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

Student name: _____
Student ID: _____

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.

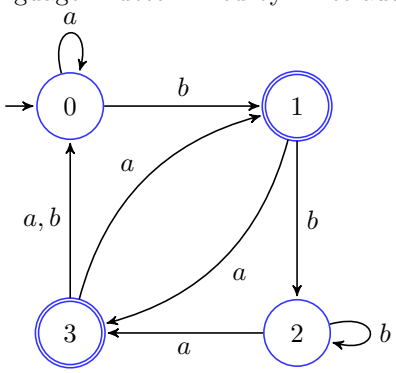
Question 1. Let's consider $\Sigma = \{a, b, c\}$ and $L = \{a, abb, bba, ba, c\}$. Which string belongs to L^*?

(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.

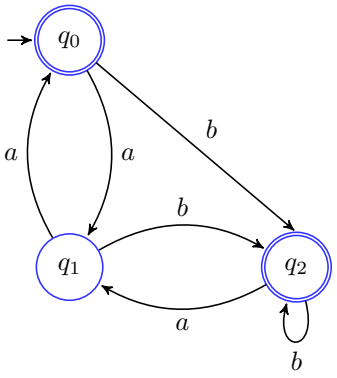
Question 11. Are two regular expressions $E_1 = (a+b)^*$ and $E_2 = (aa+ab+ba+bb)^*$ are equivalent? If not, give a counter-example.

- (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.

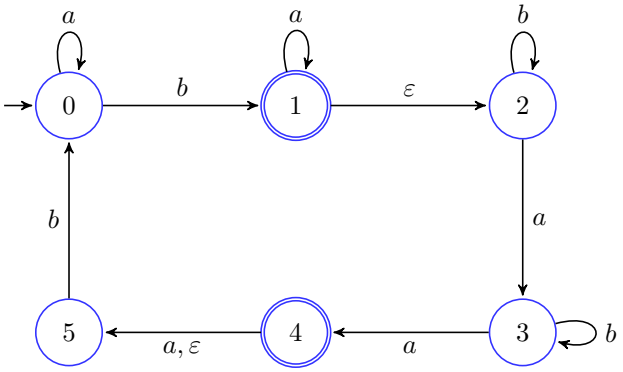


- (A) They present the same language.
- (B) They are not equivalent, the counter-example is baa.
- (C) They are not equivalent, the counter-example is ε.
- (D) They are not equivalent, the counter-example is bab.

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.

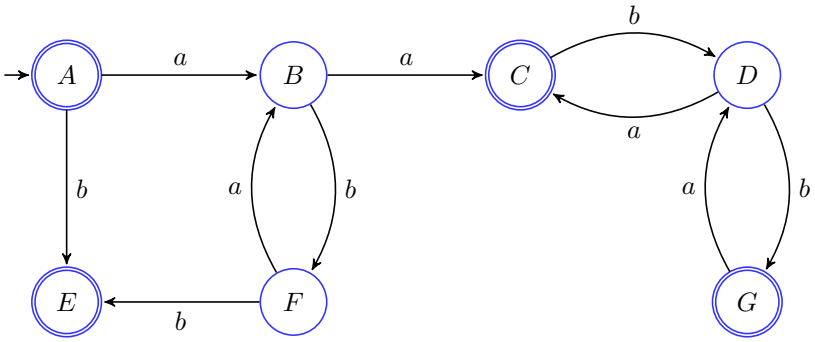
Question 15. Let a finite automata on $\Sigma = \{a, b\}$, Which regular expression Z corresponds to the considering finite automata?



