Specification and Verification II

Describe informally the meaning of the following four CTL operators: $AX$, $EX$, $A[\cdots U \cdots]$, $E[\cdots U \cdots]$. [4 marks]

Describe how CTL operators can be defined in higher order logic. [4 marks]

Hence or otherwise show that $A[true U P]$ holds if $P$ holds somewhere along every path. [2 marks]

Define $AG P \equiv \neg E[true U \neg P]$ and show that $AG P$ holds if $P$ holds everywhere along every path. [4 marks]

Express “if $P$ is ever true, then it continues to be true until $Q$ is false” in CTL. [3 marks]

Describe in English the meaning of $AG(P \land Q \Rightarrow AX(A[P U \neg Q]))$. [3 marks]