrow aAc \rightarrow aAAbc \rightarrow aaaa bcc$$

$$S \rightarrow aSc \rightarrow aAacc \rightarrow aaaa bccc$$

$$S \rightarrow aSc \rightarrow aAaAc \rightarrow aaaa Abcc \rightarrow aaaa abccc$$

$$a^n a^m b^m c^n \mid m > 0, n > 0$$

$$27) S \rightarrow AB$$

$$B \rightarrow bB|b$$

$$A \rightarrow aA|a$$

$$S \rightarrow AB \rightarrow aB \rightarrow ab$$

$$S \rightarrow AB \rightarrow aAB \rightarrow aAbB \rightarrow aabb$$

$$S \rightarrow AB \rightarrow aB \rightarrow abb \rightarrow abb$$

$$a^m b^n \mid m > 0, n > 0$$

$$28) L(G) = a^n b^m \mid n > m$$

$$S \rightarrow AB$$

$$A \rightarrow aA|a$$

$$B \rightarrow bB|b$$

$$29) S \rightarrow aS|bS|a|b$$

$$i) babbaa$$

$$S \rightarrow bS \rightarrow baS \rightarrow babS \rightarrow babbs \rightarrow babbaS \rightarrow babbaa$$

$$ii) ba bababa$$

$$S \rightarrow bS \rightarrow baS \rightarrow babS \rightarrow babaS \rightarrow bababS \rightarrow babababS \rightarrow babababa$$

$$iii) aaqbaa$$

$$S \rightarrow aS \rightarrow aaS \rightarrow aaaS \rightarrow aaqabS \rightarrow aaqabaS \rightarrow aaqabaq$$

iv) baabaaa

$S \rightarrow bS \rightarrow baS \rightarrow baas \rightarrow baabS \rightarrow baabbaS \rightarrow baabbaaS \rightarrow baabbaaaa$

30)  $w \in \{a, b\} \mid |w| \bmod 2 = 0$

$S \rightarrow aSb \mid aSa \mid bSb \mid ab \mid \epsilon$

i)  $w \in \{a, b\} \mid |w| \bmod 2 = 1$

$S \rightarrow aSb \mid aSa \mid bSb \mid a \mid b$

ii)  $w \in \{a, b\} \mid |w| \bmod 3 = 0$

iv)  $w \in \{a, b\} \mid |w| \bmod 3 = 2$

iv) all strings with the same power

v) each string is starting and ending with the same symbol