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

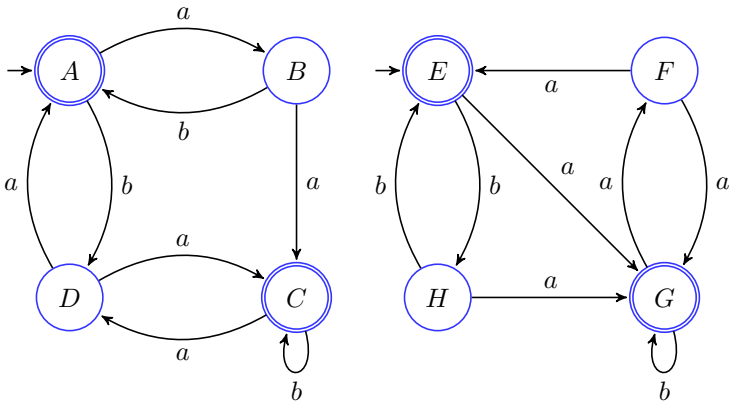
Question 16. The regular expression of a language $L = \{a^n b^m \| (n+m) \text{ is even}\}$ is
(A) $((aa)^+(bb)^+(a(aa)^+b(bb)^+)$.
(B) $(aa)^*(bb)^* + a(aa)^*b(bb)^*$
(C) $(aa)^*(bb)^*a(aa)^*b(bb)^*$
(D) $((aa)^+(bb)^+ + (a(aa)^+b(bb)^+)$.

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*

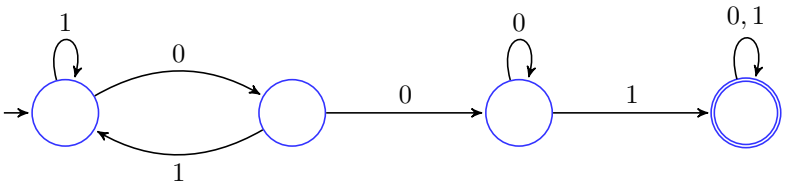
Question 19. Maximum number of states of a DFA converted from an NFA with N states is?

(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) $S \cap T$

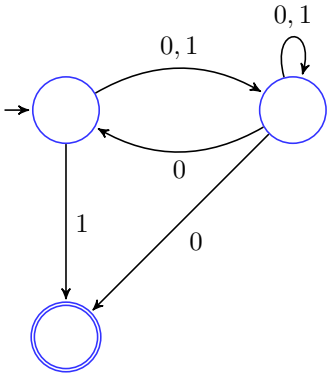
Question 21. Consider the following deterministic finite state automaton M.



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

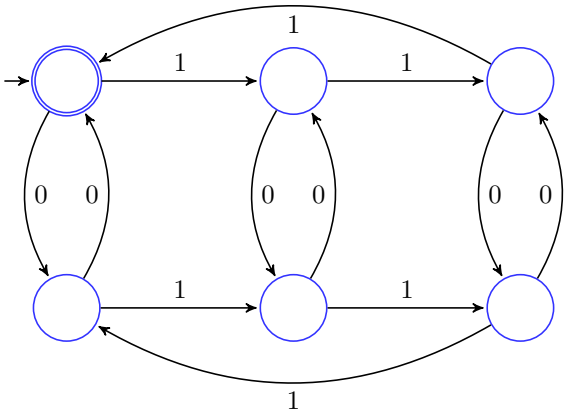
Question 22. Consider the NFA M shown below.



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.

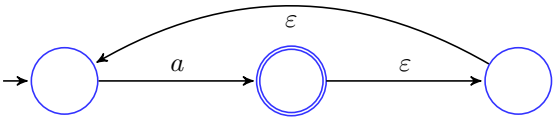


(A) divisible by 3 and 2.
(B) odd and even.
(C) even and odd.
(D) divisible by 2 and 3.

