Fall 2022 - Computation Theory.
HW1 (Last update – 20 tasks) - 15 pt
Deadline is November 2, 2022, 23:59

Structure of grades

Tasks 1-4, 5, 8:	by 0.3 points each=	1.8 pt
Tasks 9, 11, 12, 14, 16, 18, 19, 22, 24, 25, 27:	by 0.7 points each=	7.7 pt
Task 28		1.5 pt
Task 31: -		4.0 pt

Students must send a pdf version of HW1 to instructor via chat in MS Teams.

Task 1. Consider the language L={ab, c}over A={a, b, c}. Find: (*a*) L^0; (*b*) L^2;

Task 2. Let A={a, b, c}. Find L* where: (*a*) L={b^2}; (*b*) L={a, b};

Task 3. Let A={a, b}. Describe the language L(r) where:

(a) r=abb*a; (b) r=b*ab*ab*; (c) r=a*∪b*; (d) r=ab*∩a*.

Task 4. Let A={a, b, c} and let w=abc. Whether w belongs to L(r) where:

(a) r=a*∪(b∪c)*; (b) r=a*(b∪c)*.

Task 5. Let A={a, b}. Find a regular expression r such that L(r) consists of all words w where:

(*a*) w begins with a^2 and ends with b^2; (*b*) w contains an even number of *a*'s.

Task 8. Let A={a, b}. Find a regular expression r such that L(r) consists of all words w where:

(a) w contains exactly three a's. (b) the number of *a*'s is divisible by 3.

Task 9. Let A={a, b}. Construct an automaton M which accepts the language:

(a) L(M)={$b^r ab^s$ |r>0, s>0}; (b) L(M)={$a^r b^s$ |r>0, s>0}.

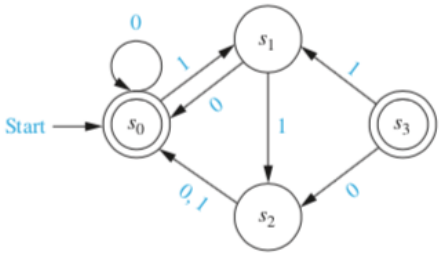


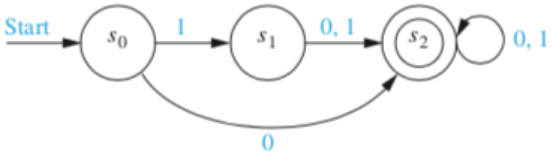
Figure 1

Task 11. Determine whether all the strings in each of these sets are recognized by the DFSA in Fig. 1

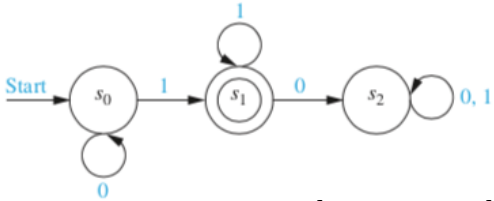
a) {0}* **b)** {0}{0}* **c)** {1}{0}*.

d) {01}* **e)** {0}*{1}* **f)** {1}{0, 1}*.

Task 12. Find the language recognized by the given DFSA.



Task 14. Find the language recognized by the given DFSA.



Task 16 (not for Midterm Exam). Show that there is no finite-state automaton with two states that recognizes the set of all bit strings that have one or more 1 bits and end with a 0.

Task 18. Construct a deterministic finite-state automaton that recognizes the set of all bit strings beginning with 01.

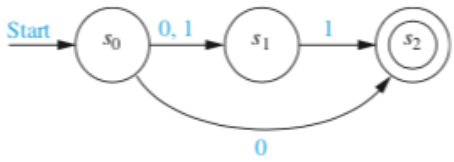
Task 19. Construct a deterministic finite-state automaton that recognizes the set of all bit strings that contains the string 101.

Task 22. Construct a deterministic finite-state automaton that recognizes the set of all bit strings that contain an odd number of 0s.

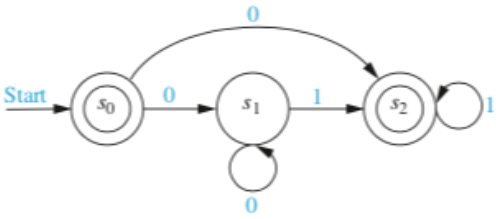
Task 23. Construct a finite-state automaton that recognizes the set of bit strings consisting of a 0 followed by a string with an odd number of 1s.

Task 24. Construct a deterministic finite-state automaton that recognizes the set of all bit strings that begin and end with 11.

Task 25. Find the language recognized by the given NDFSA M.



Task 27. Find the language recognized by the given NDFSA M.



Task 28.

1. Find a DFSA in "table form" that recognizes the same language as the NDFSA in task 25.
2. Then build up state diagram for the DFSA created.

Task 31.

Let P and Q are regular languages over the set $I=\{0, 1\}$; M_P and M_Q are automata which recognize the languages P and Q respectively.

Table 4 (NDFSA M_P**)**

State	f	
	Input	
	0	**1**
S_0	S_1	S_2
S_1	S_2	
S_2	S_3	S_1, S_3
S_3		S_3
Start state:	S_0	
Final States:	S_0, S_3	

Table 5 (NDFSA M_Q**)**

State	f	
	Input	
	0	**1**
T_0	T_0, T_2	T_1
T_1		T_2
T_2	T_1	T_3
T_3	T_3	
Start state:	T_0	
Final State:	T_0, T_2	

Subtask (a) Provide state diagrams for M_P and M_Q – **(2*0.1=0.2 pt)**

Subtask (b). Use Kleene's method to construct state diagram for the machine M_{PQ} which recognizes the concatenation PQ. Provide **a description of start state, final states, and new transitions in M_{PQ}. No description – no points.** **(0.9 pt)**

Subtask (c). Use Kleene's method to construct state diagram for the machine M_{QP} which recognizes the concatenation QP. Provide **a description of start state, final states, and new transitions in M_{QP}. No description – no points.** **(0.9 pt)**

Subtask (d). Use Kleene's method to construct state diagram for the machine M_{P^*} which recognizes the language P^* (Kleene closure of P). Provide **a description of start state, final states, and new transitions in M_{P^*}. No description – no points.** **(1 pt)**

Note: When preparing the HW1 **ALL new transitions** generated for M_{PQ}, M_{QP} and M_{P^*} must be shown in state diagrams ***by dashed lines.***

Good Luck,

Fuad bey