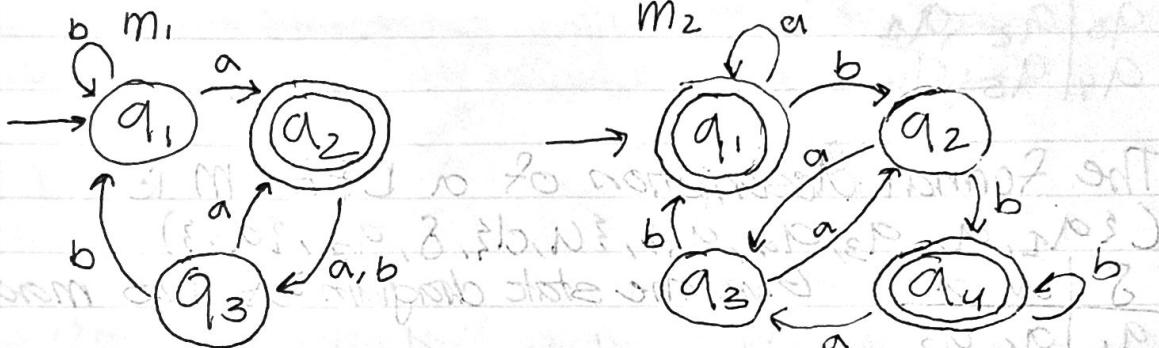


Homework 2

- 1.1 The following are the state diagrams of two DFAs, M_1 and M_2 . Answer the following questions about each of these machines.



a) What is the start state?

$$M_1: q_1; M_2: q_1$$

b) What is the set of accept states?

$$M_1: q_2; M_2: q_1, q_4$$

c) What sequence of states does this machine go through on input aabb?

$$M_1: a - q_1 \rightarrow q_2; M_2: a - q_1 \rightarrow q_1$$

$$a - q_2 \rightarrow q_3$$

d) Does the machine accept the string aabb?

$$M_1: \text{reject}; M_2: \text{accept}$$

e) Does the machine accept the string ϵ ?

$$M_1: \text{no}; M_2: \text{yes}$$

- 1.2 Give the formal description of the machines M_1 and M_2 pictured in exercise 1.1.

$$M_1 = (\{q_1, q_2, q_3\}, \{a, b\}, \delta, q_1, \{q_2\})$$

S	a	b
q1	q2 q1	q1
q2	q2 q3	q3
q3	q2	q1

1) short form
QEI caps
who, who, Q8 priority

S short form

$$M_2 = (\{q_1, q_2, q_3, q_4\}, \{a, b\}, \delta, q_1, \{q_1, q_4\})$$

at 8	a, b	an input state set for parallel set 1.
q_1	q_1	q_2 sup parallel set 1. M dom 1. m
q_2	q_3	q_4 an input state for class
q_3	q_2	q_1 m
q_4	q_3	q_4

