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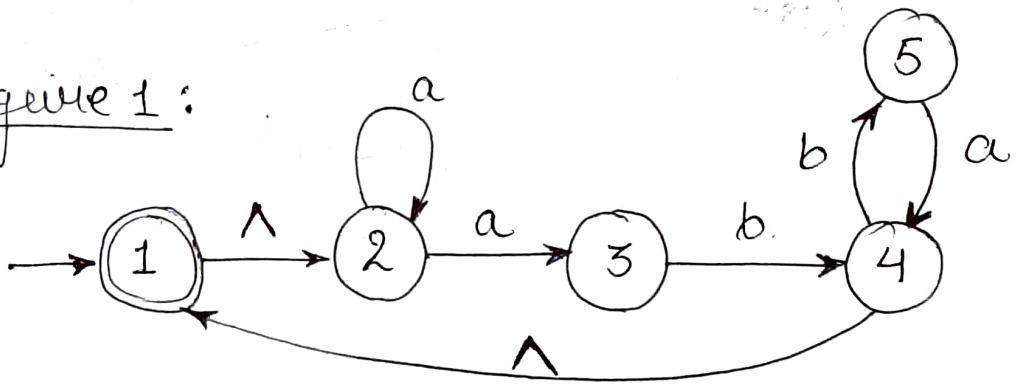
Problem Sheets-2

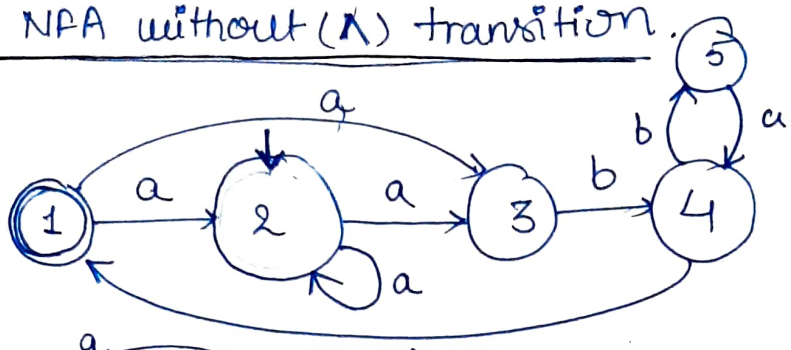
CSPC-41

(1) figure 1:

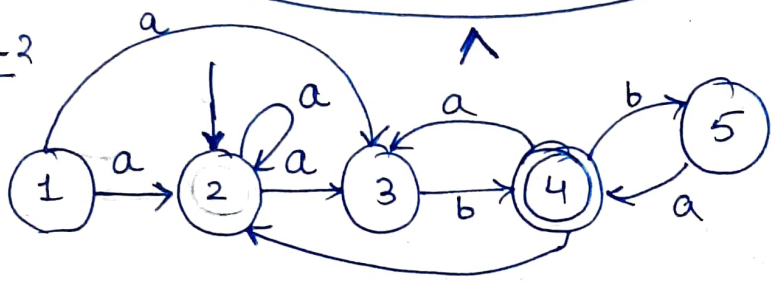


(a) Equivalent NFA without (^) transition.