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

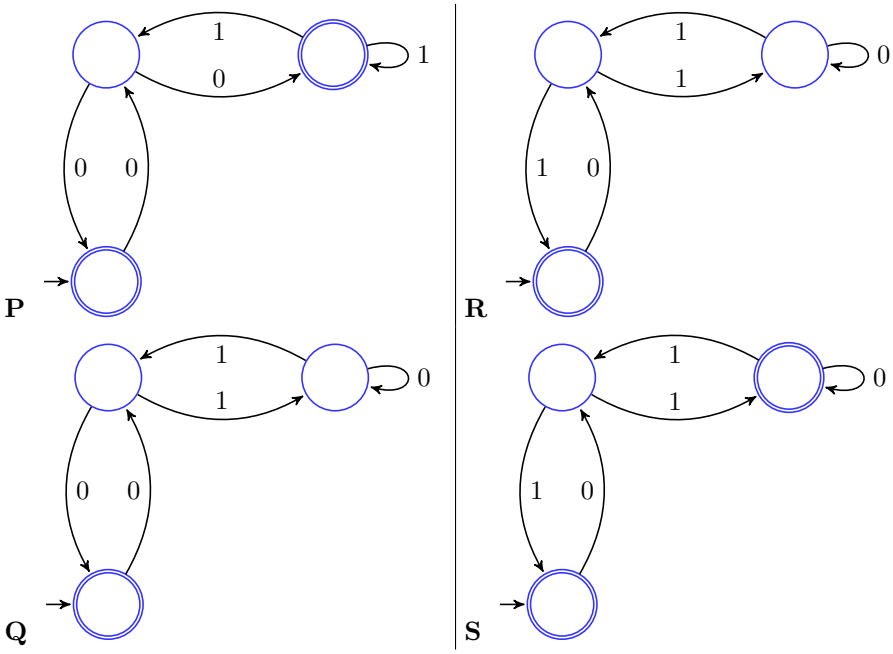
(A) $\emptyset$ (B) $\{\varepsilon\}$ (C) $\{a^*\}$ (D) $\{a, \varepsilon\}$

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) $(1011)^*$

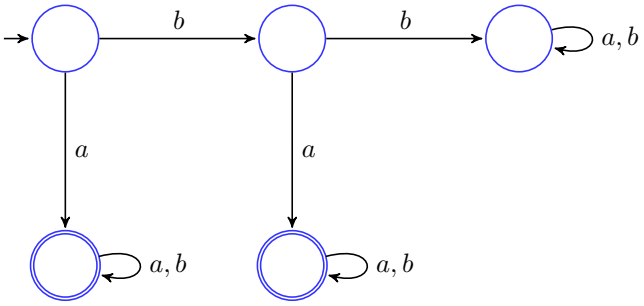
Question 28. What can be said about a regular language L over $\{a\}$ whose minimal finite state automaton has two states?

(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.

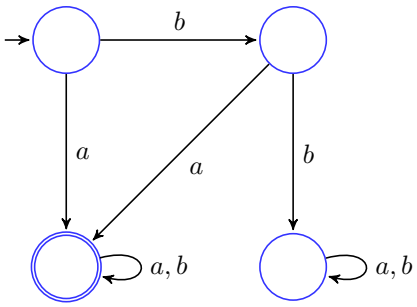
(A) 1
(B) 2
(C) 3
(D) 4

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

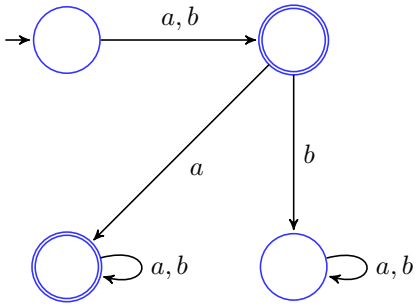


Which of the following finite state machines is a valid minimal DFA which accepts the same language as D?

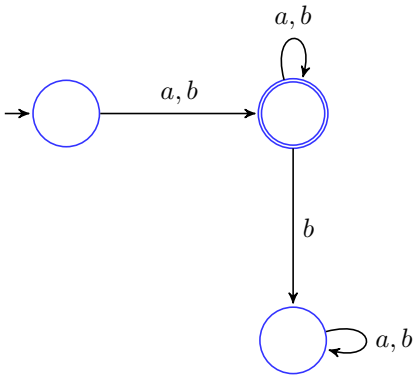
(A)



(B)



(C)



(D)