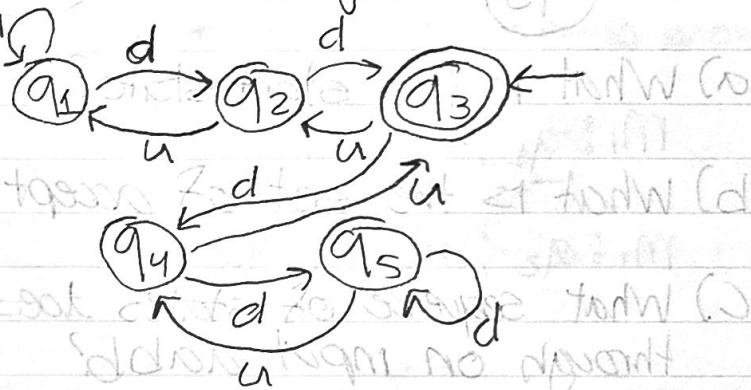
1.3

The formal description of a DFA M is

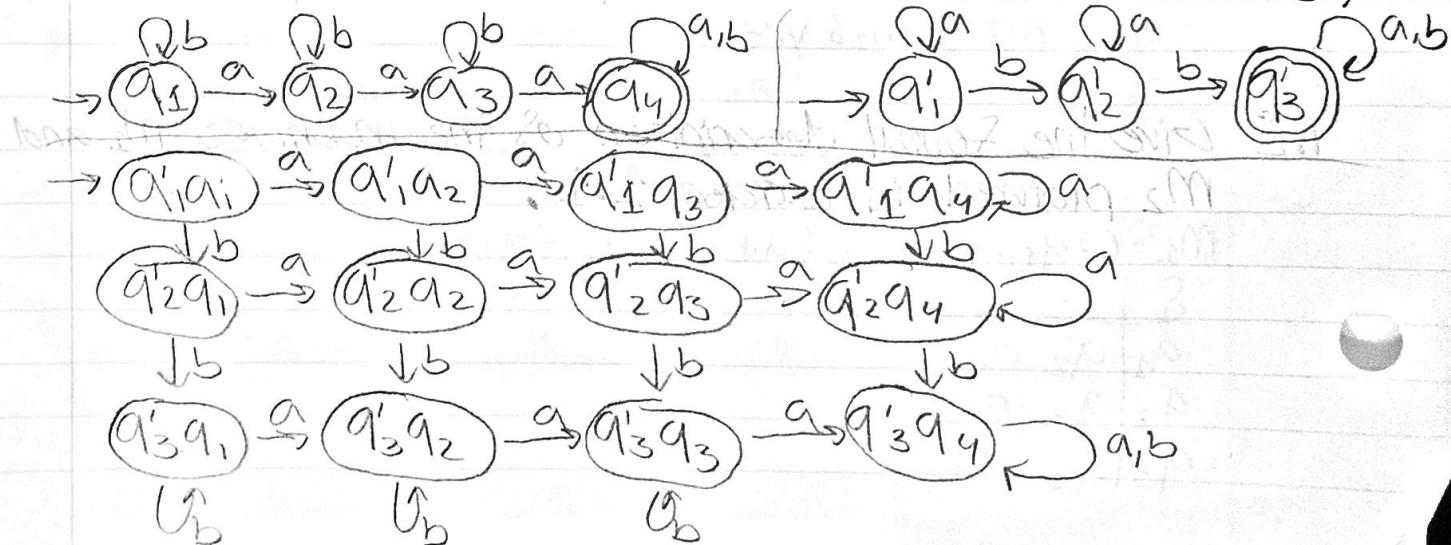
$$(\{q_1, q_2, q_3, q_4, q_5\}, \{u, d\}, \delta, q_3, \{q_3\})$$

Give the state diagram of this machine.

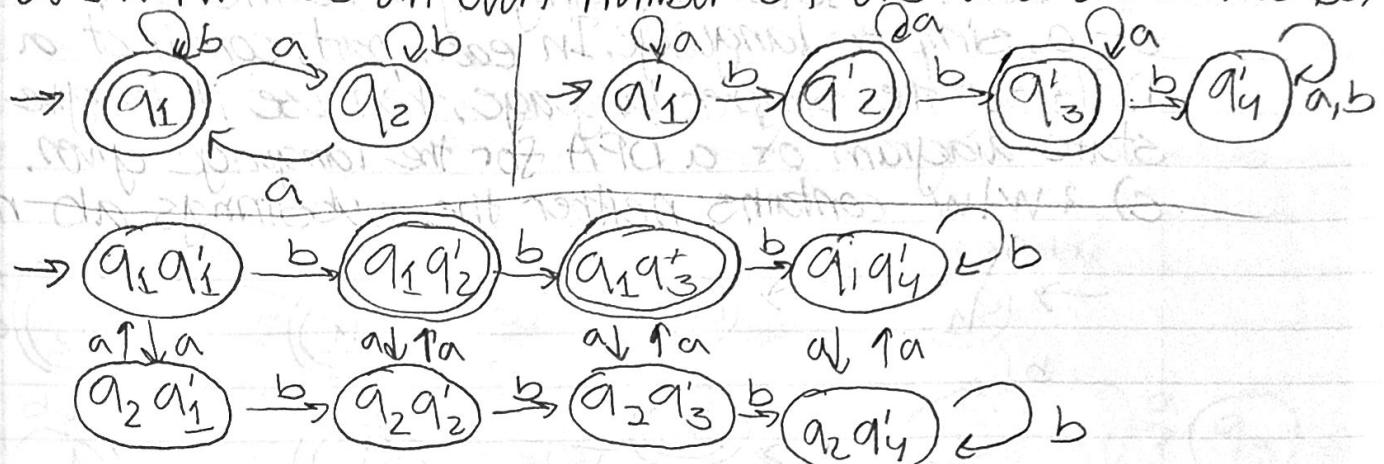
q_i	q_1	q_2
q_1	q_1	q_2
q_2	q_1	q_3
q_3	q_2	q_4
q_4	q_3	q_5
q_5	q_4	q_5



