Assignment 3

1) Let $N$ be a NFA such that starting state of $N$ is not an accepting state. What is the minimum length string that can accept

- Length of the shortest path from starting state to some accepting state
- $|Q| - 1$, Where $Q$ is the set of states of $N$
- 1
- 0

Accepted Answers:

2) Consider the grammar $G$,

- $S \rightarrow AB$
- $A \rightarrow ab \mid ba \mid bb$
- $B \rightarrow aB \mid bB \mid C$
- $C \rightarrow aa \mid ab \mid ba \mid bb$

Which of the following string is generated by $G$?

- bababbab
- ababab
- aaabbbba
- babaa

Accepted Answers:

bababbab
aaabbbba
3) Consider the following DFA,

![Diagram of a DFA](https://example.com/dfa_diagram.png)

What will be number of states in minimum DFA, which accepts the same language as above DFA?

- 2
- 3
- 4
- 5

**Accepted Answers:** 4

4) Let $L$ be a language. We define another language $L'$ as follow

$$L' = \{w \mid w \text{ is binary equivalent of } 2^x, \text{ where } x \in L \text{ and consider } x \text{ as a binary number}\}$$

Which of the following is false?

- If $L$ is regular then $L'$ is also regular
- If $L$ is regular then $L'$ may not regular
- $L'$ is always regular irrespective of $L$
- $L'$ is always non-regular irrespective of $L$

**Accepted Answers:**

- If $L$ is regular then $L'$ is also regular
- $L'$ is always regular irrespective of $L$
- $L'$ is always non-regular irrespective of $L$

5) Consider the following languages,

- $L_1 = \{0, 1\}^*$
- $L_2 = \{w \mid w \text{ is binary equivalent of } 2^x, \text{ where } x \in L_1 \text{ and consider } x \text{ as a binary number}\} \cup \{0\}$
- $L_3 = L_2^*$

which of the following is regular?

- Only $L_1$
- Only $L_1$ and $L_2$
- Only $L_1$ and $L_3$
- All of them.

**Accepted Answers:**
All of them.

6) Let \( L = \{ w \mid w \text{ is a binary strings and contains equal number of occurrences of substring } 01 \text{ and } 10 \} \)

What is the minimum number of states in a DFA for \( L \)

- 4
- 5
- 6
- Can not construct a DFA for \( L \)

**Accepted Answers:**
5

7) What is the language accepted by following grammar ?

\[
S \rightarrow aS \mid bT \mid e \\
T \rightarrow aaT \mid bT \mid e \\
\]

- \( (a+b)^* \)
- \( \{a^n b^{2n}, n \geq 0\} \)

All strings \( w \in (a+b)^* \), where \( w \) contains even number of \( a \)'s.

All strings \( w \in (a+b)^* \), where in \( w \) every \( b \) is followed by even number of \( a \)'s.

**Accepted Answers:**
All strings \( w \in (a+b)^* \), where in \( w \) every \( b \) is followed by even number of \( a \)'s.

8) Which regular expression describes the language generated by the following grammar?

\[
S \rightarrow aSb \mid e \\
S \rightarrow aA \mid bB \\
A \rightarrow aA \mid bB \mid e \\
B \rightarrow bB \mid aA \mid e \\
\]

- \( a^n (a+b)^* b^n \), where \( n > 0 \).
- \( a^n (a+b)^* b^n \), where \( n \geq 0 \).
- \( (a+b)^* \)
- \( \{a^n b^n, n \geq 0\} \)

**Accepted Answers:**
\( a^n (a+b)^* b^n \), where \( n \geq 0 \).  
\( (a+b)^* \)