Feedback — Week 1: Finite Automata

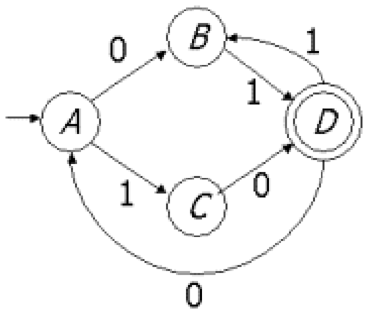
Help Center

You submitted this homework on **Sun 20 Sep 2015 5:26 PM CEST**. You got a score of **4.00** out of **5.00**. You can attempt again, if you'd like.

The course will have a number of homeworks that are designed using the Gradiance technology. The objective of these homeworks is to enable everyone to get 100% and learn the underlying material. While questions look like multiple choice, you should think of them as more conventional "solve this problem and submit the solution" questions. That is, you are given a problem to solve, which you should work completely. Then, you are given a random choice of responses that are designed to figure out whether you got the right solution or not. If you do have the right solution, you should be able to answer the question easily, regardless of the choices presented. If you get it wrong, you will be given a hint and allowed to try again. Your score on a homework is the maximum of any try. We group about 5 questions together, so you can't repeatedly guess each question independently, without actually doing the work.

Question 1

Examine the following DFA:



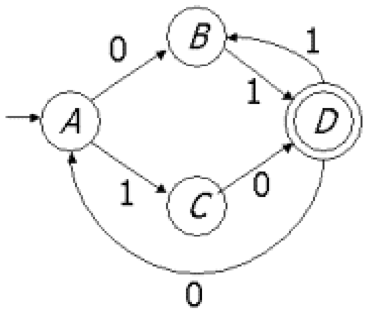
Identify in the list below the string that this automaton accepts.

Your Answer		Score	Explanation
0110			
10001	✔	1.00	Correct. The sequence of states entered is A,C,D,A,B,D. Since D is an accepting state, the string is accepted.
1001			
100			

Total	1.00 / 1.00

Question 2

The finite automaton below:

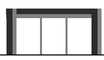


accepts no word of length zero, no word of length one, and only two words of length two (01 and 10). There is a fairly simple recurrence equation for the number N(k) of words of length k that this automaton accepts. Discover this recurrence and demonstrate your understanding by identifying the correct value of N(k) for some particular k. Note: the recurrence does not have an easy-to-use closed form, so you will have to compute the first few values by hand. You do not have to compute N(k) for any k greater than 14.

Your Answer		Score	Explanation
○ N(14) = 16			
○ N(13) = 16			
○ N(14) = 280			
◉ N(11) = 32	✔	1.00	
Total		1.00 / 1.00	

Question 3

1Here is the transition function of a simple, deterministic automaton with start state A and accepting state B:



	0	1
A	A	B
B	B	A

We want to show that this automaton accepts exactly those strings with an odd number of 1's, or more formally:

δ(A,w) = B if and only if w has an odd number of 1's.

Here, δ is the extended transition function of the automaton; that is, δ(A,w) is the state that the automaton is in after processing input string w. The proof of the statement above is an induction on the length of w. Below, we give the proof with reasons missing. You must give a reason for each step, and then demonstrate your understanding of the proof by classifying your reasons into the following three categories:

A)
Use of the inductive hypothesis.
B)
Reasoning about properties of deterministic finite automata, e.g., that if string s = yz, then δ(q,s) = δ(δ(q,y),z).
C)
Reasoning about properties of binary strings (strings of 0's and 1's), e.g., that every string is longer than any of its proper substrings.

Basis (|w| = 0):

(1)
w = ε because ________
(2)
δ(A,ε) = A because ________
(3)
ε has an even number of 1's because ________

Induction (|w| = n > 0)

(4)
There are two cases: (a) when w = x1 and (b) when w = x0 because ________
Case (a):
(5)
In case (a), w has an odd number of 1's if and only if x has an even number of 1's because ________
(6)
In case (a), δ(A,x) = A if and only if w has an odd number of 1's because ________
(7)
In case (a), δ(A,w) = B if and only if w has an odd number of 1's because ________
Case (b):
(8)
In case (b), w has an odd number of 1's if and only if x has an odd number of 1's because ________
(9)

In case (b), δ(A,x) = B if and only if w has an odd number of 1's because _________

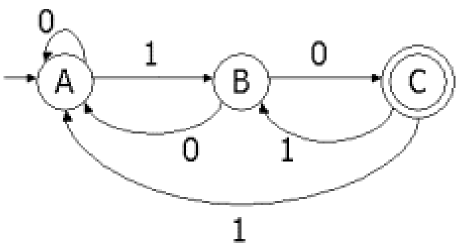
(10)

In case (b), δ(A,w) = B if and only if w has an odd number of 1's because _________

Your Answer		Score	Explanation
(7) for reason C.			
(1) for reason C.			
(2) for reason A.			
(9) for reason B.	✗	0.00	Can we conclude that δ(A,x) = B if and only if w has an odd number of 1's by reasoning only about finite automata?
Total		0.00 / 1.00	

Question 4

The following nondeterministic finite automaton:

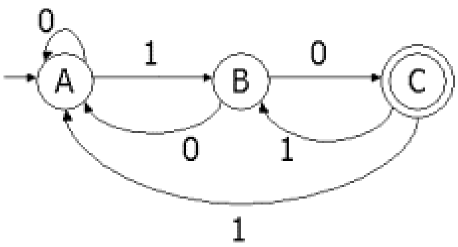


accepts which of the following strings?

Your Answer		Score	Explanation
10011010			
010111			
00110100			
10001010	✓	1.00	
Total		1.00 / 1.00	

Question 5

Convert the following nondeterministic finite automaton:



to a DFA, including the dead state, if necessary. Which of the following sets of NFA states is **not** a state of the DFA that is accessible from the start state of the DFA?

Your Answer		Score	Explanation
{A,C}			
{C}	✔	1.00	
{A,B}			
{B}			
Total		1.00 / 1.00	