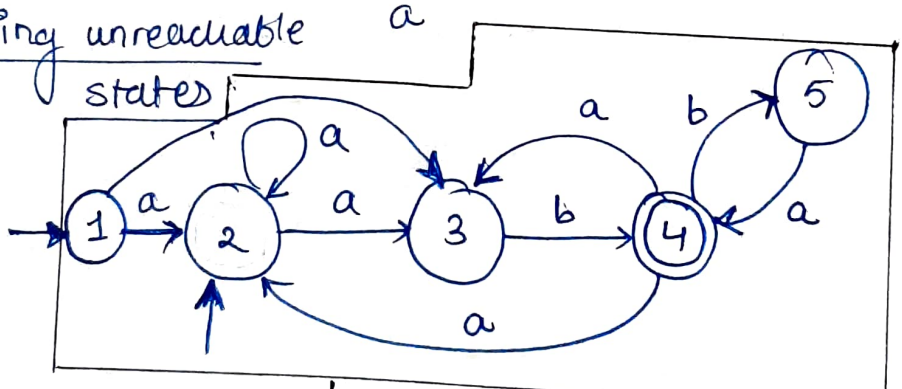
Step-1



Step-2



Step: removing unreachable states



↳ NFA without Null (^) transition

(b) conversion into DFA with null (^) transition

δ_E	a	b	ε
→ (1)	ϕ	ϕ	{2}
2	{2,3}	ϕ	ϕ
3	ϕ	{4}	ϕ
4	ϕ	{5}	{1}
5	{4}	ϕ	ϕ

$\in$-closure(1) = {1,2}
$\in$-closure(2) = {2}
$\in$-closure(3) = {3}
$\in$-closure(4) = {4,1,2}
$\in$-closure(5) = {5}
$\in$-closure({2,3}) = {2,3}

now, for.

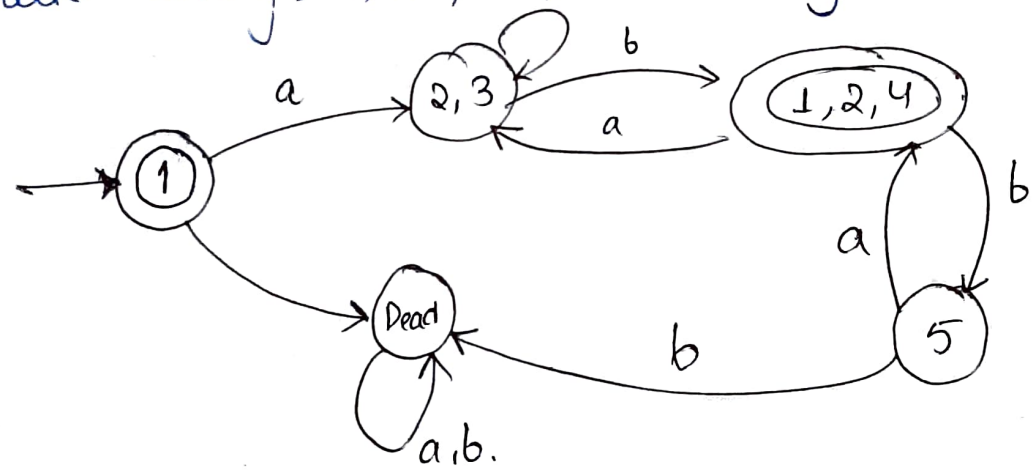
DFA

δ_D	a	b
→ {1,2}	{2,3}	ϕ
{2,3}	{2,3}	{1,2,4}
{1,2,4}	{2,3}	5
5	{1,2,4}	ϕ

$Q'' = \{1^*, \{2,3\}, \{1,2,4\}^*, 5, Dead\}$.

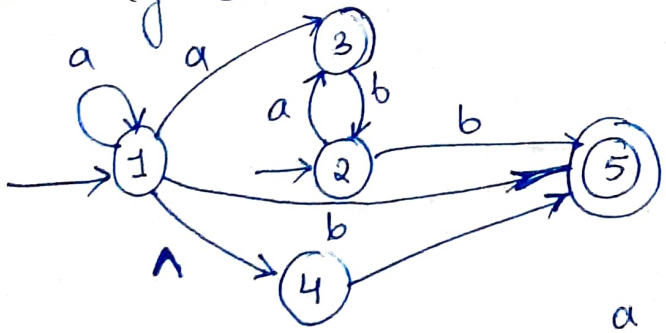
$F'' = \{1^*, \{1,2,4\}^*\}$

{ valid string : ϵ, ab, abab, aab, aaab }
{ invalid string : b, bb, bbb, bbb, bbbb. }

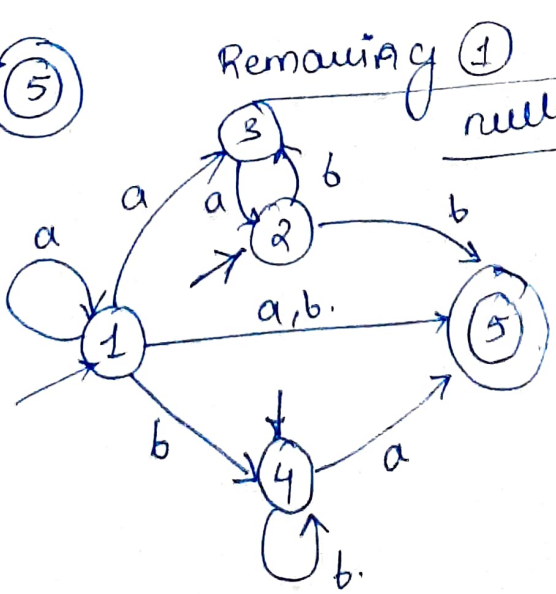


(2)

