

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.

$$\begin{aligned} A &\rightarrow aa \mid ABA \\ B &\rightarrow b \mid bAbA \mid \epsilon \end{aligned}$$

[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.

$$(x \vee y \vee z) \wedge (\bar{x} \vee \bar{y} \vee z) \wedge (x \vee \bar{y} \vee \bar{z}) \wedge (\bar{x} \vee y \vee \bar{z}) \wedge (x \vee \bar{y} \vee z)$$

[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]