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.

   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.

   \[ A \rightarrow aa | ABA \]
   \[ B \rightarrow b | bAbA | \epsilon \]
[additional space for answering the earlier question]
3. (15 pts.) Using the tabular representation used in class, depict the operation of the CYK algorithm on the input string aabaabaaaa and the final (Chomsky normal form) grammar of Question 2.
4. (15 pts.)

(a) Reduce the following SAT instance to a SUBSET-SUM using the textbook’s method.

(b) Depict corresponding solutions to the instances, or explain why none exist.

\[(x \lor y \lor z) \land (\bar{x} \lor \bar{y} \lor z) \land (x \lor y \lor \bar{z}) \land (\bar{x} \lor y \lor \bar{z}) \land (x \lor \bar{y} \lor z)\]
[additional space for answering the earlier question]
5. (15 pts.) Repeat Question 4, but reduce the SAT instance to an instance of CLIQUE (instead of SUBSET-SUM).
[additional space for answering the earlier question]