Removing (1) to (2) null transition



Removing (1) to (4) null transition



δ'' (DFA)

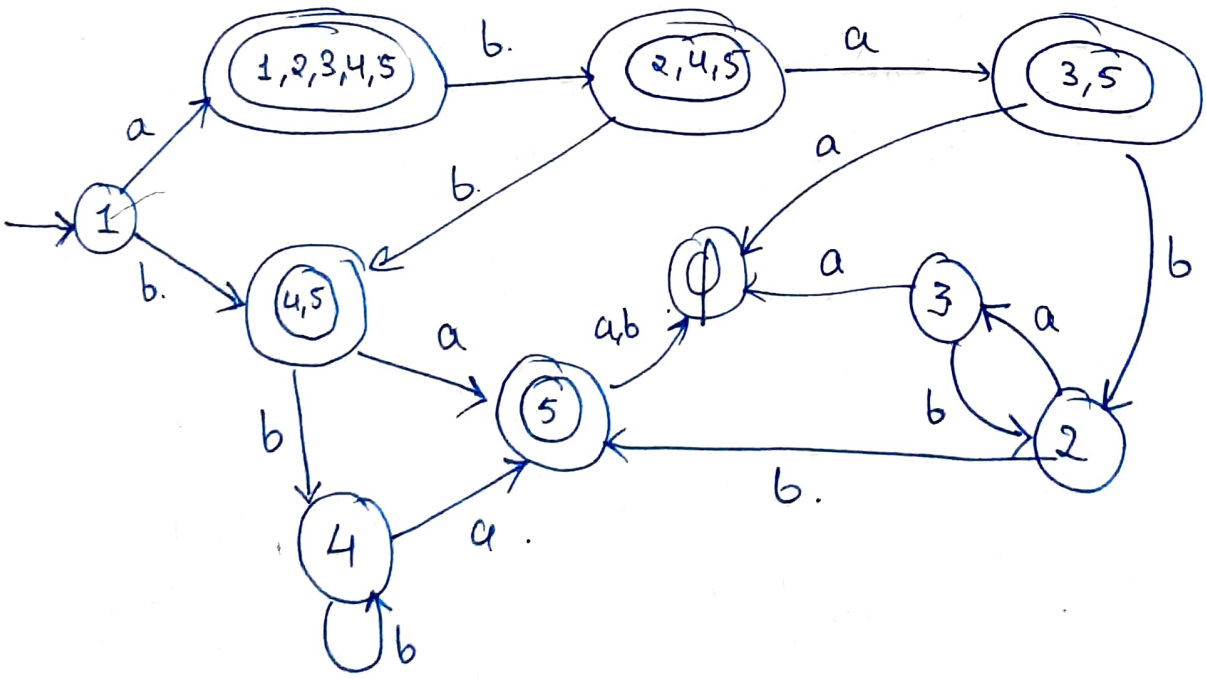
	a	b
1	{1,2,3,4,5}	{4,5}
→ {1,2,3,4,5}	{1,2,3,4,5}	{2,4,5}
→ {4,5}*	{5}	{4}
→ {2,4,5}	{3,5}	{5,4}
→{5}*	ϕ	ϕ
{4}	{5}	{4}
→ {3,5}*	ϕ	{2}
→ {5,4}*	{5}	{4}
{2}	{3}	{5}
{3}	ϕ	{2}
ϕ	ϕ	ϕ

valid strings:

aa, ab, aaa, aaaa, aaaa

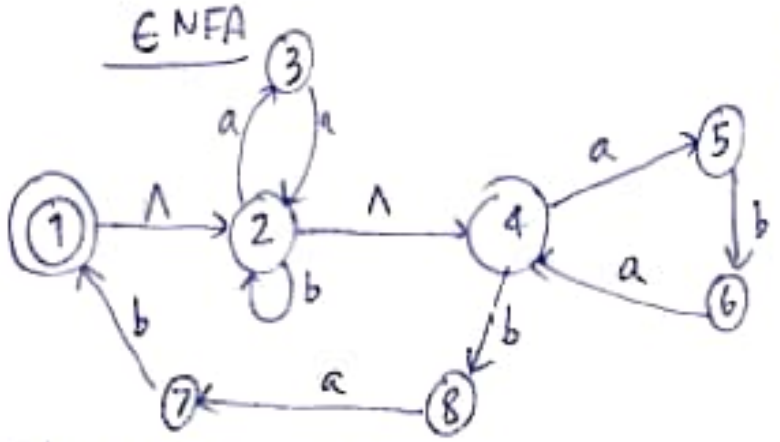
invalid: baa, bab, baaa.
baba, babb.
etc

F'' = final states.
of equivalent
DFA.
= {{5}, {5,4}*, {3,5}*, {1,2,3,4,5}*, {2,4,5}*}



3.

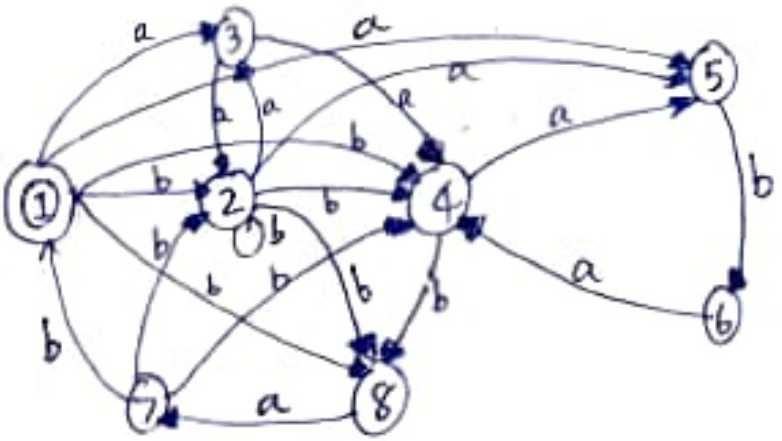
∈ NFA



q	Λ(q)
1	1,2,4
2	2,4
3	3
4	4
5	5
6	6
7	7
8	8

No.	δ'(NFA)	a	b
1		3,5	2,4,8
2		3,5	2,4,8
3		2,4	ϕ
4		5	8
5		ϕ	6
6		4	ϕ
7		ϕ	1,2,4
8		7	ϕ

NFA



No.	δ''(DFA)	a	b
1		{3,5}	{2,4,8}
{3,5}		{2,4}	{6}
{2,4,8}		{3,5,7}	{2,4,8}
{2,4}		{3,5}	{2,4,8}
{6}		{4}	Dead (ϕ)
{3,5,7}		{2,4}	{1,2,4,6}
~~{3,5}~~ {4}		{5}	{8}
{1,2,4,6}		{3,4,5}	{2,4,8}
{5}		ϕ (Dead)	{6}
{8}		{7}	Dead
{3,4,5}		{2,4,5}	{6,8}
{7}		ϕ Dead	{1,2,4}
{2,4,5}		{3,5}	{2,4,6,8}

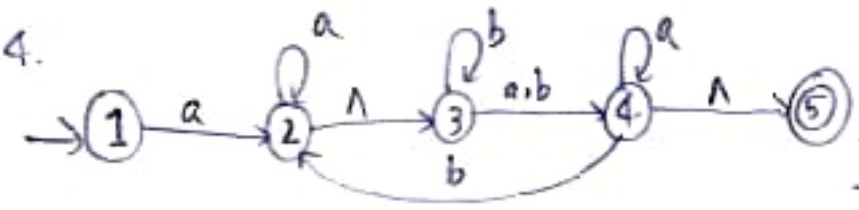
δ'' (DFA)	a	b
{6,8}	{4,7}	Dead
{1,2,4}	{3,5}	{2,4,8}
{2,4,6,8}	{3,4,5,7}	{2,4,8}
{4,7}	{5}	{1,2,4,8}
{3,4,5,7}	{2,4,5}	{1,2,4,6,8}
{1,2,4,8}	{3,5,7}	{2,4,8}
{1,2,4,6,8}	{3,4,5,7}	{2,4,8}.
Dead	Dead	Dead

