HO CHI MINH CITY UNIVERSITY OF TECHNOLOGY
Faculty of Computer Science & Engineering

Student name: ______________
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Revision for Automata session

Course: Mathematical Modeling
Duration:... mins   Exam Code: **2212**
Choose the best answer for each multiple-choice question and fill in the blank needed.

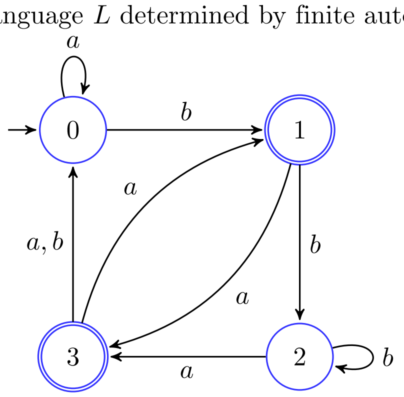
Question 1. Let's consider $\Sigma = \{a, b, c\}$ and $L = \{a, abb, bba, ba, c\}$. Which string belongs to L^*?

(A) *abaaacbb* (B) *aaabbbbba* (C) *aabacabba* (D) *babacbbbaaa*

Question 2. Let's consider $\Sigma = \{a, b, c\}$ and $L = \{a, aab, bbc, ba\}$. Which string does not belong to L^4?

(A) *aababbc* (B) *baaaaab* (C) *abaaabba* (D) *abbcaab*

Questions from 3–9, consider the language L determined by finite automata on $\{a, b\}$ as follows.



Question 3. Choose the correct statement.

(A) This automata is a NFA since it is not deterministic.
(B) This automata is not a DFA since the number of states is not finite.
(C) This automata is not optimized.
(D) Any language L could be represented by this automata.

Question 4. Which string is valid?

(A) *aabb* (B) *aababbab* (C) *aabba* (D) *abbbbbab*

Question 5. Which string is not valid?

(A) *ababab* (B) *aabbbaabbab* (C) *aabbbbaaa* (D) *bbbbbababa*

Question 6. Which string is not in L^2?

(A) *aababbab* (B) *aabba* (C) *aabbbbaaa* (D) *abbbb*

Question 7. Which regular expression Z corresponds to the considering finite automata?

(A) $X = a^*b;\ Y = X(a + bb^*a)\ ;\ Z = X(Y(a + b)X)^*$
(B) $X = a^*b + Ya;\ Y = X(a + bb^*a)\ ;\ Z = (XY(a + b))^*(X + XY)$
(C) $X = a^*b + (a + bb^*a)a;\ Y = X(a + bb^*a)\ ;\ Z = (XY(a + b))^*(X + XY)$
(D) $X = a^*b[(a + bb^*a)a]^*;\ Y = (a + bb^*a)\ ;\ Z = X(Y(a + b)X)^* + XY((a + b)XY)^*$

Question 8. When using determinisation algorithm to convert NFA into DFA, how many states are there in the new DFA?

(A) 6 (B) 7
(C) 10 (D) None of the others.

Question 9. How many states are there in the minimized/optimized DFA (which is equivalent to the above NFA) ?

(A) 6 (B) 7
(C) 10 (D) None of the others.

Question 10. Find the correct statement.

(A) When occuring an event from a state, the NFA does not determine the next state.

(B) NFA has not finite number of states but DFA has a finite number of states .

(C) The number of states is always reduced when determinisation from NFA to DFA.

(D) NFA does not determine surely the next state in order to simplify the graph.

Question 11. Are two regular expressions $E_1 = (a+b)^*$ and $E_2 = (aa+ab+ba+bb)^*$ are equivalent? If not, give a counter-example.

(A) They present the same language

(B) $E_1 \subseteq E_2$

(C) They are not equivalent, the counter-example is a

(D) They are not equivalent, the counter-example is aa

Question 12. Do two regular expression $E_3 = ((a+b)^*(ac)^*)^*$ and $E_4 = (a+aa+ba+b+c)^*$ present the same language? If not, give a counter-example.

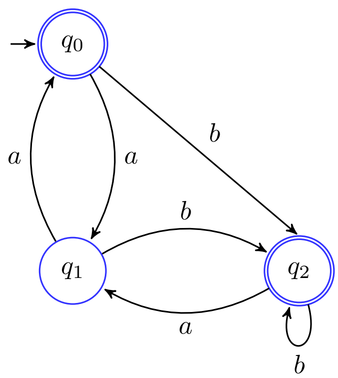
(A) They present the same language

(B) $E_4 \subseteq E_3$

(C) They are not equivalent, the counter-example is cc.

(D) They are not equivalent, the counter-example is aa.

Question 13. Do the following automata and regular expression $E = ((aa)^* + bb^*a(aa)^*b(ab)^*)^*$ present the same language? If not, give a counter-example.



