CS 254: Computability and Complexity	**Anonymous submission**
Problem Set #01	*October 24, 2019*

1. Let C_{CFG} = {(G,k)| G is a CFG and L(G) contains exactly k strings where k $\geq$ 0 or k = ∞} show that C_{CFG} is decidable.

   We can use a machine M to check whether the language L(G) is an infinite or finite set:

   - L(G) is infinite and k = ∞, accept
   - L(G) is infinite and k $\neq$ ∞, reject
   - L(G) is finite and k = ∞, reject
   - L(G) is finite and k $\neq$ ∞, continue

   calculate the pumping length p for grammar G

   set count = 0

   use for loop i = 0 to p

   Use the loop to find all the strings whose length = i for every i. Increment count for every string found.

   After for loop, check, if count = k, accept. Else reject.

   M discovers if L(G) is an infinite set or not and matches k. After that if L(G) is not infinite and k $\neq$ ∞. Then to be able to prove that C_{CFG} is decidable we need to prove the size of L(G) is k. We do this by looping and keeping track of all the strings that can be generated by grammar G. Since the grammar is finite, we we cannot generate strings longer than p. Lastly we check the value of k against our increment variable count. Thus C_{CFG} is decidable.