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.

Write your name in the space provided above.

2. (14 pts.) Convert the following grammar to Chomsky normal form. Upper-case letters
denote variables and lower-case letters denote terminals. Show enough intermediate
results and include brief explanations to make it clear that the method described in
the textbook is being followed.

\[
A \rightarrow BCDE | \epsilon \\
B \rightarrow bBC \\
C \rightarrow ABE \\
D \rightarrow \epsilon | dd | DD | E \\
E \rightarrow A | e
\]
3. (15 pts.) Provide a pushdown automaton that is equivalent to the original grammar of Question 2. Depict the automaton using the textbook’s graphical conventions. Briefly explain why your answer is correct.
4. (15 pts.) Generate a regular expression that is equivalent to the following finite-state automaton. *Show enough intermediate results and include brief explanations* to make it clear that the method described in the textbook is being followed.

![Finite-State Automaton Diagram]

- Start in state q1.
- Transition on 'a' from q1 to q2.
- Transition on 'b' from q1 to q3.
- Transition on 'a' from q2 to q2.
- Transition on 'b' from q3 to q3.

Intermediate results:
1. Start: q1
2. Transition on 'a': q2
3. Transition on 'b': q3
4. Transition on 'a': q2 (loop)
5. Transition on 'b': q3 (loop)

The regular expression is: \( a+b(a|b)* \)
[additional space for answering the earlier question]
5. (15 pts.) Prove or disprove: The language \( L = \{a^i b^{2i} c^j \mid i, j \geq 0\} \) is context-free.