Assignment 1

1) Which of following is true?

- For every finite language, there exists a DFA which accepts the language. [1 point]
- For some finite language, there does not exist a DFA which accepts the language.
- Only finite languages are accepted by DFAs.
- Every infinite language is accepted by some DFA.

**Accepted Answers:**
For every finite language, there exists a DFA which accepts the language.

2) DFA has

- infinitely many state but finitely many accept states.
- finitely many states.
- transition function with finite domain and range.
- transition function with possibly infinite range or domain.

**Accepted Answers:**
finitely many states.
transition function with finite domain and range.

3)
Which of the following language is accepted the given DFA?

\[
\phi \\
\Sigma^* - \{ x \in \Sigma^* \text{ and } |x| > 0 \}
\]

4) What is a dump state?  
- A state in DFA whose removal will not change the language accepted by DFA.  
- A state in DFA from where cannot goto any other state.  
- A state in DFA from where we cannot goto any accept state.  
- A state in DFA reachable by every other state.  

**Accepted Answers:**  
A state in DFA from where we cannot goto any accept state.

5) Which of the following are true?  
- NFA may have \( \epsilon \) transitions but DFA does not.  
- NFA and DFA both may have \( \epsilon \) transitions.  
- NFA computes on multiple paths but not simultaneously.  
- NFA computes on multiple paths simultaneously.  

**Accepted Answers:**  
NFA computes on multiple paths simultaneously.  
NFA may have \( \epsilon \) transitions but DFA does not.
Which of the following languages are accepted by the given DFA?

- All binary strings of even length.
- All binary strings with odd difference between number of 0 and number of 1.
- All binary strings of odd length.
- All binary strings with even difference between number of 0 and number of 1.

**Accepted Answers:**
- All binary strings of odd length.
- All binary strings with odd difference between number of 0 and number of 1.

7) Which of the following languages are accepted by the given DFA? 

- \{w \mid w \text{ ends with } 0\}
- \{w \mid w \text{ contains equal number of 0 and 1}\}
- \{w \mid w \text{ does not end with } 1\}
- \{w \mid w \text{ contains } 1 \text{ and ends with a } 0\}

**Accepted Answers:**
- \{w \mid w \text{ does not end with } 1\}

8) Exactly one of the four languages given below is not accepted by any DFA. Identify it.

- \( L = \{x \mid x = 0^{2m}1^{4m} \text{ where } m \in \mathbb{N}\} \)
- \( L = \{x \mid x \text{ is name of some city in India} \} \)
- \( L = \{x \mid x|x = 0^{4m} \text{ where } m \geq 0\} \)
- \( L = \{x \mid x \text{ is binary representation of numbers of form } 5m + 2 \text{ and } 5m + 3\} \)

**Accepted Answers:**
9) Which of the following languages are accepted by given DFA?  

\[ L = \{ x \mid x = 0^{2m}1^{4m} \text{ where } m \in \mathbb{N} \} \]

\[ L = \{ x \mid x \text{ is binary representation of multiple of 5 and contains even number of 1} \} \cup \{ \epsilon \} \]

\[ L = \{ x \mid x \text{ contains even number of 1} \} \cup \{ \epsilon \} \]

\[ L = \{ x \mid x \text{ is binary representation of multiple of 5 and has prefix of } x \text{ is of form } 5m + 3 \} \cup \{ \epsilon \} \]

\[ L = \{ x \mid x \text{ is binary representation of multiple of 5} \} \cup \{ \epsilon \} \]

Accepted Answers:
\[ L = \{ x \mid x \text{ is binary representation of multiple of 5 and has prefix of } x \text{ is of form } 5m + 3 \} \cup \{ \epsilon \} \]

10) \[ L_1 = \{ x \mid x \text{ is binary representation of multiple of 3} \} \cup \{ \epsilon \} \]

\[ L_2 = \{ x \mid \text{ no prefix of } x \text{ is of form } 3m + 2 \} \]

Which of the following languages are accepted by given DFA?

\[ L_1 \cup L_2 \]

\[ L_1 \cap L_2 \]

\[ L_1 \cup L_2 \]

\[ L_1 \cap L_2 \]

\[ L_1 \cup L_2 \]

\[ L_1 \cap L_2 \]

Accepted Answers:
\[ L_1 \cap L_2 \]