Started on	Monday, 13 September 2021, 8:01 AM
State	Finished
Completed on	Monday, 13 September 2021, 10:01 AM
Time taken	2 hours
Grade	Not yet graded

Question **1**

Correct

Mark 1.00 out of 1.00

Question 1. (1 point) Consider the languages $L_1 = \{\}$ and $L_2 = \{\epsilon\}$. Which of the following is equivalent to $\{\}$?

Select one:

a. $L_1 L_2$

✔

b. $L_1 L_2^* \cup L_1^*$

c. $L_1^* L_2$

d. $L_1^* L_2^* \cup L_1$

Your answer is correct.

The correct answer is: $L_1 L_2$

Question **2**

Not answered

Marked out of 1.00

Question 2. (1 point) What is the minimum number of states required to construct a DFA to recognize $L = \{0^{5n} | n > 0\}$?

Select one:

a. 5

b. 4

c. 7

d. 6

Your answer is incorrect.

The correct answer is: 5

Question **3**

Correct

Mark 2.00 out of 2.00

Question 3. (2 points) Which of the following regular expression are equivalent?

R_1 : $a^*(ab^*a^* + b^*) + b^*(ba^*b^* + a^*)$
R_2 : $(a^* + b^*)(a^* + b^*)(b^* + a^*)$
R_3 : $a^*b^*a^* + b^*a^*b^*$
R_4 : $a^*b^* + bb^*a^* + aa^*b^*a^*$

Select one:

a. Only R_3 and R_4

b. Only R_2, R_3 and R_4

c. Only R_1, R_2 and R_3 ✔

d. Only R_1 and R_3

Your answer is correct.

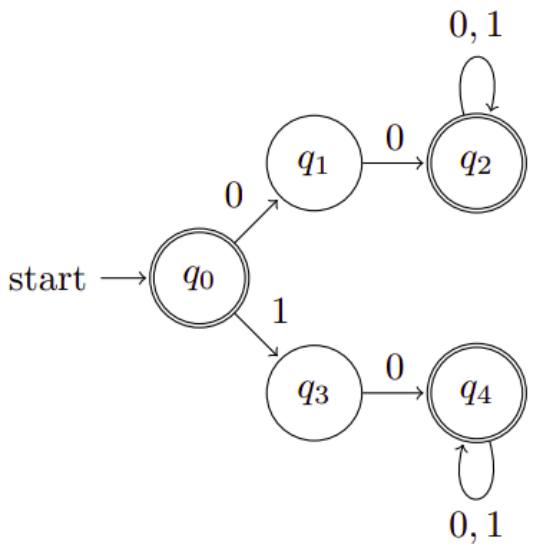
The correct answer is: Only R_1, R_2 and R_3

Question **4**

Correct

Mark 2.00 out of 2.00

Question 4. (2 points) What is the regular expression corresponding to the following NFA?



Select one:

a. $(\epsilon + 00 + 10)(0 + 1)^*$

b. $(\epsilon + (0 + 1)0)(0 + 1)^*$

c. $\epsilon + (0 + 1)0(0 + 1)^*$ ✔

d. $(\epsilon + 0 + 1)0(0 + 1)^*$

Your answer is correct.

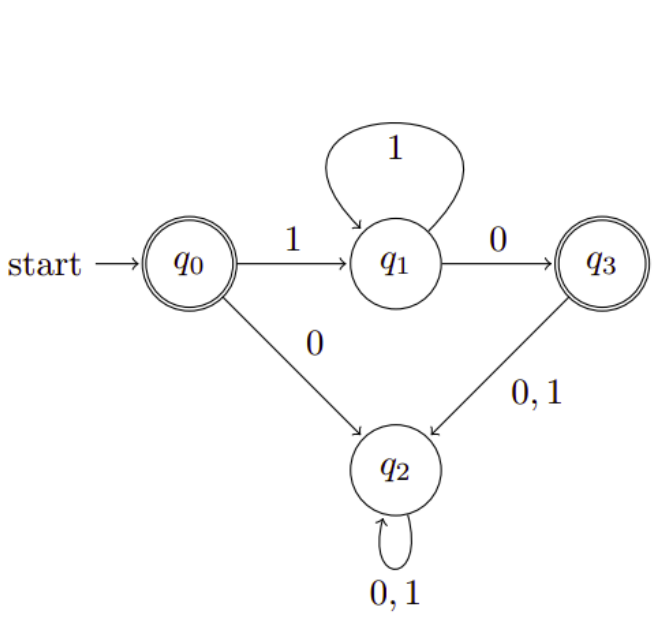
The correct answer is: $\epsilon + (0 + 1)0(0 + 1)^*$