(A) They present the same language.

(B) They are not equivalent, the counter-example is baa.

(C) They are not equivalent, the counter-example is ε.

(D) They are not equivalent, the counter-example is bab.

Question 14. Which the method is used to determine the equivalent property of two given finite automatas (FA)?

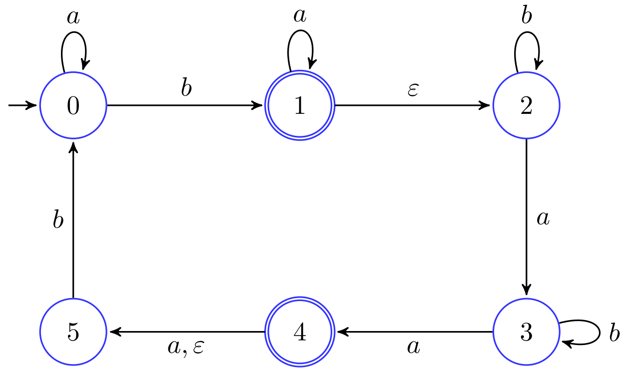
(A) Compare the number of states between two FAs.

(B) Compare transition table of two new FAs that have been minimized from two given FAs.

(C) Verify all posible cases based on transition table of two FAs.

(D) Check through equivalent regular expressions.

Question 15. Let a finite automata on $\Sigma = \{a, b\}$, Which regular expression Z corresponds to the considering finite automata?



(A) $X = a^*ba^*, Y = b^*ab^*a, Z = X(Y(a+b)X)^* + XY((a+b)XY)^*$

(B) X=$a^*ba^*b^*a, Y = b^*a, Z = X(Y(ab+b)X)^* + XY((ab+b)XY)^*$

(C) X=$a^*b, Y = a^*b^*ab^*a, Z = X(Y(ab+b)X)^* + XY((ab+b)XY)^*$

(D) $X = a^*b, Y = a^* + a^*b^*ab^*a, Z = X(Y(ab+b)X)^* + XY((ab+b)XY)^*$

(E) $X = a^*ba^*, Y = b^*ab^*a, Z = X(Y(ab+b)X)^* + XY((ab+b)XY)^*$

Question 16. The regular expression of a language $L = \{a^n b^m \| (n+m) \text{ is even}\}$ is

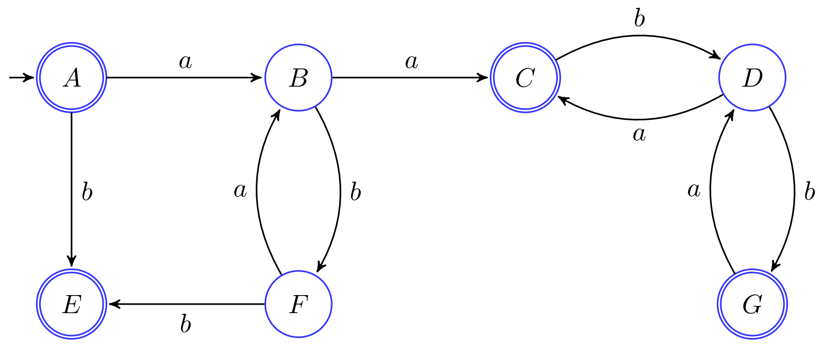
(A) $((aa)^+(bb)^+(a(aa)^+b(bb)^+)$.

(B) $(aa)^*(bb)^* + a(aa)^*b(bb)^*$

(C) $(aa)^*(bb)^*a(aa)^*b(bb)^*$

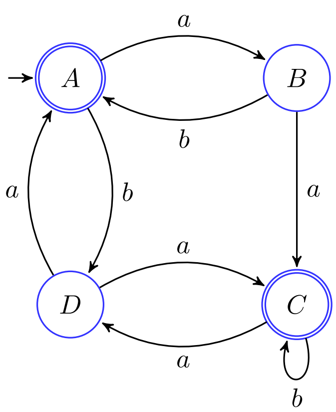
(D) $((aa)^+(bb)^+ + (a(aa)^+b(bb)^+)$.

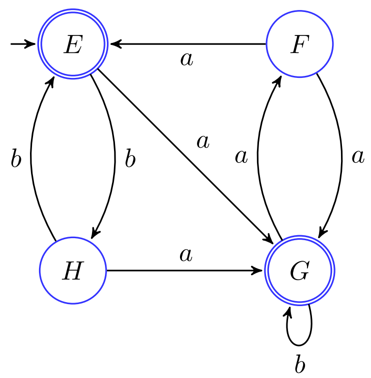
Question 17. Which of the following strings can not be in L^* with L is the following automata?



(A) *aababba* (B) *bbaaaa* (C) *aaaabb* (D) *abaababab*

Question 18. Which of the following is a counter-example that shows that the two automata below are not equivalent?