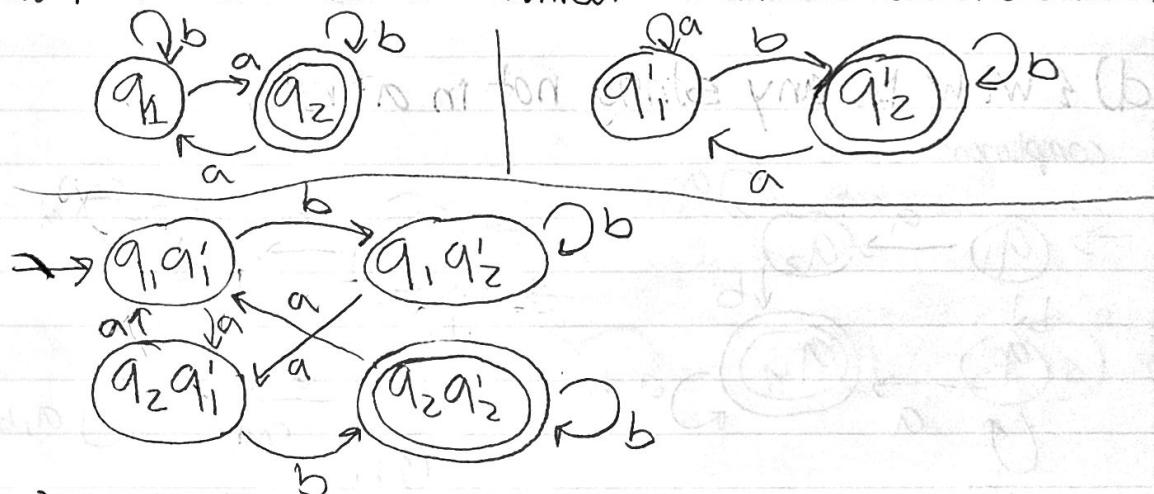
- 1.4 Each of the following languages is the intersection of two simpler languages. In each part, construct DFAs for the simpler languages, then combine them using the construction discussed in footnote 3 (page 46) to give the state diagram of a DFA for the language given. In all parts $\Sigma = \{a, b\}$
- a) $\{w | w \text{ has at least three } a's \text{ and at least two } b's\}$



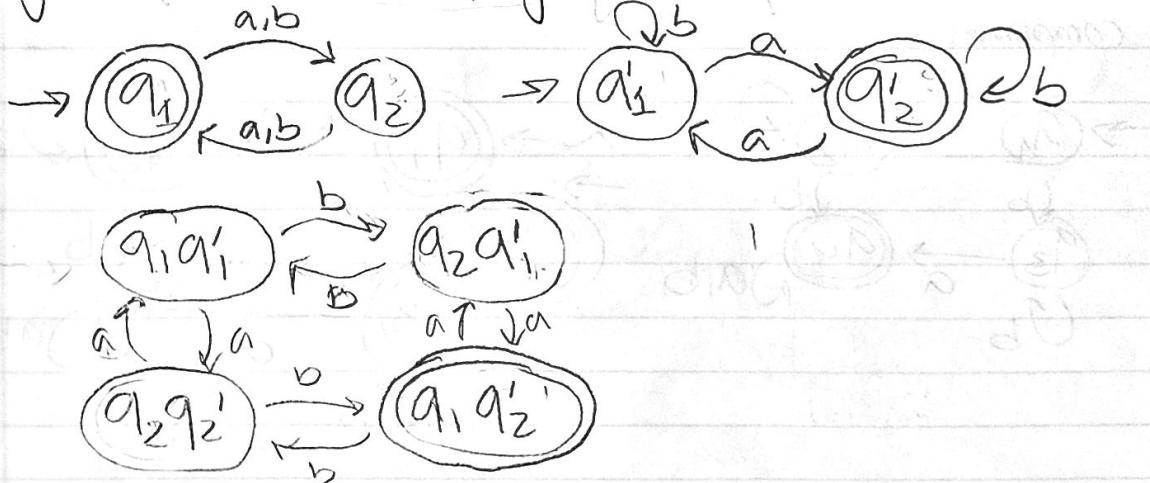
c) $\{w|w \text{ has an even number of } a's \text{ and one or two } b's\}$



f) $\{w|w \text{ has an odd number of } a's \text{ and ends with } ab\}$

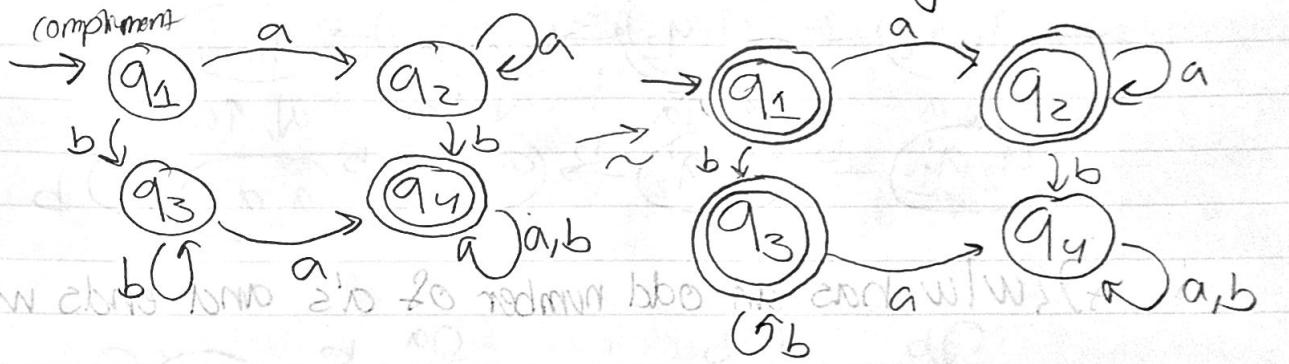


g) $\{w|w \text{ has even length and an odd number of } a's\}$



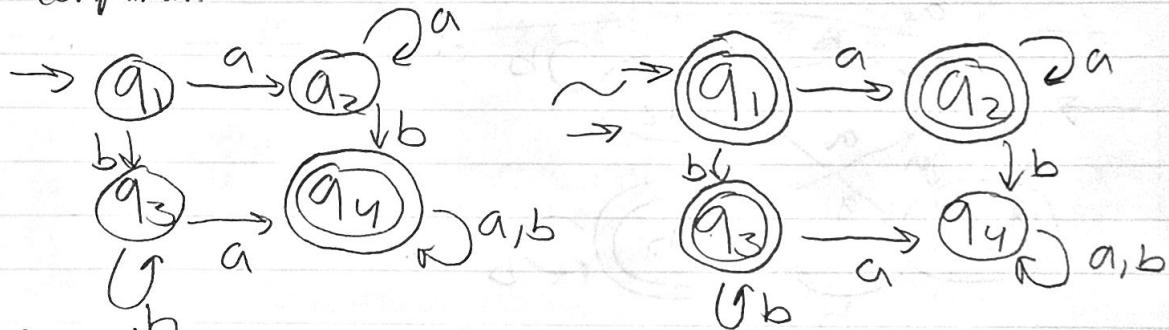
Q1.5 Each of the following languages is the complement of a simpler language. In each part, construct a DFA for the simpler language, then use it to give the state diagram of a DFA for the language given.

c) $\{w \mid w \text{ contains neither the substrings } ab \text{ nor } ba\}$



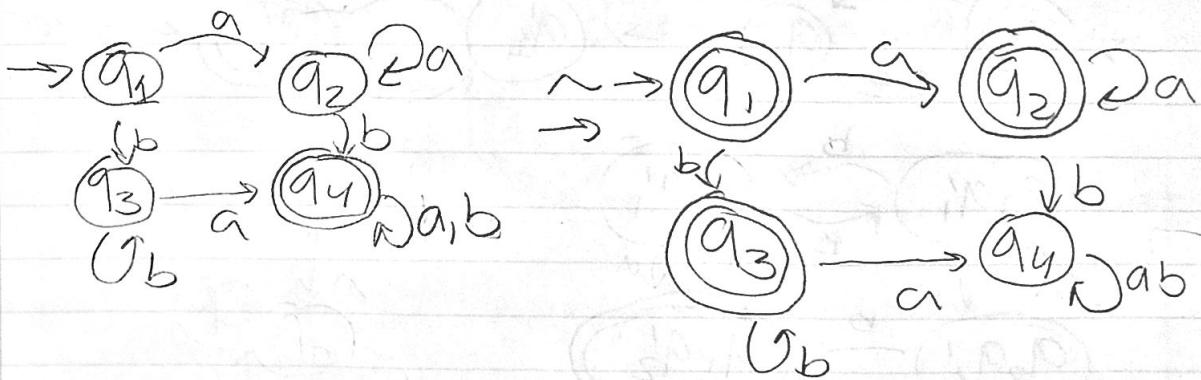
d) $\{w \mid w \text{ is any string not in } a^*b^*\}$

complement

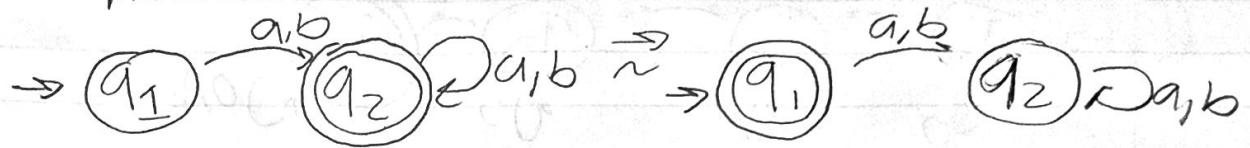


e) $\{w \mid w \text{ is any string not in } (ab^+)^*\}$

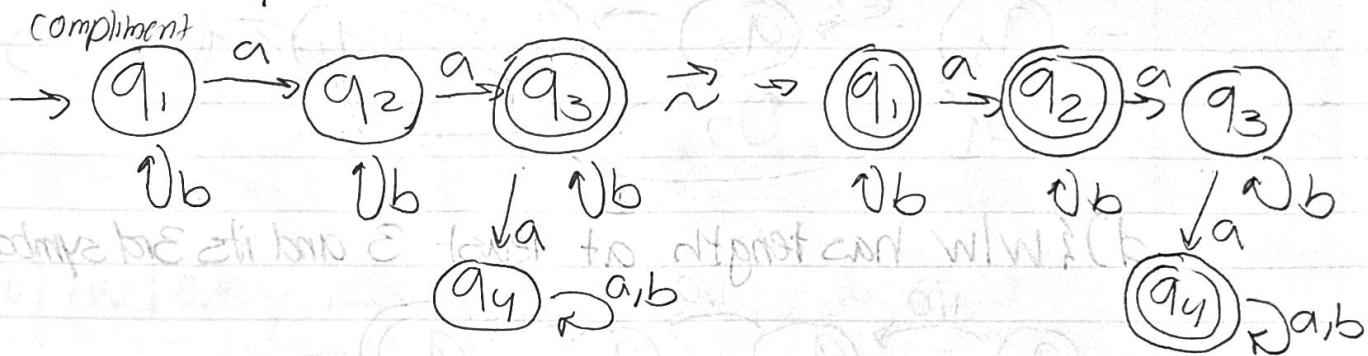
complement



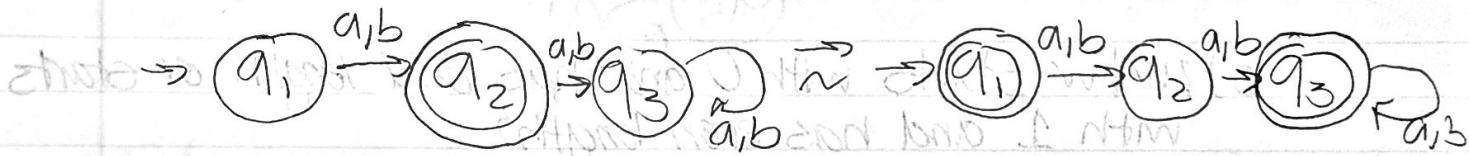
f) $\{w \mid w \text{ is any string not in } a^* \cup b^*\}$
complement



g) $\{w \mid w \text{ is any string that doesn't contain exactly two a's}\}$

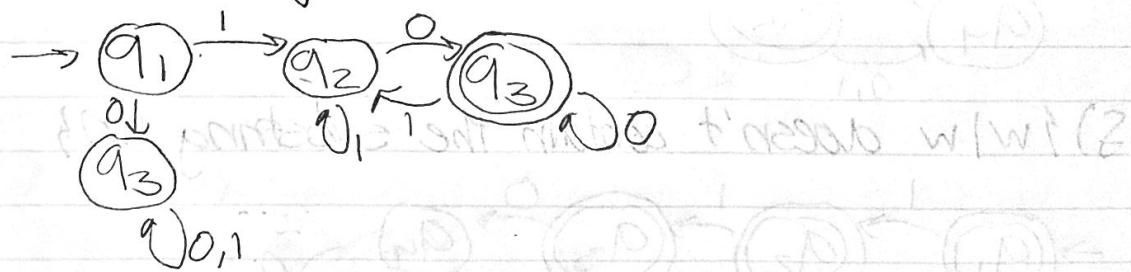


h) $\{w \mid w \text{ is any string except a and b}\}$
complement

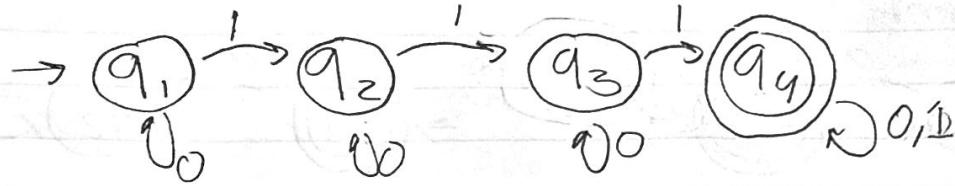


1.6 Give state diagrams of DFAs recognizing the following languages.

a) $\{w \mid w \text{ begins with a 1 and ends with a 0}\}$



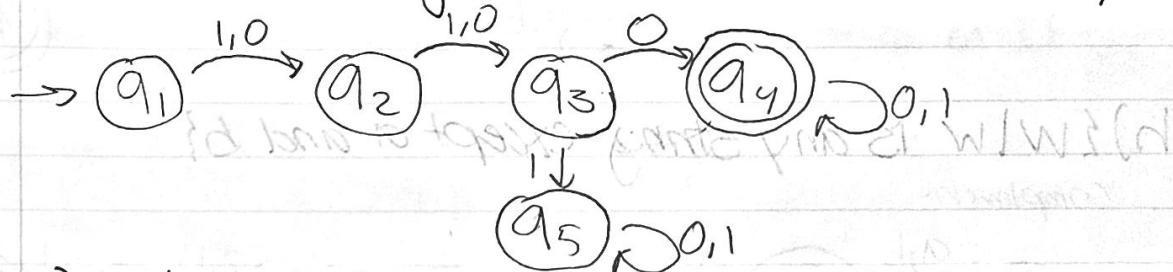
b) $\{w|w \text{ contains at least 3 } 1\text{'s}\} \cap \{w|w\in\{0,1\}^*\}$



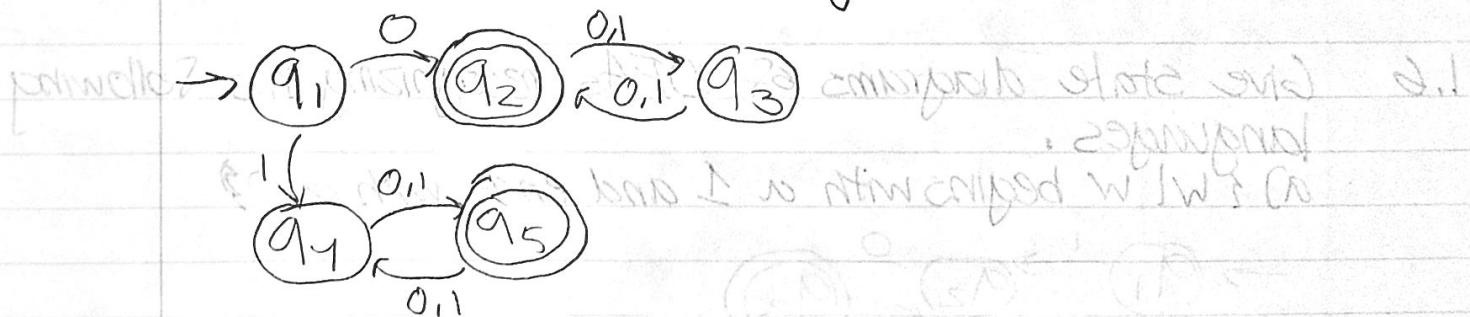
c) $\{w|w \text{ contains the substring } 0101\} \cap \{w|w\in\{0,1\}^*\}$



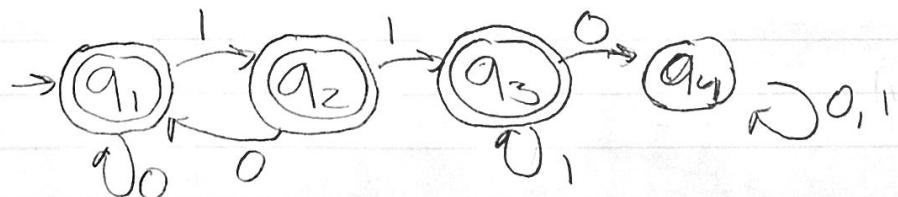
d) $\{w|w \text{ has length at least 3 and its 3rd symbol is } 0\} \cap \{w|w\in\{0,1\}^*\}$



e) $\{w|w \text{ starts with } 0 \text{ and has odd length, or starts with } 1 \text{ and has even length}\}$