Question **5**

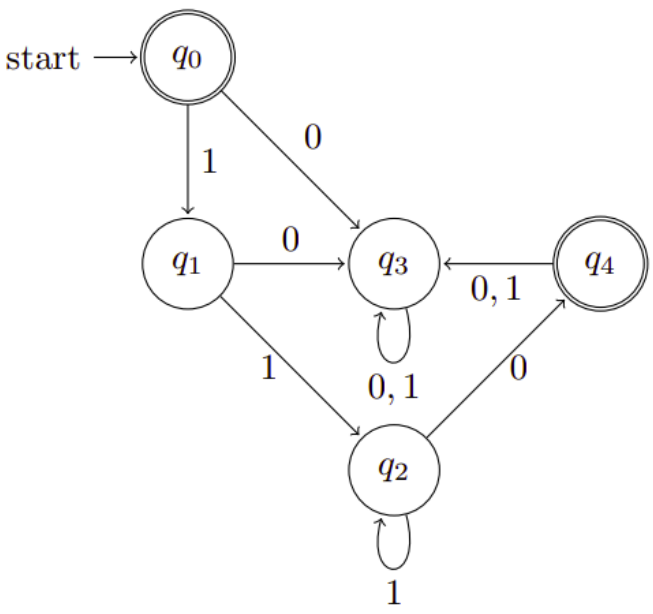
Correct

Mark 5.00 out of 5.00

Question 5. (5 points) Consider the following two DFAs A_1 and A_2



DFA A_1



DFA A_2

Which one of the following is true?

Select one:

a. $L(A_1) \subsetneq L(A_2)$

b. $L(A_2) \subsetneq L(A_1)$ ✔

c. $L(A_1) = L(A_2)$

d. None of the above

Your answer is correct.

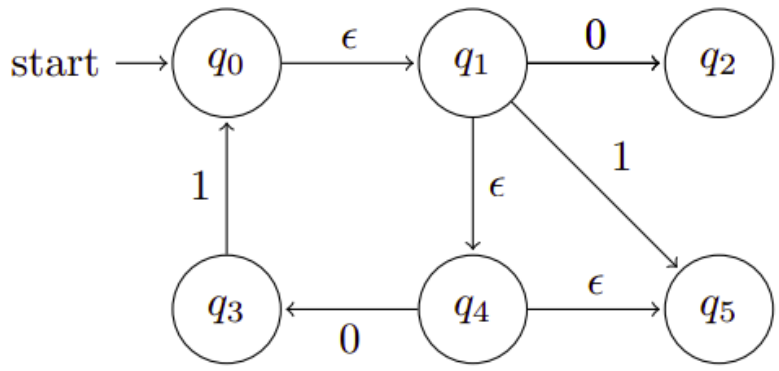
The correct answer is: $L(A_2) \subsetneq L(A_1)$

Question **6**

Partially correct

Mark 0.67 out of 1.00

Question 6. (1 point) Consider the following NFA.



Which states belong to the ϵ-closure of the state q_1 in the above NFA?

Select one or more:

- a. q_0
- b. q_4 ✔
- c. q_5 ✔
- d. q_1

Your answer is partially correct.

You have correctly selected 2.

The correct answers are: q_1 , q_4 , q_5

Question **7**

Correct

Mark 1.00 out of 1.00

Question 7. (1 point) Context-free languages are closed under which of the following operations?

Select one or more:

- a. Union ✔
- b. Set difference
- c. Concatenation ✔
- d. Complementation

Your answer is correct.

The correct answers are: Concatenation , Union

Question **8**

Partially correct

Mark 0.67 out of 1.00

Question 8. (1 point) Which of the following production rules are not allowed in a grammar in Chomsky Normal Form (S is the start symbol)?

Select one or more:

- a. $A \longrightarrow aB$ ✔
- b. $A \longrightarrow BCD$ ✔
- c. $A \longrightarrow AB$
- d. $S \longrightarrow SA$ ✖

Your answer is partially correct.

You have correctly selected 2.

