ComSS 331 **Fall 2017** **Name:**_____

HW 8 Due: 20 oct 2017

1. Define a NPDA for the language $L = \{a^n b^m : m, n \in \mathbb{N}, n \geq 3, m > n\}$. 50

2. Consider the language

$$L = \{w \in \{a, b\}^* : \text{the longest run of } a\text{'s in } w \text{ is longer than any run of } b\text{'s in } w\}.$$

For example, *abbbbaabbbaaaaaa* $\in L$ because the longest run of b's in it has length four, while the longest run of a's has length six. Prove that L is not context-free. 70

3. Prove or disprove that the following language is context-free:

$$L = \{\alpha 2 \beta : \alpha, \beta \in 1(0+1)^*, [\alpha]_2 < [\beta]_2\}$$

where $[x]_2$ is the numerical value of the string x interpreted as a positive number in base 2. For example, $[1110]_2 = 8 + 4 + 2 = 14$, $[10100]_2 = 16 + 4 = 20$, thus $1110210100 \in L$, while $111021110 \notin L$ and $1010021110 \notin L$. 100