Part One Put a circle on the correct answer(8 marks)

1.

a. every regular language is countably infinite
b. some regular languages are infinite
c. regular languages are not decidable by DFAs
d. a language is not regular if there is no DFA that accepts it

2. The language ϕ^* contains

a. only one word.
b. infinite number of empty words
a. no word
b. all words containing the empty string

3. The DFA transition function maps

a. $\Sigma \times Q \rightarrow \Sigma$
b. $Q \times Q \rightarrow \Sigma$
c. $\Sigma \times \Sigma \rightarrow Q$
d. $Q \times \Sigma \rightarrow Q$

4. The number of DFA states required to accept a string containing three distinguished alphabets is

a. Three
b. Four
c. Five
d. None of the above

5. All regular languages

a. Do not satisfy the pumping lemma.
b. Can be described by regular expressions
c. Are not closed under complementation
d. All of the above

6. The language L= { letter(digit + letter)*} is

a. Regular
b. Not regular
c. May be either
d. None of the above

7. The regular expression $\Sigma^*11\Sigma^*$ describes a language

a. {w|w has at least one 1}
b. {w|w have two ones}
c. {w|w contains the substring 11}
d. None of the above

8. the language L ={ε}

a. Recognizing only the empty string
b. Recognizes the symbol e
c. Does not contain any string
d. None of the above

Part II (short questions, 7 marks)

9. Describe what the Kleene star operation • over the following alphabets produces. **(two marks)**

(i) $\Sigma = \{1\}$

$\Sigma^* = \{\varnothing, 1, \{1\}\}$

(ii) $\Sigma = \varnothing$

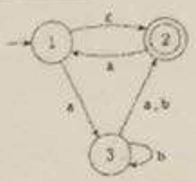
$\Sigma^* = \varnothing = \{\ \}$ is empty

10. Find a regular expression which represents the set of strings over {a, b} which contains the two substrings aa and bb. **(two marks)**

$\Sigma . \{aa, bb\}$
ε
$\varnothing$
$(aa \cup BB)$
$(aa \circ bb)$
(aa^+)

Part III (fifteen marks, five marks for each)

1. Convert the following NFA to a DFA.

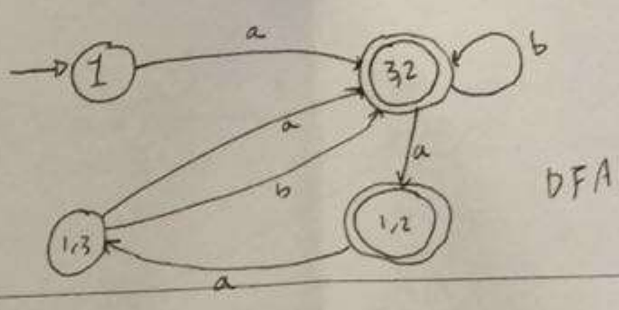


	a	b	ε
1	3	∅	{1,2}
2	1	∅	{2}
3	2	(3,2)	

