Q	Part 1	Part II	Part II	Total	Remarks
Weight marks	5	6	9	20	
Student marks	2	5	7	14	

Part One: State whether each of the following statements is TRUE (T) or FALSE (F)

(Five marks)

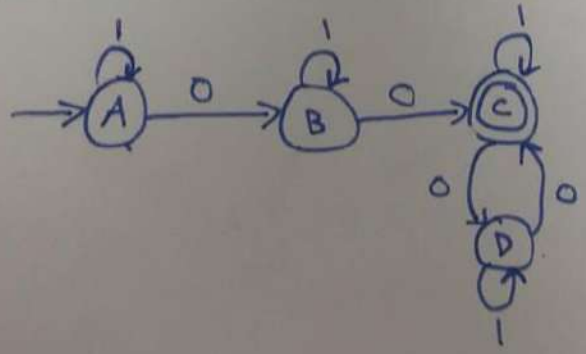
1. Every regular language is countably finite [T]
2. $|\varepsilon|=1$ [T]
3. Not All DFAs are convertible into NFAs [F]
4. A predicate is a function whose range is the set of the language alphabets. [T]
5. Regular Expressions are more powerful than finite automata [T]
6. NFA and GNFA are equivalent though not the same [T]
7. A prove by contradiction is achieved by demonstrating the invalidity of at least one case [T]
8. The complement of the empty language is Φ. [T]
9. All regular languages are closed under the * operation [T]
10. A unary language contains only a single string [T]

10,5

Part II (6 marks)

1. If $\Sigma=\{0,1\}$, Give the state diagram of a DFA recognizing the following language **(two marks)**

L= {w| w contains an even number of 0s}



A

2. Prove that the language $\{a^m b^n c^m \mid n, m \geq 0\}$ is not regular **(two marks)**

Assume that the language A is regular

Pumping length = p

$S = a^m b^n c^m$

x y z p = 2

aabbcc

x y z

let i = 2

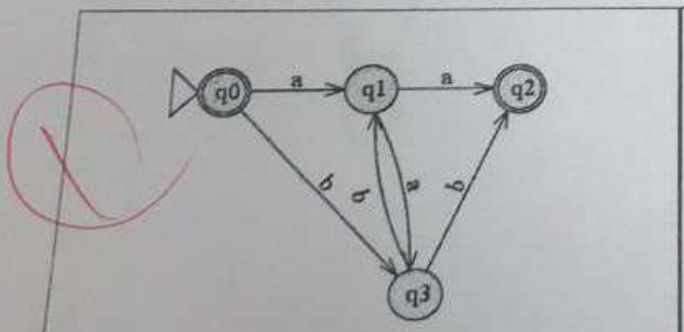
$S = aababbcc$

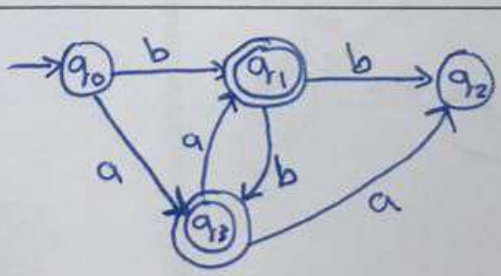
we see that $xy^2z \notin A$

By contradiction

A is not regular.

3. Complement the following automaton **(two marks)**

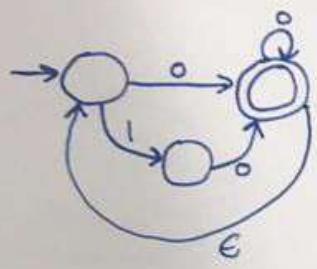




Part III (9 marks)

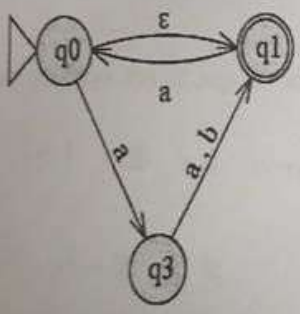
a. Construct an NFA from the following regular expression **(two marks)**

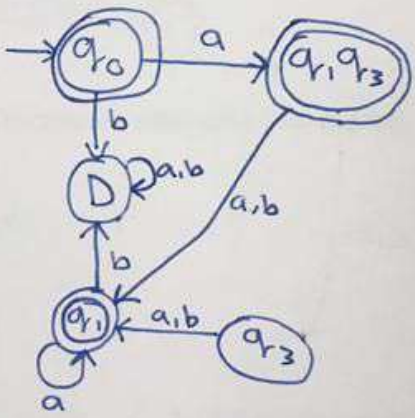
$(0^* \cup 10)^*$



2

b. Convert the following NFA into its equivalent DFA **(three marks)**





using tables

2

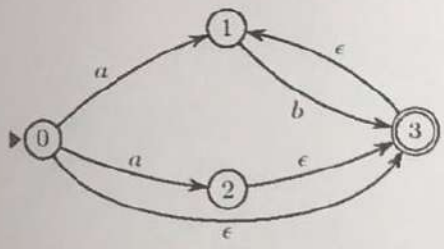
	ϵ^*	a	ϵ^*
q_0	$q_0 q_1$	$q_0 q_3$	$q_1 q_3$
q_1	q_1	q_0	q_1
q_3	q_3	q_1	q_1

	ϵ^*	b	
q_0	$q_0 q_1$	ϕ	–
q_1	q_1	ϕ	–
q_3	q_3	q_1	q

NFA form:

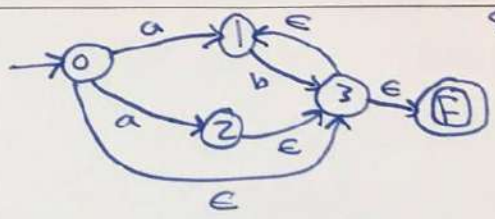
	a	b
q_0	$q_1 q_3$	ϕ
q_1	q_1	ϕ
q_3	q_1	q_1
$q_1 q_3$	q_1	q_1

c. Convert the following NFA to its equivalent regular expression **(two marks)**

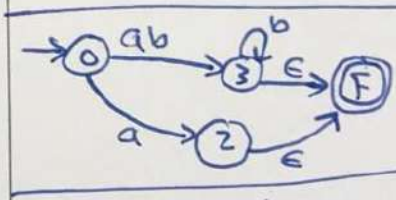


the regular expression is: ab+ab*

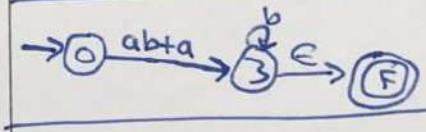
Step 1



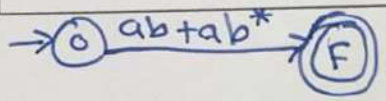
Step 2



Step 3



Step 4



d. Prove that the set of regular languages is closed under symmetric difference [two marks]