The correct answers are: $A \longrightarrow BCD$, $A \longrightarrow AB$, $A \longrightarrow aB$

Question **9**

Correct

Mark 2.00 out of 2.00

Question 9. (2 points) A CFG G is given below with S as the start symbol.

$$\begin{aligned} S &\longrightarrow aS \mid A \\ A &\longrightarrow aAb \mid bAa \mid \epsilon \end{aligned}$$

Which of the following strings is generated by the grammar?

Select one or more:

- a. abababb
- b. aababab ✔
- c. aabbaab ✔
- d. aabbaba

Your answer is correct.

The correct answers are: aababab, aabbaab

Question **10**

Incorrect

Mark 0.00 out of 2.00

Question 10. (2 points) Consider the language

$$L = \{w \in \{0,1\}^* \mid w \text{ begins with } 11 \text{ and has an even number of } 1\text{'s}\}.$$

How many states will the minimal DFA for L have?

Select one:

- a. 4 ✖
- b. 6
- c. 5
- d. 3

Your answer is incorrect.

The correct answer is: 5

Question **11**

Correct

Mark 1.00 out of 1.00

Question 11. (1 point) Identify the language generated by the following grammar -

$$\begin{aligned} S &\longrightarrow AB \\ A &\longrightarrow aAb \mid \epsilon \\ B &\longrightarrow bB \mid b \end{aligned}$$

Select one:

- a. $\{a^m b^n \mid n \geq m, m > 0\}$
- b. $\{a^m b^n \mid n > m, m \geq 0\}$ ✔
- c. $\{a^m b^n \mid n > m, m > 0\}$
- d. $\{a^m b^n \mid n \geq m, m \geq 0\}$

Your answer is correct.

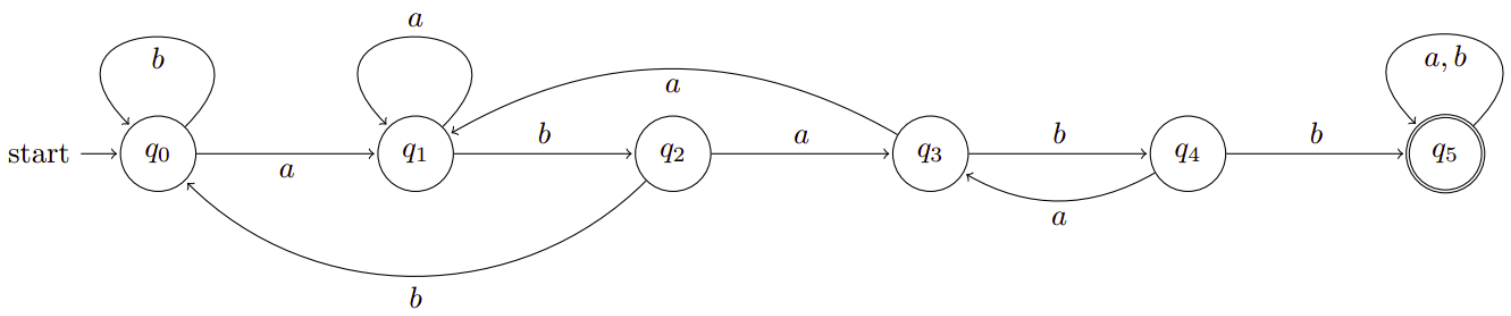
The correct answer is: $\{a^m b^n \mid n > m, m \geq 0\}$

Question **12**

Correct

Mark 2.00 out of 2.00

Question 12. (2 points) What is the language accepted by the following DFA?



Select one:

a. The set of string containing *ababb* as substring ✔

b. The set of strings ending with *ababb*

c. The set of strings beginning with *ababb*

d. The set of strings with *bababb* as substring

Your answer is correct.

The correct answer is: The set of string containing *ababb* as substring

Question **13**

Incorrect

Mark 0.00 out of 2.00

Question 13. (2 points) Consider the following two grammars: G_1:

$$S \longrightarrow SbS \mid a$$

G_2:

$$S \longrightarrow aB \mid ab$$
$$A \longrightarrow AB \mid a$$
$$B \longrightarrow ABb \mid b$$

Which of the following option is correct?

Select one:

a. Only G_1 is ambiguous.

b. Neither G_1 nor G_2 are ambiguous.

c. Only G_2 is ambiguous. ✖

d. Both G_1 and G_2 are ambiguous.

