

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.) Given a finite alphabet Σ , is the set Σ^* countable? If so, provide an explicit correspondence between Σ^* and integers. If not, provide as precise a proof as possible.

[additional space for answering the earlier question]

3. (10 pts.) Repeat Question 2 replacing Σ^* with $\mathcal{P}(\Sigma^*)$.

4. (10 pts.) Prove or disprove: The following set is decidable:

$$\{\langle G, H \rangle \mid G \text{ and } H \text{ are CFGs and } L(G) = L(H)\}$$

[additional space for answering the earlier question]

5. ★ (10 pts.) Prove or disprove: The following set is co-Turing-recognizable:

$$\{\langle G, H \rangle \mid G \text{ and } H \text{ are CFGs and } L(G) \neq L(H)\}$$