MA/CSSE 474 **Homework #13** 75 points **Updated for Spring, 2018**

Recall: When we use the pumping theorem to show that a language is not context-free, we do not get to choose the k, we choose the w whose length is at least k. We do not get to choose how w is broken up into uvxyz (although the breakup has to meet the length constraints of the theorem), but we do get to choose how many times to pump the v and y (i.e. we can choose the q in uv^qxy^qz), and 0 is a legitimate choice for that q.

Proving that a language is context-free but not regular: You must (separately) show both of those things.

A general question from a past course's Piazza: **Q: Making PDAs to prove a language is context free.** Does adding an end of string marker invalidate using a PDA to show a language is context free?
A: Adding an end-of-string marker is legitimate. If L$ can be accepted by a PDA M, there is a (possibly non deterministic) PDA M' that accepts L.

1. (t-6) 13.1a
2. 13.1b
3. (t-12) 13.1c [Hint: When I assigned this before, I thought there was value in starting with the intuitive assumption that this language is not context-free, and only after trying many approaches to showing this, begin to think that maybe it is context-free after all. But in a survey from a previous term, some students told me that they spent more than 150 minutes on this problem, mainly because of spinning their wheels trying to use the Pumping Theorem. Thus I am telling you up front that this language is indeed context-free.
4. (t-6) 13.1d
5. (t-9) 13.1f
6. 13.1g
7. 13.1h
8. (t-9) 13.1i
9. 13.1k
10. (t-9) 13.1l (thirteen point one el)
11. 13.1p
12. 13.1q
13. (t-9)13.1w
14. (t-9) 13.3
15. 13.4
16. 13.8
17. (t-6) 13.9
18. 13.12

Note on 13.12. What the author meant to ask and what she actually asked are quite different. Both parts should have said: "Is L context-free (but not regular), regular, or neither? Prove your answer."