F'' = Final States of DFA = {{1,2,4,6}, {1,2,4}, {1,2,4,8}, {1,2,4,6,8}}

Valid Strings : ∈, ~~b, aa, aba~~, bab, aabab, bbab, aabbabetc

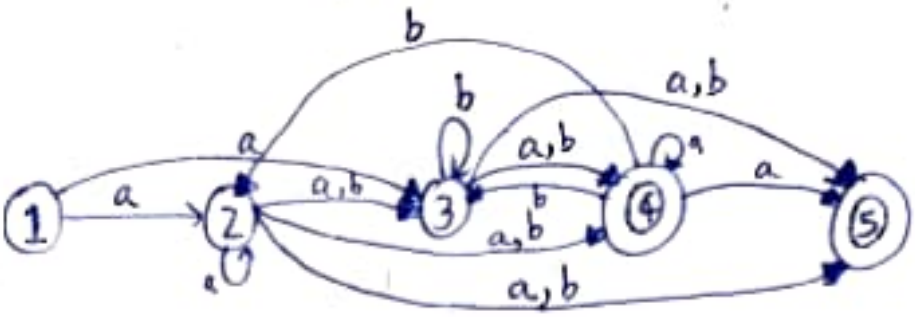
Invalid Strings : abb, abbb, abba, abbbb, abbba.

4.



q	Λ(q)
1	1
2	2, 3
3	3
4	4, 5
5	5

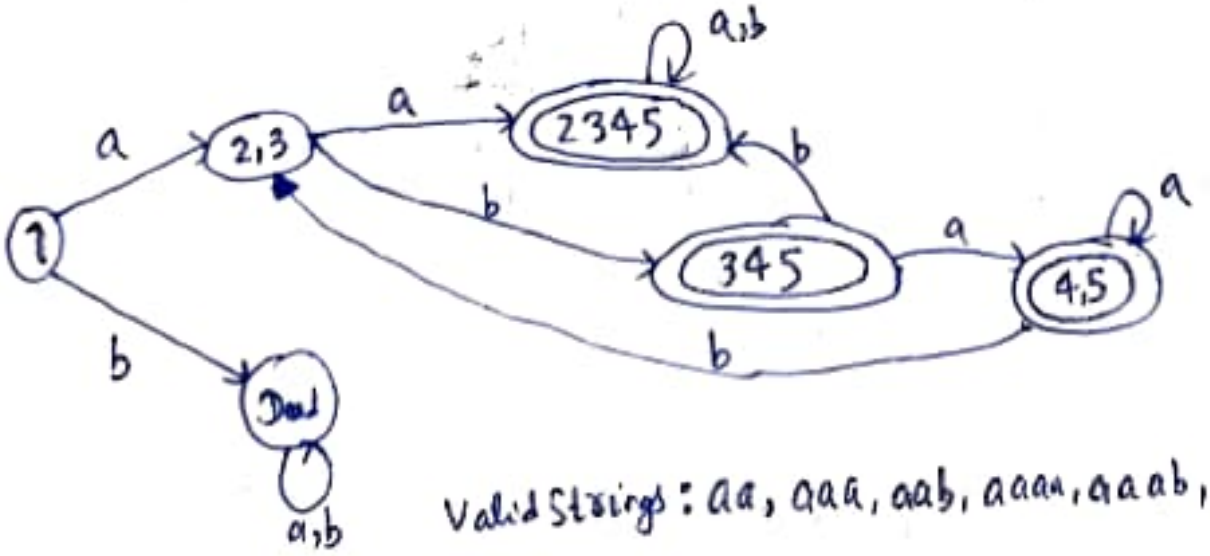
δ'(NFA)	a	b
1	2, 3	ϕ
2	2, 3, 4, 5	3, 4, 5
3	4, 5	3, 4, 5
4	4, 5	2, 3
5	ϕ	ϕ



Now

δ''(DFA)	a	b
{1}	{2,3}	Dead
{2,3}	{2,3,4,5}	{3,4,5}
{2,3,4,5}	{2,3,4,5}	{2,3,4,5}
{3,4,5}	{4,5}	{2,3,4,5}
{4,5}	{4,5}	{2,3}
Dead	Dead	Dead

