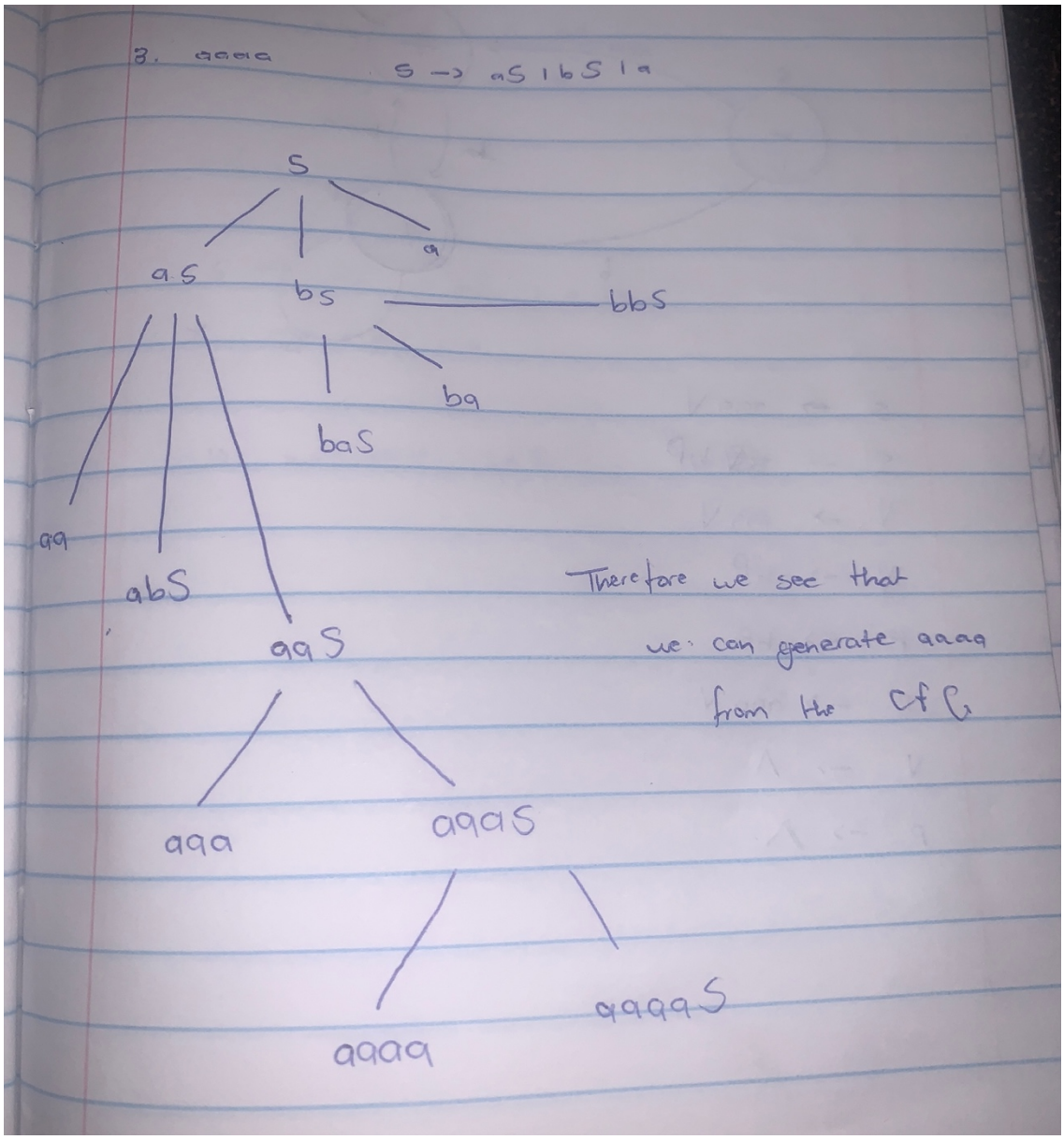
