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Question 4:

1. Basic Idea: Push x=8 symbols for each ‘a’. We read and pop one for each ‘b’.

Let Q = {s, q1, q2, q3, q4, q5, q6, q7, t, f} be the states

∑ = {a, b} be the input alphabets

s from Q be start state.

F = {s, f} accept states.

………….

The transition relation is

((s, a, ε), (q1, a))  
((qi, ε, ε), (qi+1, a)) for each i from {1, 2, 3, 4, 5, 6}  
((q7, ε, ε), (t, a))  
((t, a, ε), (q1, a))  
((t, b, a), (f, ε))

((f, b, a), (f, ε))

1. Very similar to a)  
   We will push 1 ‘a’ each time we read ‘a’ and pop 8 for each ‘b’.

The relation is as follows

((s, a, ε), (t, a))

((t, a, ε), (t, a))

((t, b, a), (q1, ε))  
((qi, ε, a), (qi+1, ε)) for each i from {1, 2, 3, 4, 5, 6}  
((q7, ε, a), (f, a))

((f, b, a), (q1, ε))

1. For L\_a a grammar is:

G = (V, ∑, R, S)  
where V={S} is the non-terminal symbols and ∑={a, b} is the terminal symbols and S is the start variable.

The rules are:  
S 🡪 a S bbbbbbbb  
S 🡪 ε

1. For L\_b a grammar is:

G = (V, ∑, R, S)  
where V={S} is the non-terminal symbols and ∑={a, b} is the terminal symbols and S is the start variable.

The rules are:  
S 🡪 aaaaaaaa S b  
S 🡪 ε

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Question 5: