Homework 1

Taitinov .E.
18BD110617

Task 1 $L = \{ab, c\}$ $A = \{a, b, c\}$

a) $L^0 = \{\lambda\}$ language in power of 0 has only empty word

b) $L^2 = LL = \{ab, c\}\{ab, c\} = \{abab, abc, cab, c^2\}$

Task 2 $A = \{a, b, c\}$

a) $L = \{b^2\}$ $L^* = L^0 \cup L^1 \cup L^2 \ldots = \{\lambda; b, ^2 b^4, b^6 \ldots\}$

b) $L = \{a, b\}$ $L^* = L^0 \cup L^1 \cup L^2 \ldots = \{\lambda\} \cup \{a, b\} \cup \{a^2, ab, ba, b^2\} \ldots = \{\lambda, a, b, a^2, ab, ba, b^2 \ldots\}$

Task 3 $A = \{a, b\}$

a) $r = abb^*a \rightarrow L(r) = L(abb^*a) = L(a)L(b)L(b)^*L(a) =$
$= \{a\}\{b\}\{\lambda, b, b^2, b^3 \ldots\}\{a\} = \{ab\}\{\lambda, b, b^2 \ldots\}\{a\} =$
$= \{ab, ab^2, ab^3 \ldots\}\{a\} = \{aba, ab^2a, ab^3a \ldots\}$

b) $r = b^*ab^*ab^* = L(b)^*L(a)L(b^*)L(a)L(b)^* = \{\lambda, b, b^2, b^3 \ldots\}$
$\{a\}\{\lambda, b, b^2, b^3 \ldots\}\{a\}\{\lambda, b, b^2, b^3 \ldots\} = \{a, ba, b^2a, b^3a \ldots\}$
$\{a, ba, b^2a, b^3a \ldots\}\{\lambda, b, b^2, b^3 \ldots\}$ x

c) $r = a^* \cup b^* \rightarrow L(r) = L(a^* \cup b^*) = L(a)^* \cup L(b)^* =$
$= \{\lambda, a, a^2 \ldots\} \cup \{\lambda, b, b^2 \ldots\} = \{\lambda, a, b, a^2, b^2 \ldots\}$

d) $r = ab^* \cap a^*$
$L(r)$ is impossible. specifically $\cap$ is not one of the symbols used for regular expressions

Task 4 $A = \{a, b, c\}$ $w = abc$

a) $r = a^* \cup (b \cup c)^*$

$L(r) = L(a^* \cup (b \cup c)^*) = L(a)^* \cup \{x$ where x is any word consist of $b, c\} = \{\lambda, a, a^2 \dots\} \cup \{x$ where x is any word in $b, c\}$

w doesn't belongs to $L(r)$ because it is union

b) $r = a^*(b \cup c)^*$

$L(r) = L(a)^* \{x$ where x is any word in $b, c\} =$

$= \{\lambda, a, a^2 \dots\}\{x$ where x is any word in $b, c\}$

w belongs to $L(r)$ because there is concatenation

Task 5 $A = \{a, b\}$ $L(r)$ consist of all words w where:

a) w begins with $a^2 = aa$ and ends with $b^2 = bb$

it means that $L(r) = \{a^2\}\{$any word $x\}\{b^2\} =$

$= L(a^2) L(a \cup b)^* L(b^2)$

$r = a^2 (a \cup b)^* b^2$

b) w contains an even number of a.

$(aa)^* = \{\lambda, a^2, a^4, a^6 \dots\}$

$L(r) = L(aa)^* L(b)^*$

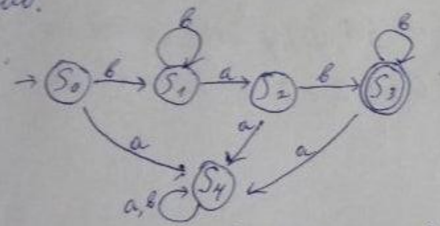
$r = (a^2)^* b^*$

I think it one of possible answers

Task 9 $A = \{a, b\}$

a) $L(M) = \{b^r a b^s \mid r > 0, s > 0\}$

min value of r and s is 1, minimal word is bab.

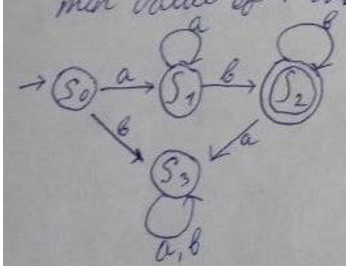


S_4 is dead state

S_3 is final state

b) $L(M) = \{a^r b^s \mid r > 0, S > 0\}$

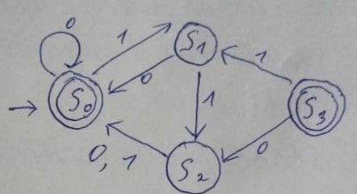
min value of r and s is 1, minimal word is ab.



S_3 - dead state

Task 11

a) $\{0\}^*$ is recognized because S_0 is final state



b) $\{0\}\{0\}^*$ is recognized

$\{0\}\{0\}^*$ will stand S_0

c) $\{1\}\{0\}^* = \{1, 10, 100 \ldots\}$

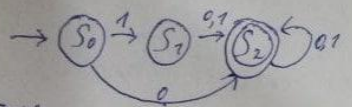
recognized because it moves to S_1 then returns to S_0 which is final state

d) $\{01\}^* = \{\lambda, 01, 0101 \ldots\}$ is not recognized S_1 is not final

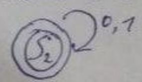
e) $\{0\}^*\{1\}^*$ is not recognized, not all words recognized.

f) $\{1\}\{0, 1\}^*$ is not recognized, not all words recognized.

Task 12



When we are on state S_2 no matter what will be next becous we stand on S_2.



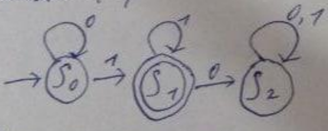
We see that there is 3 possible ways to move to S_2

$\{10\}\{x \mid x$ any word in $0,1\}$

$\{11\}\{y \mid y$ any word in $0,1\}$

$\{0\}\{z \mid z$ any word in $0,1\}$

Task 14



$L(M)=\{0^n 1 1^m \mid n,m \geq 0\}$

the quigest way to accept S_1 is 1 ~~x~~, but we also can 01 or 001, and on S_1 if we choose 1 we will return to S_1

Task 16

Assume the contrary. That is, exist state machine which recognize set of all bits strings with 2 states which recognize set of all bits strings that have one or more 1 bits and end with 0

Case 1: Start state is final. Then λ is acceptable – – contradiction

Case 2: Start state is not final, second state is final

We have a loop on 0 at S_1 then such a loop contains $0^0=\lambda$ there transition S_0 to S_1 must on 0. Therefore we need a loop at S_0 and word 0 is acceptable-contradiction

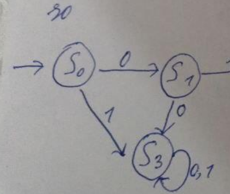
Task 18

Construct DFSA that recognize set of all bit strings beginning 0 1

0 1 is beginning so $L(M) = \{01x \mid x$ is any word in 0 and 1$\}$

the minimal word is 0 1

so



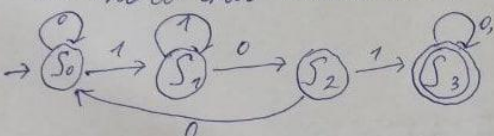
S_3 is dead state

Task 19

Task 19

Construct DFSA that recognize the set of all bit strings contains 101

We know that minimal word is 1 0 1



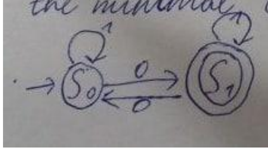
S	1	0
S_0	S_1	S_0
S_1	S_1	S_2
S_2	S_3	S_0
S_3	S_3	S_3

at S_2 if we read 0 we go to S_0 because the sequence 10 1 is broken

Task 2 2

DFSA that recognize the set of all bit strings that contains odd number of 0.

the minimal word is 0 so

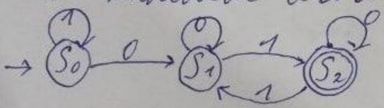


loops when 1 because no matter number of 1.

Task 23

DFSA that recognize set of bit strings consisting of a 0 followed by string with odd number of 1.

the minimal word is 01



S	0	1
S_0	S_1	S_0
S_1	S_1	S_2
S_2	S_2	S_1

$L(M) = \{0^n 1^m \mid n>0, m>0$ and m is odd$\}$

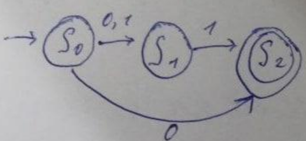
Task 24

DFSA that recognize set of bit strings that begin and end with 11.

$L(M) = \{11\}\{0,1\}^*\{11\}$

so the diagram

Task 25



the ways to move to S_2 are
01, 11, 0
and there are not other words
so
$L = \{01, 11, 0\}$