Formal Methods - Temporal logics

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An execution can be seen as **an infinite set of computation paths** or **an infinite computation tree**

1 Temporal logics

Express properties of "reactive systems"

1. nonterminating behaviours,
2. without explicit reference to time

Linear temporal logic (LTL) interpreted over each path of the Kripke structure. linear model of time, temporal operators.

Computation tree Logic (CTL) interpreted over computation tree of Kripke model. Branching model of time, temporal operators plus path quantifier.

1.1 Linear Temporal Logic (LTL)

In addition to the boolean logic we use the following temporal operators which operates through paths $< s_0, s_1, \ldots, s_k, \ldots >$.

1. X : next $> X\phi$ is true in s_t iff ϕ is true in s_{s+1}
2. G : globally $> G\phi$ is true in s_t iff ϕ is true in **all** $s_{t'}$ with $t' \geq t$
3. F : finally $> F\phi$ is true in s_t iff ϕ is true in **some** $s_{t'}$ with $t' \geq t$
4. U : until $> \phi U \psi$ is true in s_t iff for **some** state $s_{t'}$ s.t. $t' \geq t$
   (a) ψ is true in $s_{t'}$ **and**
   (b) ϕ is true in **all** states $s_{t''}$ s.t. $t \leq t'' \leq t'$
5. R : releases (the dual of U) $> \phi R \psi$ is true in s_t iff for **all** state $s_{t'}$ s.t. $t' \geq t$
   (a) ψ is true **or**
   (b) ϕ is true in **some** states $s_{t''}$ s.t. $t \leq t'' \leq t'$

`https://www.youtube.com/results?search_query=linear+temporal+logic`