(A) *abaab* (B) *baaab* (C) *babb* (D) *abbaa*

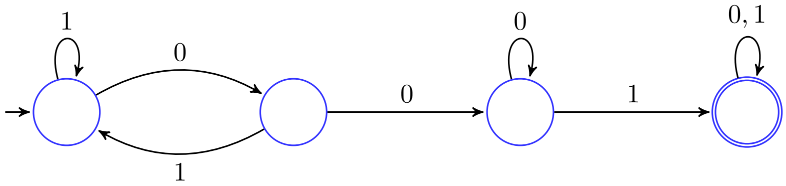
Question 19. Maximum number of states of a DFA converted from an NFA with N states is?

(A) N^2 (B) 2^N (C) $N!$ (D) N

Question 20. Let S and T be languages over $\Sigma = \{a, b\}$ represented by the regular expressions $(a + b^*)^*$ and $(a + b)^*$ respectively. Which of the following is true?

(A) $S \subset L$ (B) $S = T$ (C) $T \subset S$ (D) $S \cap T$

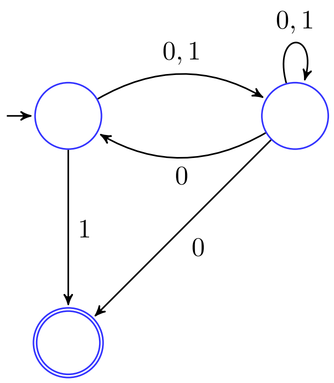
Question 21. Consider the following deterministic finite state automaton M.



Let S denote the set of seven bit binary strings in which the first, the fourth, and the last bits are 1. The number of strings in S that are accepted by M is

(A) 8 (B) 5 (C) 7 (D) 10

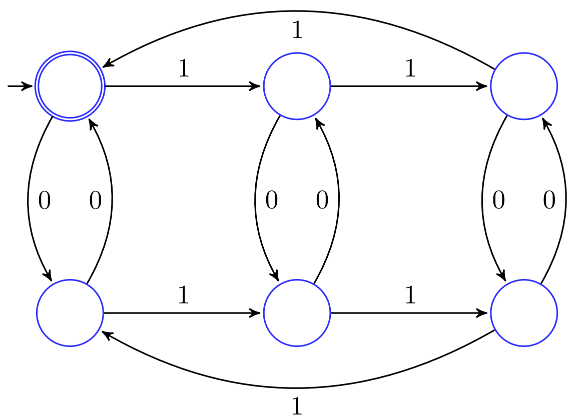
Question 22. Consider the NFA M shown below.



Let the language accepted by M be L. Let L_1 be the language accepted by the NFA M_1, obtained by changing the accepting state of M to a non-accepting state and by changing the non-accepting state of M to accepting states. Which of the following statements is true?

(A) $L_1 = \{0, 1\}^* \backslash L$ (B) $L_1 \subseteq L$ (C) $L_1 = L$ (D) $L_1 = \{0, 1\}^*$

Question 23. The following finite state machine accepts all those binary strings in which the number of 1's and 0's are respectively.

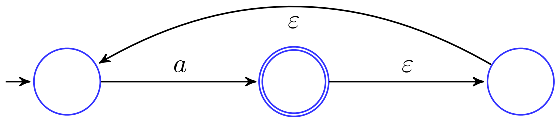


(A) divisible by 3 and 2.
(B) odd and even.
(C) even and odd.
(D) divisible by 2 and 3.

Question 24. Consider the languages $L_1 = \emptyset$ and $L_2 = \{a\}$. Which one of the following represents $L_1 L_2^* \cup L_1^*$?

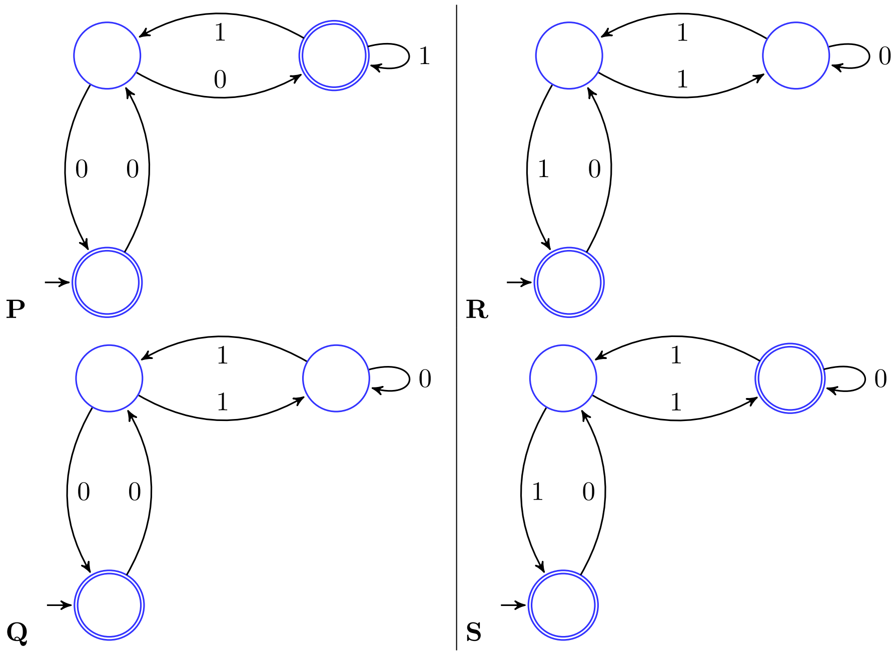
(A) $\emptyset$ (B) $\{\varepsilon\}$ (C) $\{a^*\}$ (D) $\{a, \varepsilon\}$