⇓

	a	b
→{1}	{3,2}	∅
{3,2}	{1,2}	{3,2}
{1,2}	{1,3}	∅
{1,3}	{3,2}	{3,2}

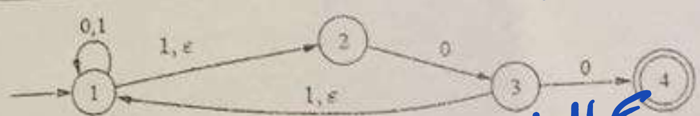
⇓



5

2. Convert the following finite automata to a Generalized NFA (GNFA)

1∪ε



1∪ε

	0	1
1	1	{1,2}
2	3	∅
3	4	1
4	∅	∅

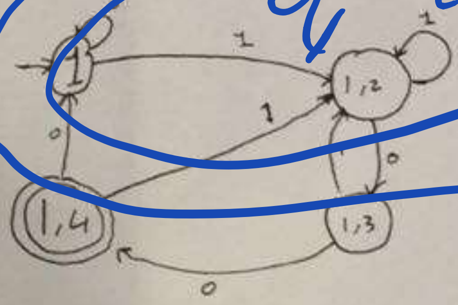
q start

ε

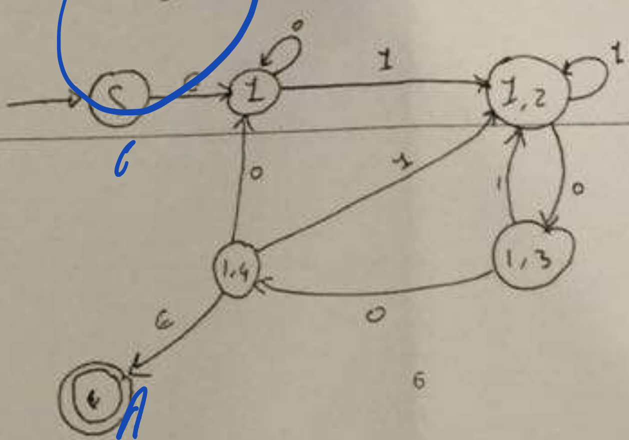
1

	0	1
{1}	1	{1,2}
{1,2}	{1,3}	{1,2}
{1,3}	{1,4}	{1,2}
{1,4}	1	{1,2}

q accept

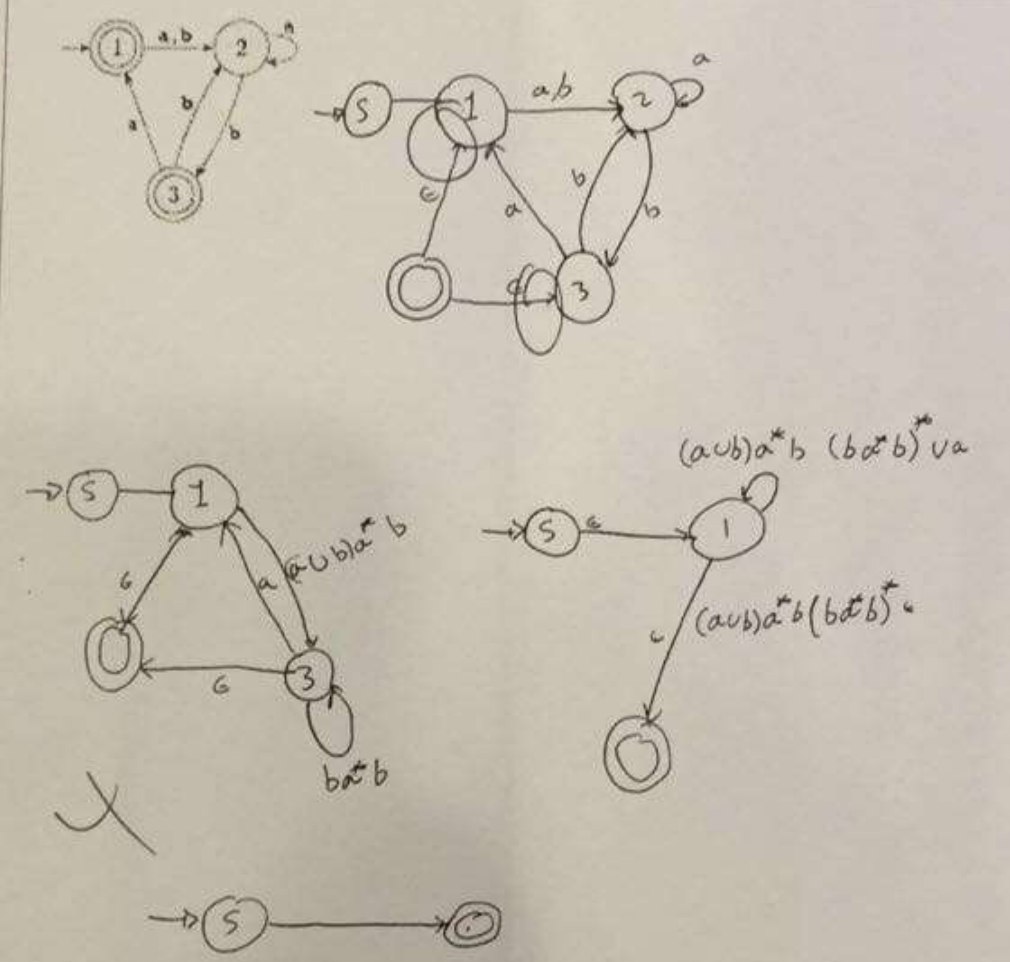


