

1. (1 pt.)

- This *quick check* is **closed book, notes, etc.**
- You may use a 3 in.  $\times$  5 in. **reference card**, *hand-written by you*.
- Use the **classroom and textbook conventions** and terminology.

Read the above carefully; then write your name below:

2. (3 pts.) State the *pumping lemma for context-free languages*.

3. (3 pt.) In the context of the textbook's proof that constructs a PDA that recognizes a given context-free grammar: Briefly explain what *intermediate strings* are and how they are stored by the PDA.

4. (3 pts.) Indicate (no proof needed) which of the following languages are context-free:

- (a)  $\{a^n b^n c^n \mid n \geq 0\}$
- (b)  $\{a^n b^m c^n \mid m, n \geq 0\}$
- (c)  $\{a^n b^m c^m \mid m, n \geq 0\}$