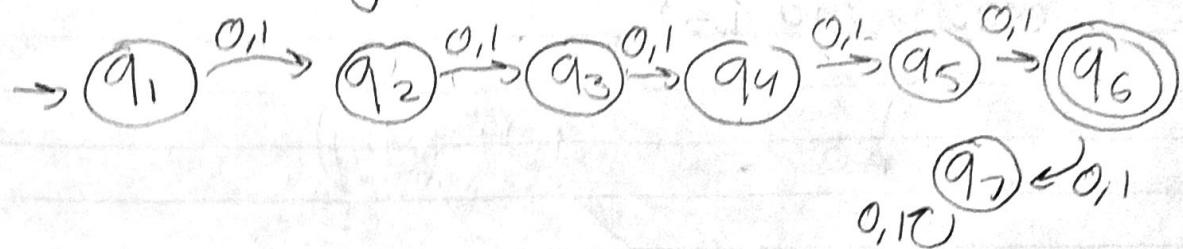


f) $\{w|w \text{ doesn't contain the substring } 110\}$

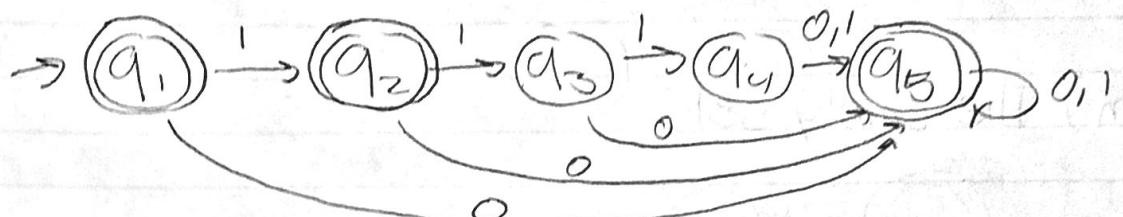


4

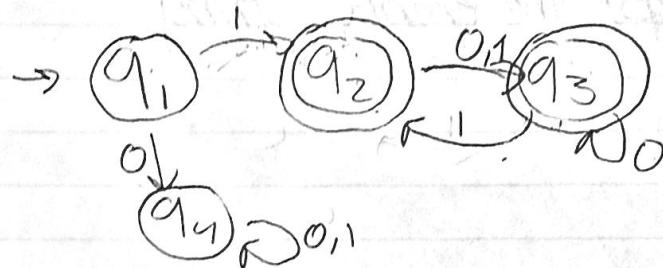
g) $\{w \mid \text{the length of } w \text{ is at most } 5\}$



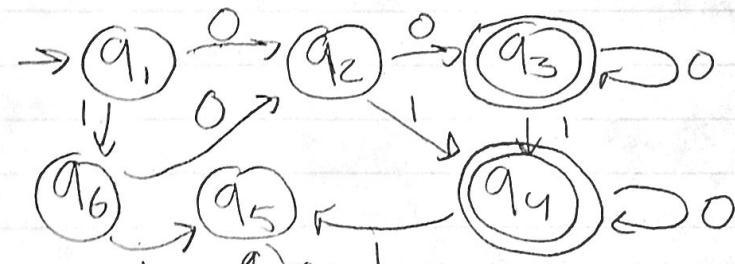
h) $\{w \mid w \text{ is any string except } 11 \text{ and } 111\}$



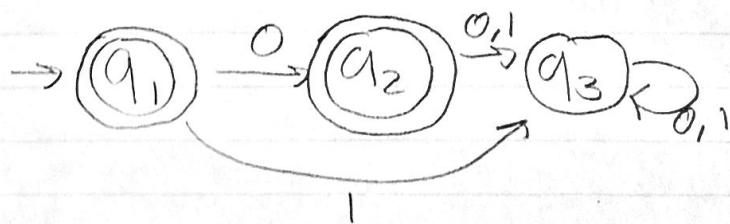
i) $\{w \mid \text{every odd position of } w \text{ is a } 1\}$



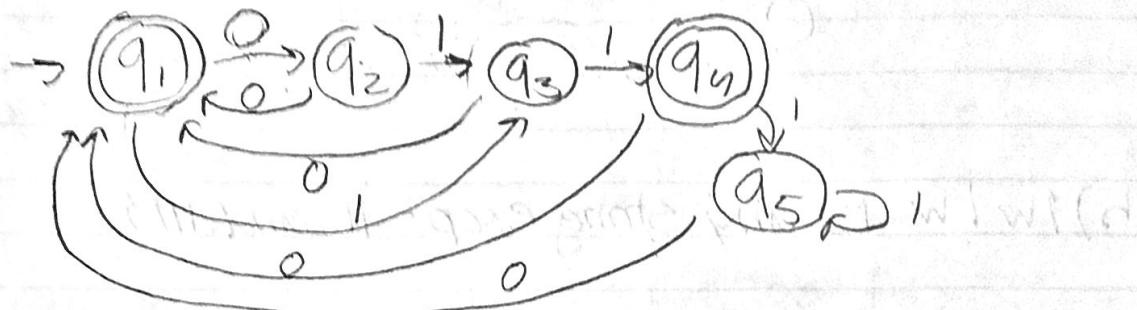
j) $\{w \mid w \text{ contains at least two } 0\text{s and at most one } 1\}$



k) $\{\epsilon, 0^3\}$



l) $w|w$ contains an even number of 0s, or contains exactly two 1s;



m) The empty set



n) All strings except the empty string

