Specification and Verification II

(a) Describe the semantics of formulae in linear temporal logic (LTL) and computation tree logic (CTL).
   Illustrate your answer by contrasting the meanings of $\mathcal{G}P$ in LTL with $\mathcal{A}\mathcal{G}P$ in CTL (where $P$ is a property of states).
   
(b) Give an LTL property that cannot be expressed in CTL.

(c) Give a CTL property that cannot be expressed in LTL.

(d) Describe briefly the kinds of properties that can be expressed using Sugar Extended Regular Expressions (SEREs), Foundation Language (FL) formulae and Optional Branching Extension (OBE) formulae of the Sugar 2.0 property language.

(e) Consider the property: “whenever a, b and c occur on successive cycles, then on the cycle that c occurs, d must occur also, followed on the next cycle by e” (where a, b, c, d and e are boolean expressions). Use this property to illustrate how SEREs can sometimes help specify properties more compactly than pure LTL.