Your answer is incorrect.

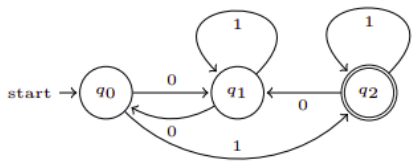
The correct answer is: Both G_1 and G_2 are ambiguous.

Question **14**

Correct

Mark 5.00 out of 5.00

Question 14. (5 points) Match the NFAs , DFAs and REs in column A with their appropriate languages in column B.

Column A	**Column B**
(1) 	(a) $\{w \in \{0,1\}^* \mid w$ ends with 1 and has even no. of 0's$\}$
(2) $00^*1(0+1)^*$	(b) $\{w \in \{0,1\}^* \mid w$ has 101 as a substring$\}$
(3) $0^*(\epsilon + 10^*(\epsilon + 10^*))$	(c) $\{w \in \{0,1\}^* \mid w$ has at most two 1's$\}$
(4)	(d) $\{w \in \{0,1\}^* \mid w$ begins with 0 and has at least one 1$\}$

Choose the correct matching from following choices.

Select one:

- a. 1-a, 2-d, 3-c, 4-b ✔
- b. 1-d, 2-c, 3-a, 4-b
- c. 1-b, 2-d, 3-a, 4-c
- d. 1-b, 2-c, 3-a, 4-d

Your answer is correct.

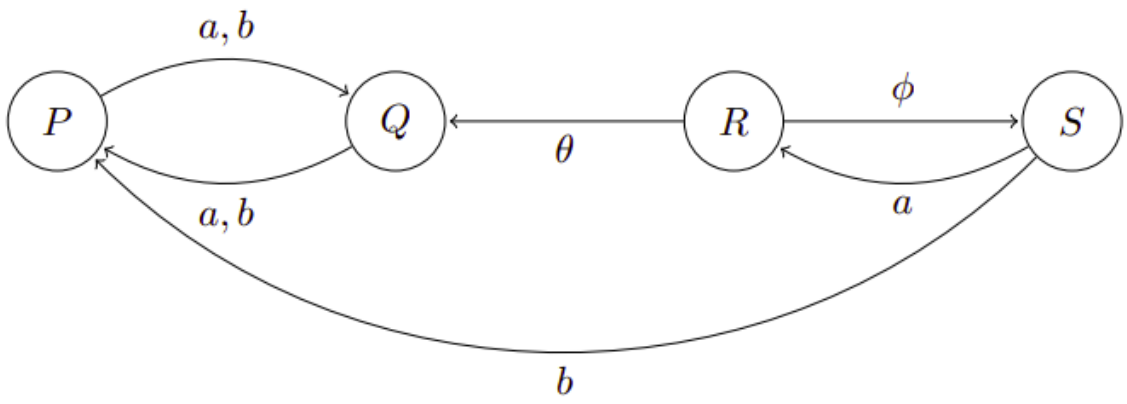
The correct answer is: 1-a, 2-d, 3-c, 4-b

Question **15**

Correct

Mark 5.00 out of 5.00

Question 15. (5 points) Consider the following finite state machine A



Choose the correct modifications so that A becomes a DFA and

$$L(A) = \{w \in \{a,b\}^* \mid w \text{ has odd length with at least one } b\}.$$

Select one:

a. Replace θ by $'b'$ and ϕ by $'a'$ and make P starting state and S accept state

b. Replace θ by $'a'$ and ϕ by $'b'$ and make Q starting state and P accept state

c. Replace θ by $'b'$ and ϕ by $'a'$ and make S starting state and P accept state ✔

d. Replace θ by $'a'$ and ϕ by $'b'$ and make P starting state and Q accept state

Your answer is correct.

The correct answer is:

Replace θ by $'b'$ and ϕ by $'a'$ and make S starting state and P accept state

Question **16**

Correct

Mark 1.00 out of 1.00

Question 16. (1 point) If $L = \{a, ab\}$, which of the following are in L^*?

Select one or more:

a. bababaaba

b. abababaab ✔

c. aabaaab ✔

d. abababbab

Your answer is correct.

The correct answers are: aabaaab , abababaab

Question **17**

Partially correct

Mark 1.00 out of 2.00

Question 17. (2 points) Consider the following grammar.

$$\begin{aligned} S &\longrightarrow AB \\ A &\longrightarrow a \mid BaB \\ B &\longrightarrow bbA \end{aligned}$$

Which of the following statements is/are true?