Question 25. What is the complement of the language accepted by the NFA shown below?



(A) $\emptyset$ (B) $\{\varepsilon\}$ (C) $\{a^*\}$ (D) $\{a, \varepsilon\}$

Question 26. Match the following NFAs with the regular expressions they correspond to:
1.$\varepsilon + 0(01^*1 + 00)^*01^*$ 2. $\varepsilon + 0(10^*1 + 10)^*1$
3.$\varepsilon + 0(10^*1 + 00)^*0$ 4. $\varepsilon + 0(10^*1 + 10)^*10^*$



(A) $P-2, Q-1, R-3, S-4$
(B) $P-1, Q-3, R-2, S-4$
(C) $P-3, Q-2, R-1, S-4$
(D) $P-1, Q-2, R-3, S-4$

Question 27. Reduce the following expression $\varepsilon + 1^*(011)^*(1^*(011)^*)^*$?

(A) $(1 + 011)^*$ (B) $1^*(011)^*$ (C) $(1(011)^*)^*$ (D) $(1011)^*$

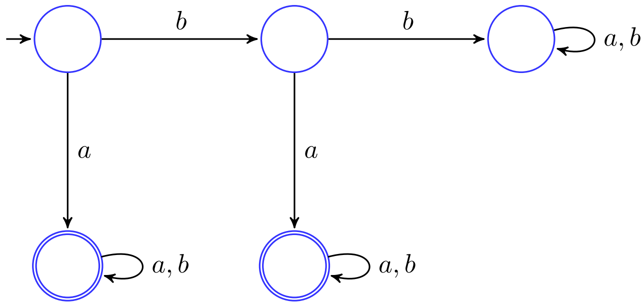
Question 28. What can be said about a regular language L over $\{a\}$ whose minimal finite state automaton has two states?

(A) $L = \{a^n | n \text{ is odd}\}$
(B) $L = \{a^n | n \text{ is even}\}$
(C) $L = \{a^n | n \geq 0\}$
(D) Either $L = \{a^n | n \text{ is odd}\}$, or $L = \{a^n | n \text{ is even}\}$

Question 29. How many minimum states are required in a DFA to find whether a given binary string has odd number of 0's or not, there can be any number of 1's.

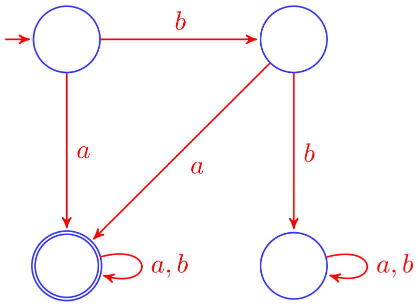
(A) 1
(B) 2
(C) 3
(D) 4

Question 30. A deterministic finite automation (DFA)D with alphabet $\Sigma = \{a, b\}$ is given below

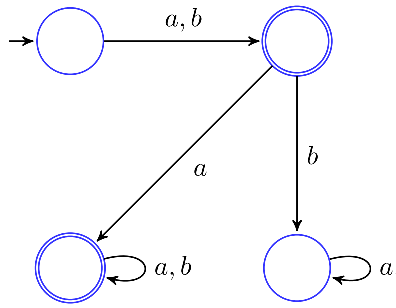


Which of the following finite state machines is a valid minimal DFA which accepts the same language as D?

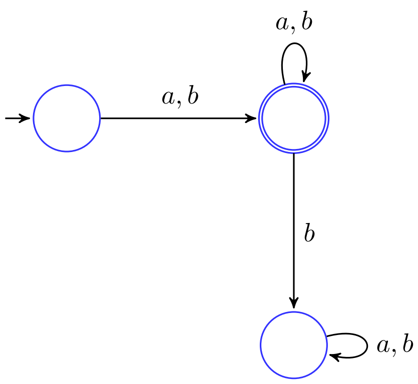
(A)



(B)



(C)



(D)