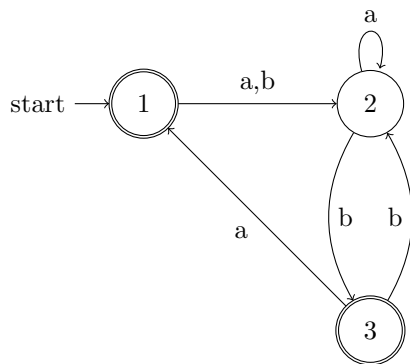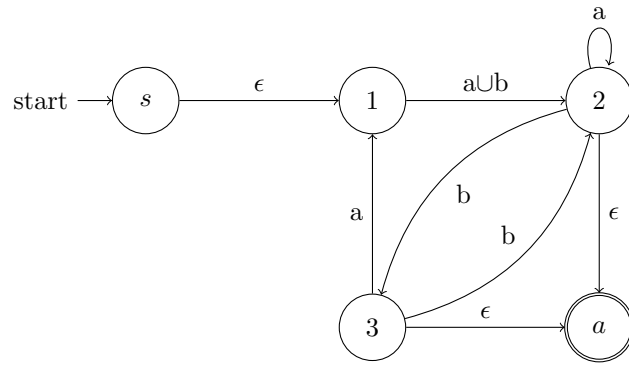# Homework 2

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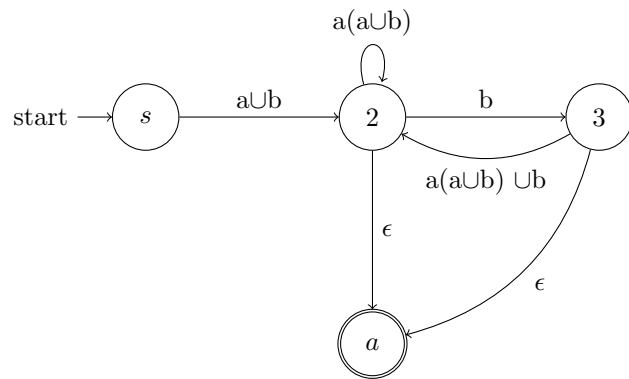
1 Give the regular expression for the FA below. Create a program that generates a regular expression from the language description in the language of your choosing.
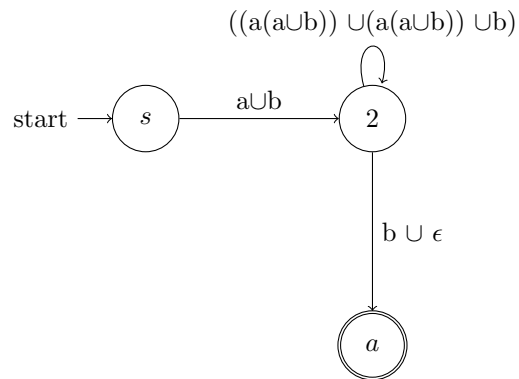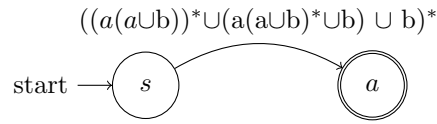

3 *state FA*

5 *state GFA*

4 *State GFA*

3 *State GFA*

2

$((a(a\cup b))^*\cup(a(a\cup b)^*\cup b) \cup b)^*$

2 State GFA

1.1 Regular Expression: $((a(a\cup \textbf{b}))^*\cup (\textbf{a}(\textbf{a} \cup \textbf{b})^*\cup \textbf{b}) \cup \textbf{b})^*$

2 Minimize the FA:
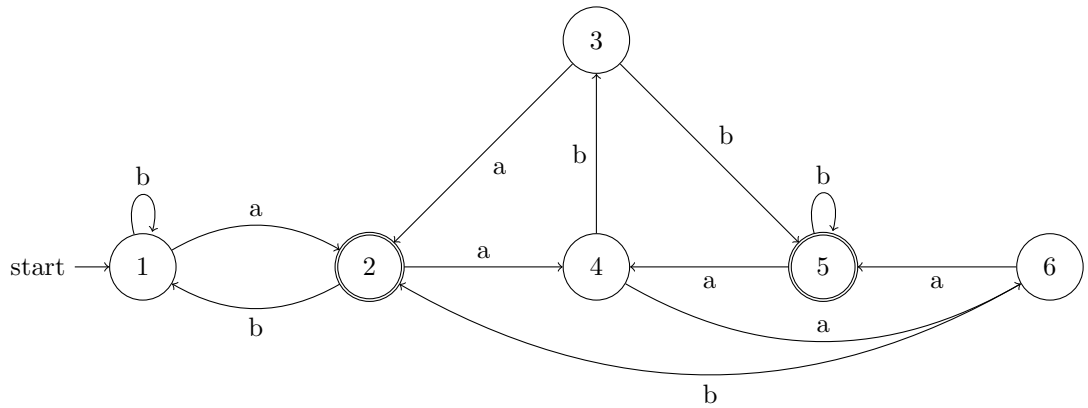
2.1 State Transition Table

q	δ (q,a)	δ (q,b)
1	2*	1
2*	4	1
3	2*	5*
4	6	3
5*	4	5*
6	5*	2*

3

2.2 Let's create sets of the pairs that are distinguishable:
$\mathbf{P}_0 = \{(1,3,4,6),(2^*,5^*)\}$
$P_1 = \{(1),(3,6),(4),(2^*),(5^*)\}$
$P_2 = \{(1),(3),(6),(4),(2^*),(5^*)\}$

2.3 All sets in P_2 are singletons, hence all pairs are distinguishable. therefore the DFA cannot be minimized further.

3 Use the pumping lemma to show that the language $L = \{a^i b^j c^k | i < j, j < k\}$ is not regular.

3.1 We will prove by contradiction.
Assume that **L** is a regular language. Let **p** be the pumping length given by pumping lemma. Let $s = a^p b^{p+1} c^{p+2}$. Then s can be split into xyz, satisfying the conditions of pumping lemma. By condition 3, y consists only of b's. Adding an extra copy y increases the number of b's. Recall that s has less number of b's than c's and less number of a's than both. Therefore, xyyz cannot have equal b's and c's, so it cannot be a string in L. Thus we obtain a contradiction.

4 Give a regular expression which denotes the language **L** over $\{0,1\}$ for each of the languages described below:

4.1 all strings that begin or end with 00 or 11.

4.1.1

4.2 all strings that have exactly one occurrence of 00.

4.2.1

4.3 all strings that do not have the sub-string 000.

4.3.1