#### Cairo University

Faculty of Computers & Artificial Intelligence

Theory of Computations

## Assignment 2 (DFA & NFA)

### **Instructions**

- The assignment is submitted in groups of 4 students from the same lab or the same TA.
- The Deadline for submission is on Tuesday 23/4 at 11:59 pm
- Submission will be on Google Classroom, No late submission, or through e-mail submission is allowed.
- Please submit one compressed folder with the .java files. The folder name should follow this structure: ID1\_ID2\_ID3\_GROUP.zip
- In case of Cheating, you will get a negative grade whether you give the code to someone, take the code from someone/internet, or even send it to someone for any reason.

## Requirements

- Solve all the 10 problems.
- For all problems write in Java Language.
- The Java program will take ONE input text file containing the input values for each problem, the program must save the output of each problem in ONE output text file following the required format for each problem.
- Submit all Drawings of automata of all DFAs and NFAs in separated PDF.

#### Input file:

Starts with the number of the problem, followed by the input values for the problem, then "end" to indicate the input for this problem is finished and to move to the next problem.

#### **Output file:**

Starts with the number of the problem, followed by the corresponding output values of the input for the problem, then "x" to indicate the output for this problem is finished and to move to the next problem

## **DFA**

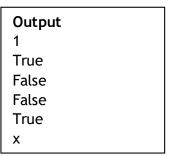
Simulate a Deterministic Finite Automaton:

- The DFA's states
- The alphabet
- The transition function
- The start state
- The set of accepting states

#### **Problem 1**

Design a DFA that accepts all strings which do not contain the substring ba over {a, b}

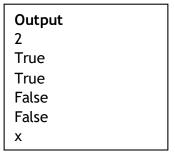
Input	
1	
ab	
ba	
aba	
bbb	
end	



# **Problem 2**

Design a DFA that accepts all strings that contains even number of 0's followed by single 1 over  $\{0, 1\}$ 

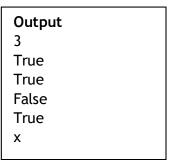
Input	
2	
1	
001	
00	
0011	
end	



# **Problem 3**

Design a DFA that accepts all strings that contains odd number of x's over {x, y}.

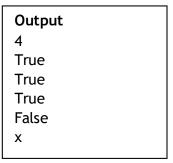
Input	
3	
x	
хухухуу	
ууу	
yxxxy	
end	



## **Problem 4**

Design a DFA that accepts strings starting and ending with the same characters over {a,b}.

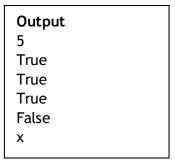
Input 4
aa
bab
baaabab
aaab
end



# **Problem 5**

Design a DFA that accepts all the strings that binary integers divisible by 4 over {0,1}.

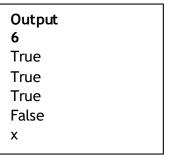
Input	
5	
0	
10000	
100	
101	
end	



#### **Problem 6**

Construct an DFA that accepts all strings {W | W is any string except 11 and 111}

Input 6	
1000	
101	
0000	
111	
end	



# **NFA**

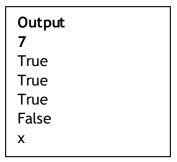
Simulate a Nondeterministic Finite Automaton (NFA):

- The NFA's states
- The alphabet
- The transition function.
- The start state(s)
- The set of accepting states

## **Problem 7**

Construct an NFA that accepts all strings over the alphabet {0, 1} containing an equal number of occurrences of '01' and '10'.

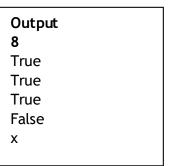
### Input 7 010110 1001 0101010101010 101010 end



#### **Problem 8**

Design an NFA that accepts all strings over the alphabet {0, 1} that contain the substring "101"or "010".

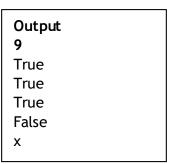
Input 8
101010
001010
010
1001
end



## **Problem 9**

Design an NFA that accepts all strings over the alphabet {0, 1} where no two consecutive characters are the same.

Input 9	
01	
10	
010101010101	
000	
end	



## **Problem 10**

Design an NFA that recognizes strings over the alphabet {0, 1} where every '0' is followed by at least one '1'.

Input 10
1
010111
010101111
010
End

