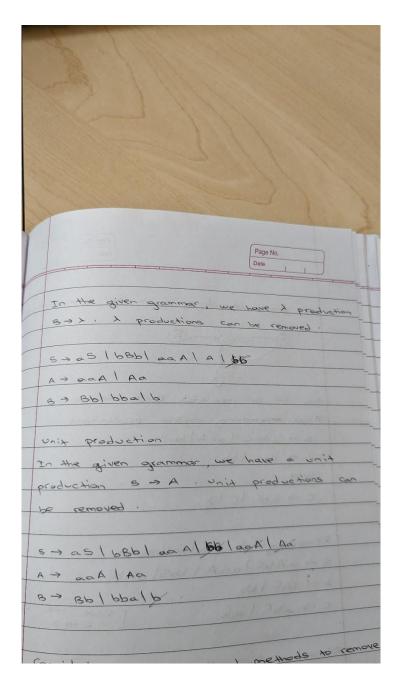
1. Remove all useless productions, λ -productions, and unit productions from the following grammar (without introducing any new useless productions, λ -productions, or unit productions):

$$S \rightarrow aS|bBb|aaA|A$$

- A -> aaA | Aa
- $B \rightarrow Bb|bba|\lambda$

Page No. Date
1. In CFG, a non terminal symbol 'A' is a nullable variable is there is a production An
e or there is a derivative that storts at A and leads to E.
· To remove A > E, look for all productions who
Replace each 'A' with 'E' in each production. Add the resultant productions to grammar.
Any production of form A > B where A B E non terminal is called unit production.
· To remove A > B, add production A > 2 to the grammar rule .
[x e terminal, x can be Null]
Delete A > B from the grammar.
· Repeat above steps until all unit production are removed.
In the given grammar, there is no useless
both non terminal A and non terminal B are
> Production



2. Remove all useless productions, λ -productions, and unit productions from the following grammar (without introducing any new useless productions, λ -productions, or unit productions):

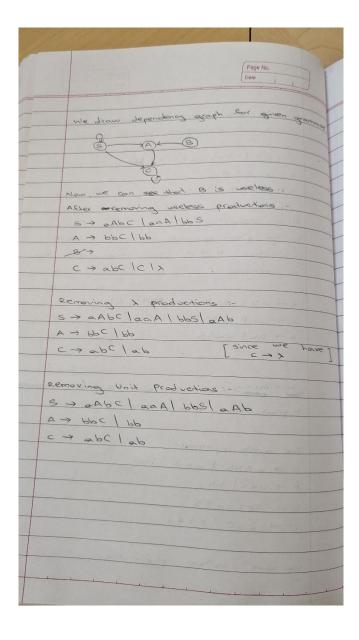
S -> aAbC|aaA|bbS

 $A \rightarrow bbC|bb$

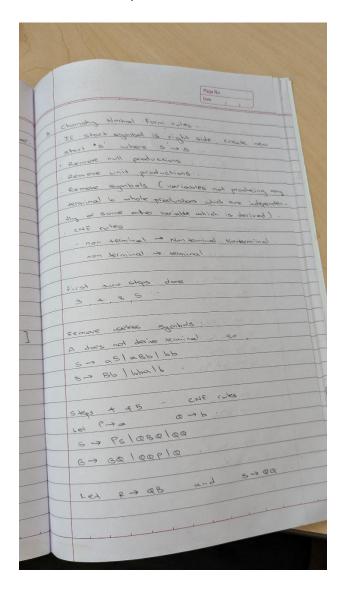
 $B \rightarrow Ab|ba|\lambda$

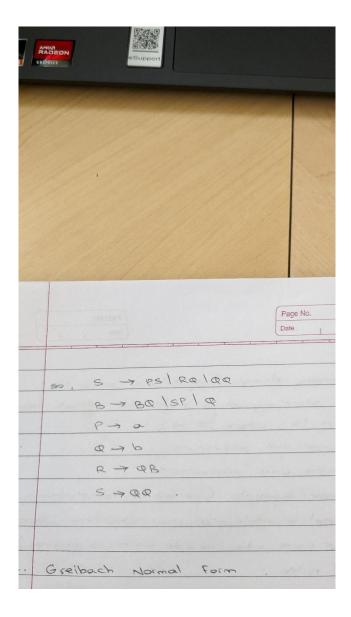
 $C \rightarrow abC|C|\lambda$

1/	preduction 5 4 have a write	-
1	removed. Dit prod whit	-
/	the sections	-
/	- AN	-
	A 7 aaA Aa	
	2 aga I Ag	
	A	
	B -> Bb bba b	
		-
	Considering all sides	
2:	A productions of unit product	
	A productions & unit productions.	16
_		
	The given grammar	
	s > a A b C aa A bbs	-
	A > lob c bb	
	B -> Ablbalx	
	c -> abc lelex	
	We have useless productions -	
	We have socios processing	
-		

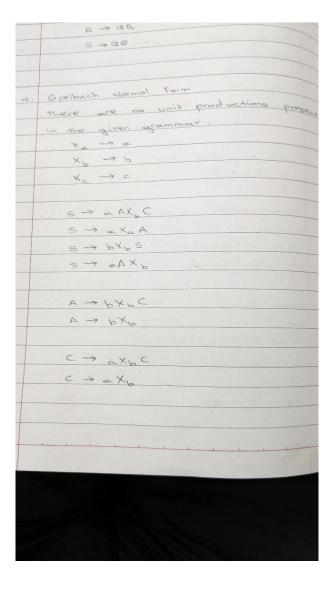


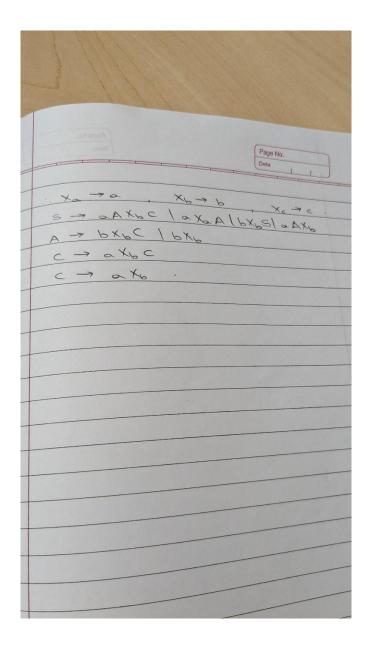
3. Convert the grammar from #1 to Chomsky normal form.



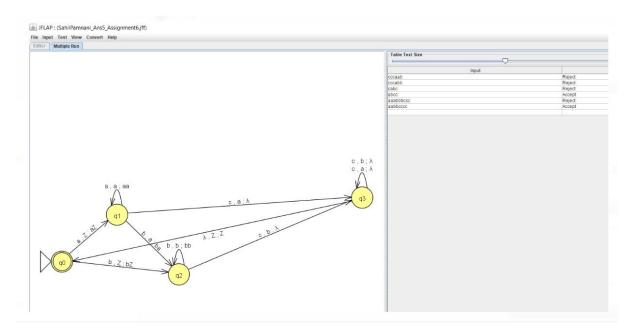


4. Convert the grammar from #2 to Greibach normal form.





5. Create a npda for the language $L = (a^x b^y c^z : z = x + y)$.



6. Create a npda for the language $L = (a^nb^n : n \text{ is not a multiple of 3})$ (zero should be considered a multiple of 3).