Select one or more:

- a. The grammar is in Chomsky Normal Form.
- b. The length of every string produced by this grammar is even.
- c. No string produced by this grammar has three consecutive *as*. ✔
- d. The string *abbaab* is generated by this grammar.

Your answer is partially correct.

You have correctly selected 1.

The correct answers are:

The length of every string produced by this grammar is even.

No string produced by this grammar has three consecutive *as*.

Question **18**

Correct

Mark 2.00 out of 2.00

Question 18. (2 points) Let R be a regular language and L be a context-free language. Which of the following is necessarily true?

Select one or more:

- a. $L \cap R$ is regular
- b. If $L \cup R$ is regular then L is regular
- c. $L \cup R$ is context-free ✔
- d. $\overline{R}$ is regular ✔

Your answer is correct.

The correct answers are: $\overline{R}$ is regular , $L \cup R$ is context-free

Question **19**

Partially correct

Mark 1.33 out of 2.00

Question 19. (2 points) Which of the following languages are regular?

Select one or more:

- a. $\{w \in \{a,b,c\}^* \mid w \text{ has no } c \text{ to the left of an } a\}$
- b. $\{w \in \{0,1\}^* \mid w \text{ has an even number of 0's}\}$ ✔
- c. $\{w \in \{a,b,c\}^* \mid w \text{ has 10 } c\text{'s after every } a\}$ ✔
- d. $\{w \in \{0,1\}^* \mid w \text{ has equal number of 0's and 1's}\}$

Your answer is partially correct.

You have correctly selected 2.

The correct answers are: $\{w \in \{0,1\}^* \mid w \text{ has an even number of 0's}\}$, $\{w \in \{a,b,c\}^* \mid w \text{ has no } c \text{ to the left of an } a\}$, $\{w \in \{a,b,c\}^* \mid w \text{ has 10 } c\text{'s after every } a\}$

Question **20**

Correct

Mark 5.00 out of 5.00

Question 20. (5 points) Let L be a language over Σ. Define

$$L' = \{w \in \Sigma^* \mid wx \in L \text{ for some } x \in \Sigma^* \text{ and } |w| = |x|\}.$$

Which one of the following statements are correct?

Select one or more:

- a. If L is regular then L' is regular ✔
- b. There exists a non-regular language L such that L' is regular ✔
- c. If L is regular then L' is non-regular
- d. There exists a regular language L such that L' is not regular

Your answer is correct.

The correct answers are: If L is regular then L' is regular, There exists a non-regular language L such that L' is regular

Question **21**

Complete

Marked out of 10.00

Question 21. Consider the CFG G given by the following production rules

$$\begin{aligned} S &\longrightarrow S_1C \mid AS_2 \\ S_1 &\longrightarrow aS_1b \mid \epsilon \\ S_2 &\longrightarrow bS_2c \mid \epsilon \\ A &\longrightarrow aA \mid \epsilon \\ C &\longrightarrow cC \mid \epsilon \end{aligned}$$

(a) (2 points) The language of G,
$L(G) = \{w \in \{a,b,c\}^* \mid$ _____ $\}$

(b) (4 points) Give a string of length 6 in $L(G)$ that has a unique parse tree with respect to G. Draw the parse tree.

(c) (4 points) Give a string of length 6 in $L(G)$ that has two parse trees with respect to G. Draw the two parse trees.

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Question **22**

Complete

Marked out of 10.00

Question 22. (10 points) Give a CFG for the language

$$L = \{a^i b^j c^k \mid j \leq i + k \leq 2j, i, j, k \geq 0\}.$$

For each variable used in your CFG, describe the language generated by the variable.

qsn22.pdf

Question **23**

Complete

Marked out of 5.00

Question 23. (5 points) Prove that no infinite subset of the language $L = \{0^n 1^n \mid n \geq 0\}$ is regular.

qsn23.pdf

Question **24**

Complete

Marked out of 10.00

Question 24. (10 points) Let $A \subseteq \{0,1\}^*$ and let

$$A' = \{xy \mid x1y \in A\}.$$

That is, A' contains all strings obtained from a string in A by deleting exactly one 1. Show that if A is regular, then A' is also regular (give the construction only).

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◄ Quiz 1

Jump to...