DFA & NFA PRACTICE SHEET
AUTOMATA & COMPUTABILITY (CSE331)

1. Starts With

1. Draw a DFA for the set of binary strings that start with 01. ∑ = {0,1}
2. Draw a DFA for the set of strings that start with a. ∑ = {a,b}
3. Draw a DFA for the set of binary strings that start with 101. ∑ = {0,1}
4. Draw a DFA for the set of binary strings that start with odd number of 0s. ∑ = {0,1}

2. Ends With

1. Draw a DFA for the set of strings that end with abb. ∑ = {a, b, c}
2. Draw a DFA for the set of strings that end in 11. ∑ = {0,1}
3. Draw a DFA for the set of strings that end with 01. ∑ = {0,1}
4. Draw a DFA for the set of strings that don't end with 01. ∑ = {0,1}
5. Draw a DFA for the set of strings that don't end with 0101. ∑ = {0,1}

3. Contains

1. Draw a DFA for the set of strings that contain 011 as a substring and 001 as not a substring. ∑ = {0,1}
2. Draw a DFA for the set of strings that contain 001. ∑ = {0,1}
3. Draw a DFA for the set of strings that have 011 as a subsequence and 001 as not a subsequence. ∑ = {0,1}

4. Does Not Contain

1. Draw a DFA for the set of strings that does not contain the string aabb. ∑ = {a,b}
2. Draw a DFA where the string does not contain consecutive '0s'? ∑ = {0,1}

5. Length Constraints

1. Draw a DFA for the set of strings that have a length of at least 4. ∑ = {a, b}
2. Draw a DFA for the set of strings that have lengths of not more than 3. ∑ = {0,1}
3. Draw a DFA for the set of binary strings of even/odd length. ∑ = {0,1}
4. Draw a DFA for the set of strings whose length is one more than a multiple of 3. ∑ = {0,1}
5. Draw a DFA for the set of strings of length exactly 3. ∑ = {0,1}
6. Draw a DFA for the set of strings that have lengths of less than 3. ∑ = {0,1}
7. Draw a DFA for the set of strings with a length of at least 2. ∑ = {0,1}
8. Binary strings which have a 0 at its third position.

9. Binary strings which have a 1 at its second last position.

6. Count Constraints

1. Draw a DFA for the set of binary strings that contain at least three 1s. ∑ = {0,1}
2. Draw a DFA for the set of binary strings that contain at least three 1s consecutive. ∑ = {0,1}
3. Draw a DFA for the set of strings that have exactly two 0s. ∑ = {0,1}
4. Draw a DFA for the set of strings that have at most two 0s. ∑ = {0,1}
5. Draw a DFA for the set of strings that have exactly three as. ∑ = {a, b, c}
6. Draw a DFA for the set of strings where the number of 1s is not an integer multiple of 4. ∑ = {0,1}

7. Character Patterns

1. Draw a DFA for the set of strings that have three consecutive 1s. ∑ = {0,1}

8 Unique Type

1. Draw a DFA for the string w , when interpreted as a binary number is divisible by 3 .
2. Draw a DFA for the string w , when interpreted as a binary number divisible by 5 .
3. Binary strings whose decimal equivalent is divisible by 6.
4. Draw a DFA for the string w , when interpreted as a binary number divisible by 8 (don't use more than 4 states)
5. *Draw a DFA for the set of strings where the first and last character are the same, and the length is greater than 1. ∑ = {a,b}*
6. *Draw a DFA for the set of strings where the first and last character are the same, and the length is greater than 0. ∑ = {a,b}*

9. New Addition

1. Draw a DFA for the set of binary strings **every** 3rd position in w is 1. ∑ = {0,1}
2. *Draw a DFA where string contains '00' exactly once? ∑ = {0,1}*
3. *Draw a DFA for the string w, starts and ends with different symbols, ∑ = {0,1}*
4. *Draw a DFA for which 0's and 1's alternate in w.*
5. Construct a DFA defined as L = {w| each "b" is followed by at least one "a"} ∑ = {a,b} For example: baaa
6. Construct a DFA defined as L = {w| each "b" is followed by at most one "a"} ∑ = {a,b}
7. Draw a DFA where w starts with a^n , where n is a odd/even number (a^n means n consecutive a's)
8. Draw a DFA where the count of 'a' in w is not a multiple of 4.

10. New Addition 2.0

1. {w ∈ ∑* | the sum of the symbols of w is a multiple of 3}, where ∑ = {0, 1, 2}.
2. {w ∈ ∑* | w is any string not in 0*1*}, where ∑ = {0, 1}.
3. The set of binary numbers has 0 in all even positions. ∑={0,1}.

4. Draw a DFA which accepts exactly two "00" as a substring.
5. Construct a DFA that accept the language, L = { w ∈ {a,b}*: w starts and ends

   with different symbols.}

6. Construct a DFA that accept the language, L = { w ∈ {a,b}*: w starts and ends

   with the same symbol.}

7. {w | w ∈ {a, b, c}* w = a^m* b^n * c^l for m, n, l >= 1}
8. where 0's and 1's appear in alternating groups of odd numbered length.
9. {w | w ∈ {0, 1}* w contains an equal number of occurrences of the substrings 01 and 01 }

For any DFA there Exists an NFA as well. Try to Draw an NFA as well.

Regular Operations on DFA:

1. Draw a DFA for a string that contains at least one 1 and an even number of 0s follows the last 1.
2. Draw a DFA for binary strings that have an even number of 0s or an odd number of 1s. ∑ = {0,1}
3. Strings that contain 011 as a substring and 001 as not a substring. ∑ = {0,1}
4. Strings that do not contain "ba" and end with "cb". ∑ = {a,b,c}
5. L1(M) → {w ∈ Σ* | w doesn't contain 00}, where Σ = {0, 1}. L2(M) → {w ∈ Σ* | w doesn't contain 11}, where Σ = {0, 1}. , find L(M) → (L1 ∩ L2)'.

Regular Operations on NFA:

1. Design an NFA which contains at least two 0's **or** exactly f 1's.
2. Design an NFA which accepts even number of 0's **or** number of 0's which are divided by 3.
3. Design an NFA which contains "000" **or** "111".
4. Design an NFA where all strings contain exactly six 0s **or** an odd number of 1s.
5. Design an NFA where the set of strings begin **or** end (or both) with 01
6. L(M) → {w ∈ Σ* | length of w is a multiple of 2 or 3}, where Σ = {0, 1}.