3



GNFA

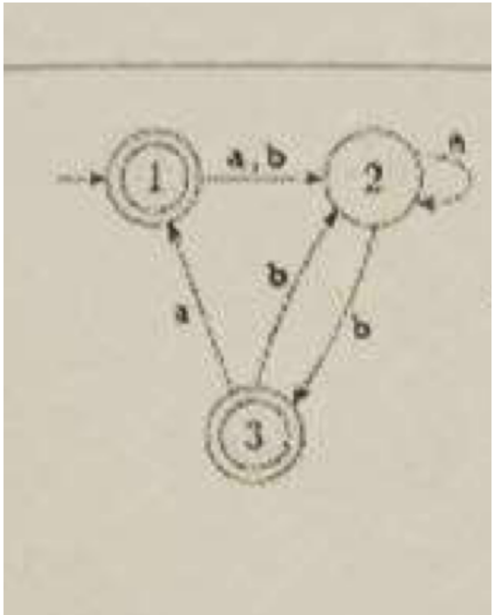
3. convert the following automata into regular expression

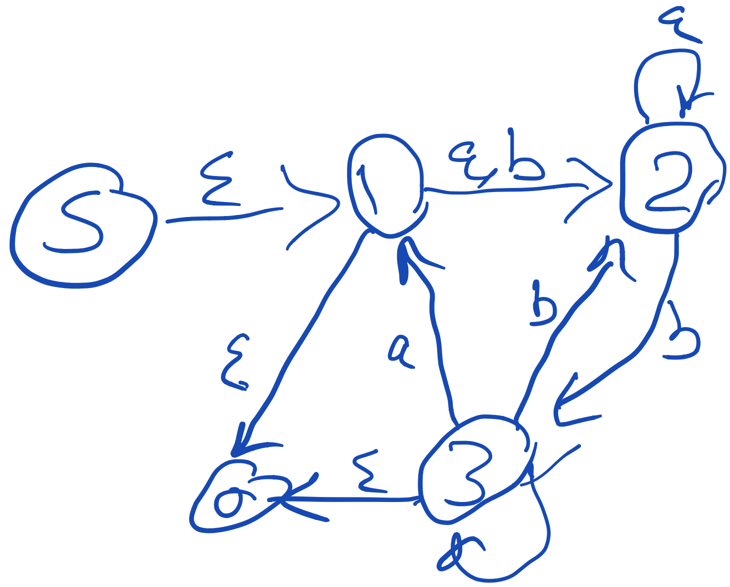


$((a \cup b) a^* b (ba^*b)^* \cup a)^* (a \cup b) a^* b (ba^*b)^*$

RE

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

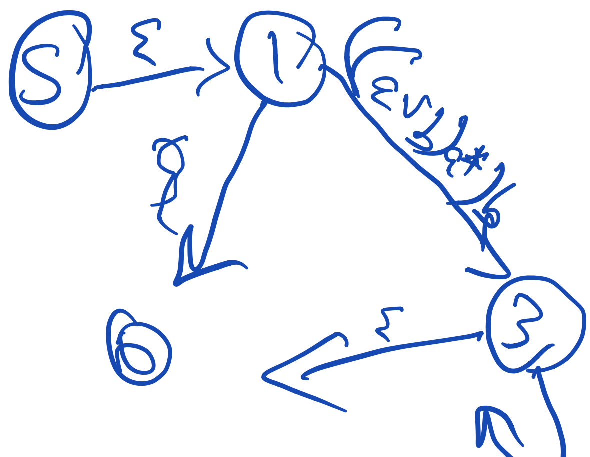




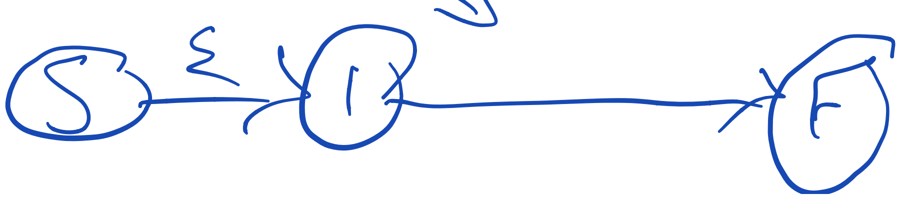
3

In out

1 — F



① $((a \cup b)a^*)b(ba^*b)^*$



1

In out

S F