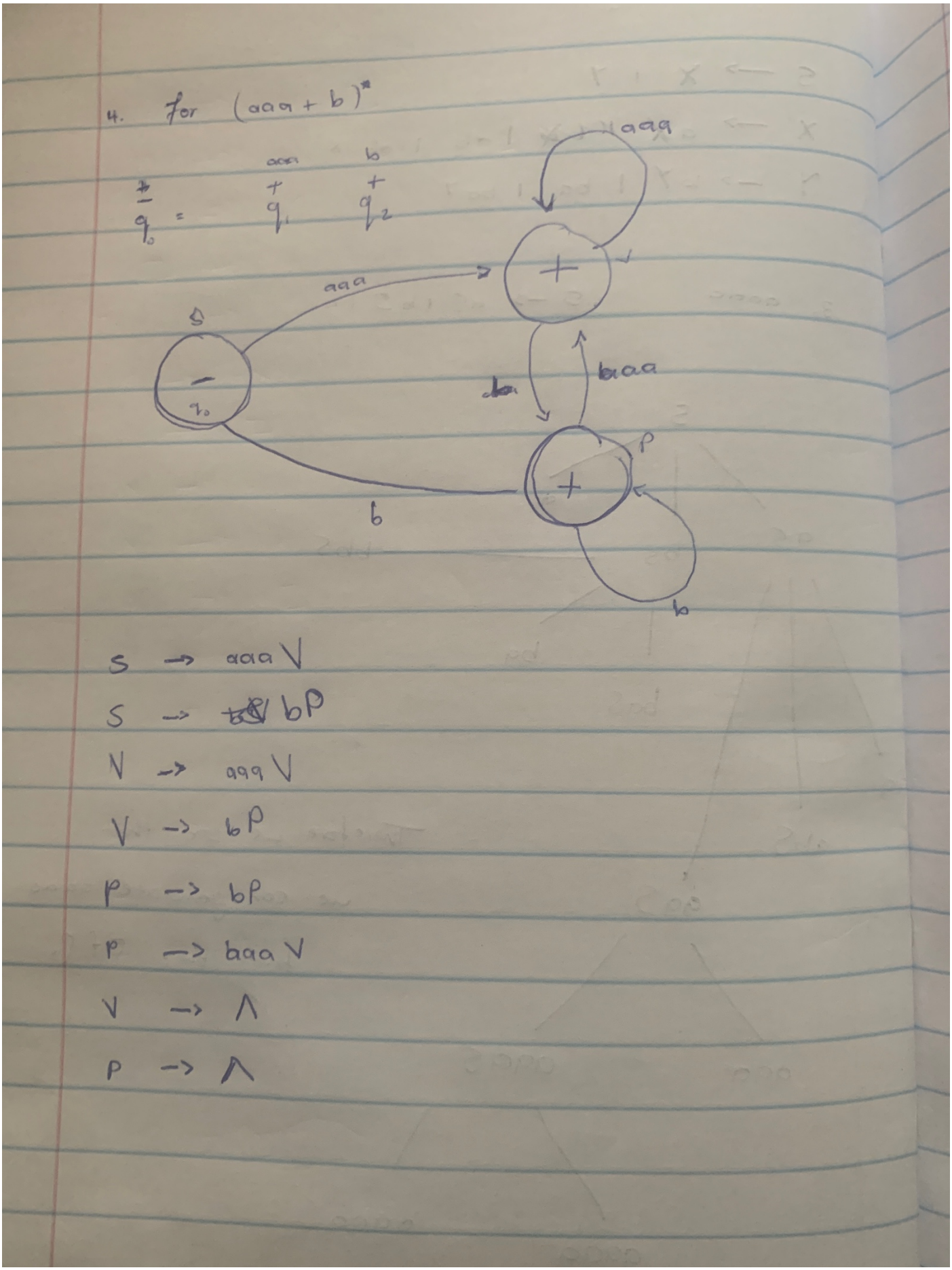
Cos3701 Task

