Indian Institute of Technology, Mandi
School of Computing & Electrical Engineering

CS304: FLAT – Quiz Exam (15% weightage)
Formal Languages & Automata Thoery

Instructor: Prof. Prateek Vishnoi

Name: _____

Roll No: _____

This exam contains 6 pages (including this cover page) and 5 questions. Total of points is 30.
You can use any result that we discussed in class without proving it.
All the Best!

Distribution of Marks

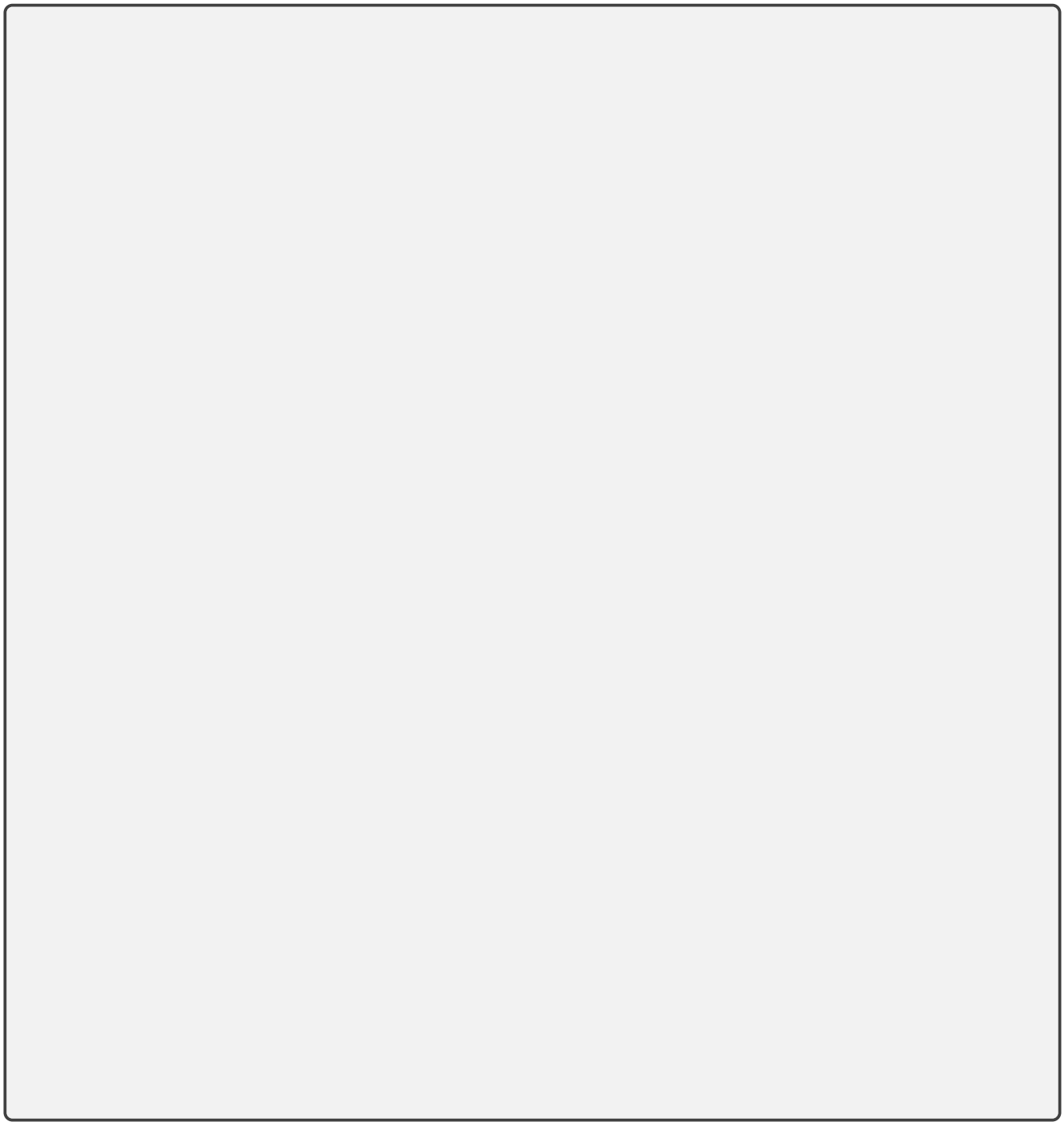
Question	Points	Score
1	6	
2	6	
3	6	
4	6	
5	6	
Total:	30	

DFA for the given regular expression

1. (a) (6 points) Consider the regular expression over $\Sigma = \{0, 1, 2\}$

$$L = (0 + 1 + 2)^*\ 0^+\ 1^+\ 2^+(0 + 1 + 2)^*$$

- Describe the language L in words.
- Construct a deterministic finite automaton (DFA) with as few states as possible that recognizes L.



2. (a) (6 points) Let L_1 and L_2 are infinite languages over finite set Σ such that $L_i \neq \Sigma^*$.
    1. Can we have an example where $L_1 \subset L_2$ such that L_1 is non-regular and L_2 is regular? Prove or disprove.
    2. Can we have an example where $L_1 \subset L_2$ such that L_1 is regular and L_2 is non-regular? Prove or disprove.

3. (a) (6 points) Construct the equivalent DFA using subset construction method for the following NFA, $N = (Q, \Sigma, \delta, q_0, F)$: $Q = \{q_0, q_1, q_2, q_3\}$, $\Sigma = \{0, 1\}$, $F = \{q_3\}$
The transition function δ is given by:

δ	0	1
q_0	$\{q_0, q_1\}$	$\{q_0\}$
q_1	$\{q_2\}$	$\{q_2\}$
q_2	$\varnothing$	$\{q_3\}$
q_3	$\{q_3\}$	$\{q_3\}$

4. (a) (6 points) Let

$$L = \{\, 0^i 1^j \mid i > j,\ i \geq 0, j \geq 0\}.$$

Prove or disprove that the language L is regular.

5. (a) (6 points) Design a DFA for a language L over $\Sigma = \{0, 1\}$ defined as :

$$L = \{w \in \Sigma^* \mid w \text{ has even number of 0s and each 0 is followed by atleast one 1}\}$$