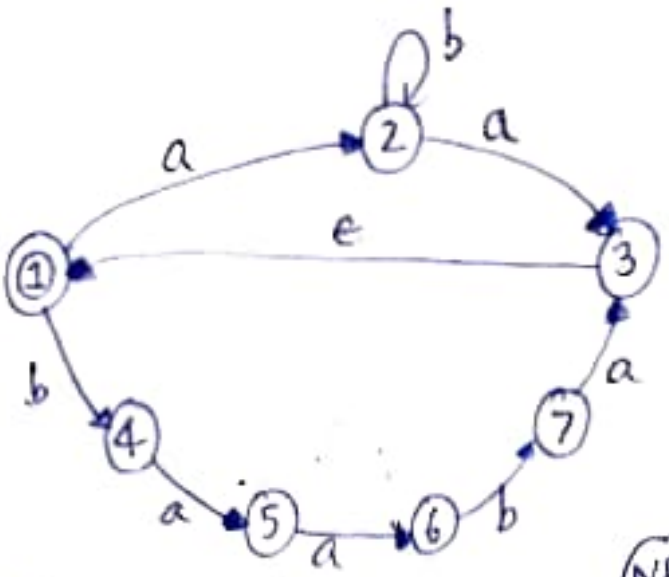
$F''(DFA) = \{\{2,3,4,5\}, \{3,4,5\}, \{4,5\}\}$.



Valid Strings : aa, aaa, aab, aaaa, aaab, aabb etc.

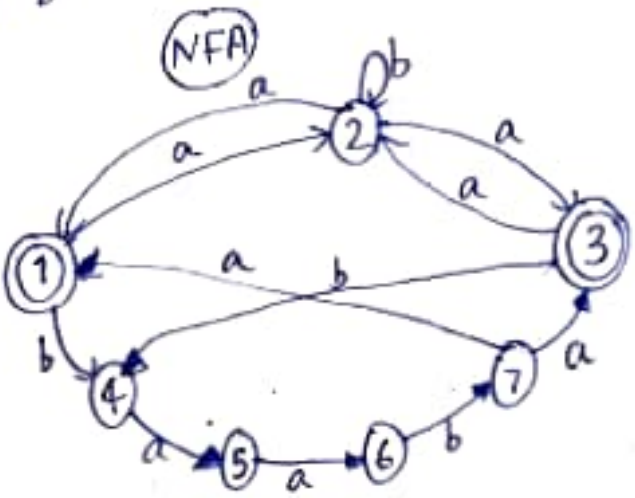
Invalid Strings : b, ba, bb, bba, bbb, etc.

(5)



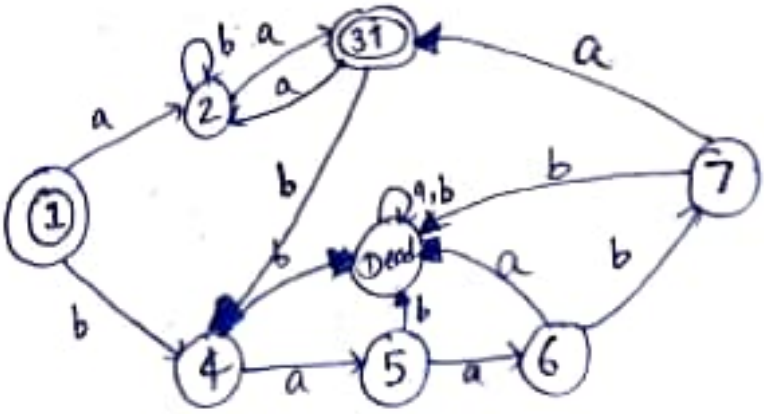
q	Λ(q)
1	1
2	2
3	3, 1
4	4
5	5
6	6
7	7

δ'(NFA)	a	b
1	2	4
2	3,1	2
3	2,4	4
4	5	ϕ
5	6	ϕ
6	ϕ	7
7	3,1	b



δ''(DFA)	a	b
1	2	4
2	{3,1}	2
4	5	Dead(ϕ)
{3,1}	2	4
5	6	Dead(ϕ)
6	Dead(ϕ)	7
7	{3,1}	Dead
Dead	Dead	Dead

Now DFA diagram



F''(DFA) = {1, {1,3}}.

Valid Strings: ϵ, aa, aba, abba, abbba, aaaa, aaaba etc

Invalid Strings: b, bb, bba, bbb, bbba bbbb etc.