1. (b + a)*a(b + a)*a(a + b)*
   This is the language with atleast 2 a's

2. S -> X | Y
   X -> aX | ab | abX
   Y -> bY | ba | baY
3. ok



4. ok



S -> aaa V

S -> ~~bS~~ V bP

V -> aaa V

V -> bP

P -> bP

P -> baa V

V -> Λ

P -> Λ

5. S -> aX | bS | a | b
   X -> aX | a | **Λ**
   Since only S -> aX and X -> aX contain the X that leads to **Λ**
   then only X -> a

   therefore

   S -> aX | bS | a | b
   X -> aX | a |

   Defines the same CFG

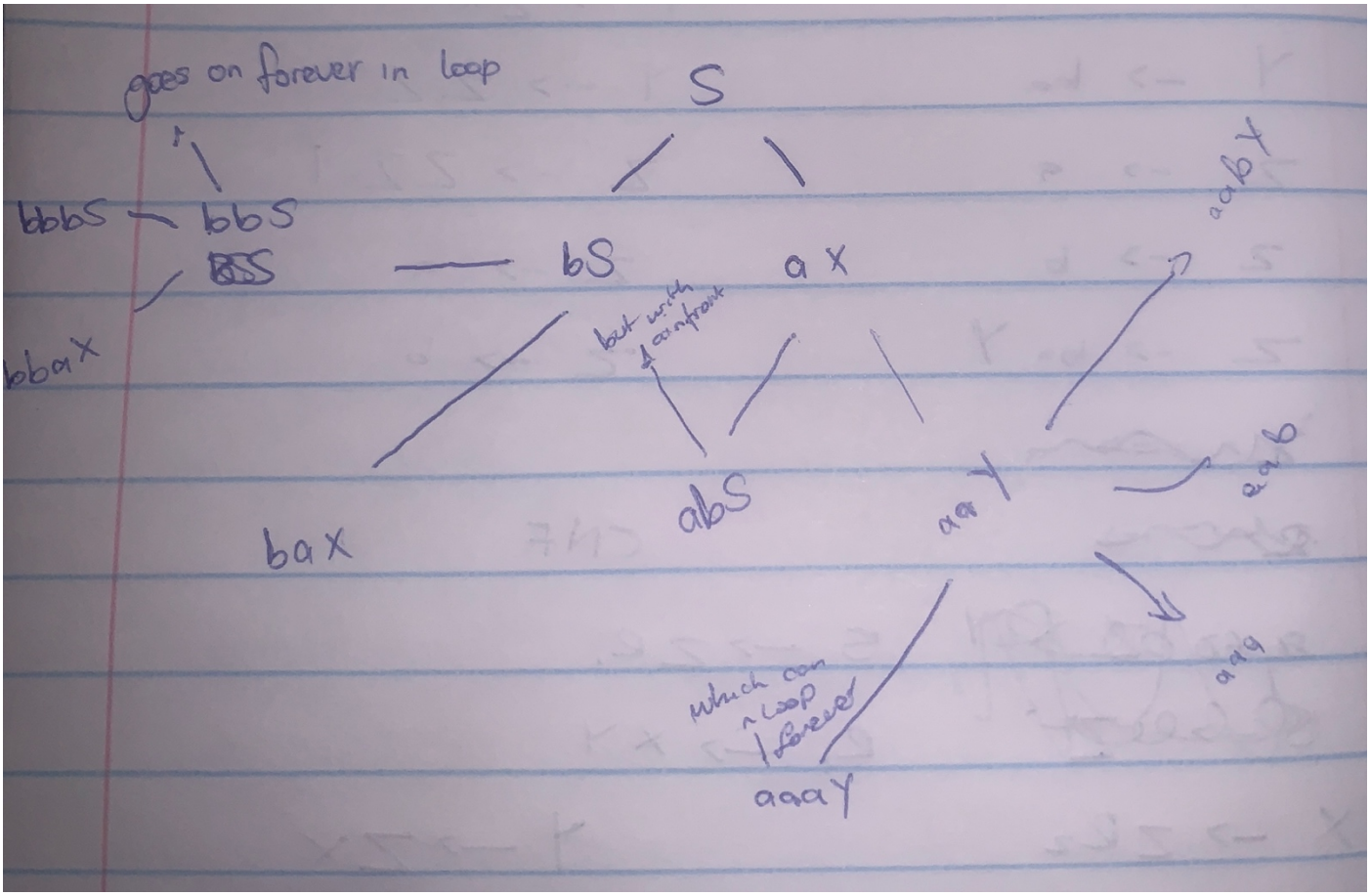
6. S -> aXY | Z
   X -> bbb | bX | aZ
   Y -> aS | **Λ**
   Z -> a | b | baY | **Λ**

Split	Remove the **Λ**	Reformulated
S -> aXY	S -> aXY	S -> ZXY
S -> Z	S -> Z	S -> Z
X -> bbb	X -> bbb	X -> ZZZ
X -> bX	X -> bX	X -> ZX
X -> aZ	X -> aZ	X -> ZZ
Y -> aS	Y -> aS	Y -> ZS
Y -> **Λ**	Y -> **aX**	Y -> ZX
Z -> a	Y -> ba	Y -> ZZ
Z -> b	Z -> a	Z -> ZZY
Z - > baY	Z -> b	Z -> a
Z -> **Λ**	Z - > baY	Z -> b

   Chomsky Normal Form

   S –> ZR
   R –> XY
   X –> ZR
   R –> ZZ
   X –> ZX
   X –> ZZ
   Y –> ZS
   Y –> ZZ
   Y –> ZX
   Z –> ZR
   R –> ZY
   Z –> a
   Z –> b

7. S -> bS | ax
   X -> bS | aY
   Y -> aY | bY | a | b



b*a(b*a)*a(a + b)*
The language of the first 2 b's having an a after them. It also has at least 2 a's.

8.