

Name: _____

1. (1 pt.)

- **Read all material carefully.**
- You may refer to your books, papers, and notes during this test.
- No computer or network access of any kind is allowed (or needed).
- Write, and draw, carefully. Ambiguous or cryptic answers receive zero credit.
- Use textbook and classroom conventions for notation, algorithmic options, etc.
- Ask for clarifications on the above if needed.
- The question marked with a ★ is optional (extra credit) for COS 451 but required for COS 550.

Write your name in the space provided above.

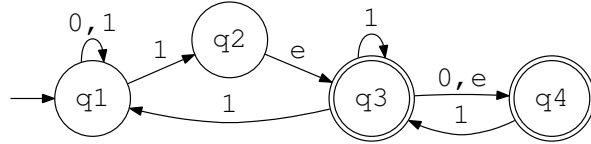
2. (9 pts.) Prove or disprove: For every natural number $n > 4$, there exists a 4-regular graph with n vertices.

3. (10 pts.) **Use exactly the textbook's method** to provide an NFA equivalent to the following regular expression. *Show intermediate steps.*

$(a \cup b \cup c)(ab \cup ba)^*$

[additional space for answering the earlier question]

4. (15 pts.) Use the textbook's method to convert the following NFA (which uses e for ϵ) into a DFA. You may omit states that are not reachable from the start state, as well as states that do not lead to an accepting state. Include enough detail to make the correctness of your answer evident.



[additional space for answering the earlier question]

5. ★ (10 pts.) Let L_1 denote the language over alphabet $\{a, b\}$ that contains exactly those strings in which the number of a s no greater than three plus the number of b s .
Prove or disprove: The language L_1 is regular.