1. State whether each of the following is true or false. No justification required.

(a) If language $A$ is context-free, then it is guaranteed that the complement of language $A$ is not context-free. [FALSE]

(b) There exists a context-free language $B$ such that $B^*$ is all binary strings. [TRUE]

(c) If language $C$ is accepted by some PDA, then it is guaranteed that $C$ is accepted by some TM. [TRUE]

2. Let $Z$ be the set of all binary strings that have even length and whose first half is the same as their second half. For example 001001 is in $Z$. Consider a proof using the Pumping Lemma that $Z$ is not context-free, and assume $k$ is the constant of the Pumping Lemma. For each of the following say, with a brief justification, whether it would be suitable for use in such a proof.

(a) 001001 - No: Too Short

(b) $0^k$ - No: Has suitable split

(c) $0^k1^k0^k1^k$ - Yes: Every umway split encounters problem

3. Consider the following TM with input alphabet \{0, 1\}:

(a) Give two strings of length 4 accepted by the TM.

(b) Give two strings of length 4 NOT accepted by the TM.

(c) Describe in succinct-ish English the language of this TM. Be precise.

All binary strings with at least one 1 ending in 0 and initially block of 0's is even (or nonexistent)