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. Follow the procedure described in the textbook and **show intermediate steps.**

$$\begin{aligned} S &\rightarrow aAbB \mid BAab \mid AAA \\ A &\rightarrow baB \mid BaB \mid \epsilon \\ B &\rightarrow b \mid abAA \mid Bb \end{aligned}$$

[additional space for answering the earlier question]

3. (10 pts.) Using the tabular representation from class, depict the operation of the polynomial-time, dynamic programming algorithm for determining whether the normalized grammar of Question 2 generates the string `abbabab`.

4. (10 pts.) Using the mapping described in the textbook, map the following SAT instance into a VERTEX-COVER instance. Clearly indicate all inputs for the VERTEX-COVER instance.

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

5. (10 pts.) Is the SAT instance of Question 4 satisfiable? If so, provide values of the variables that satisfy the formula **and** depict *all the corresponding solutions* of the VERTEX-COVER instance. If not, explain separately why the SAT and VERTEX-COVER instances have no solutions.