Supplemental Questions on: Undecidability

G1: It is known that the problem of determining if a PDA accepts every string is undecidable.
(a) Explain why this means that it is undecidable to determine if two PDAs accept the same language.
(b) Let $N = \{ \langle G \rangle : G$ is CFG that does **NOT** generate all strings$\}$. Show that N is r.e.
(c) Is the complement of N r.e.?

G2: State whether each of the following is **true** or **false**. In each case give a brief justification.
(a) The following is recursive: the set of all encodings of TMs that do not accept their own encoding.
(b) The following is recursive: the set of all encodings of FAs that do not accept their own encoding.
(c) The set of all C++ programs is countable.
(d) The set of all infinite subsets of the reals is uncountable

G3: Consider any r.e. language L. Show that L is recursive if and only if $L \leq \bar{L}$ (that is, it reduces to its complement).

G4: Give an **example** of:
(a) a language that is r.e. but not recursive
(b) a language that is recursive but not r.e.
(c) an infinite countable set
(d) an uncountable set
(e) a language accepted by an LBA that does not have a context-free grammar