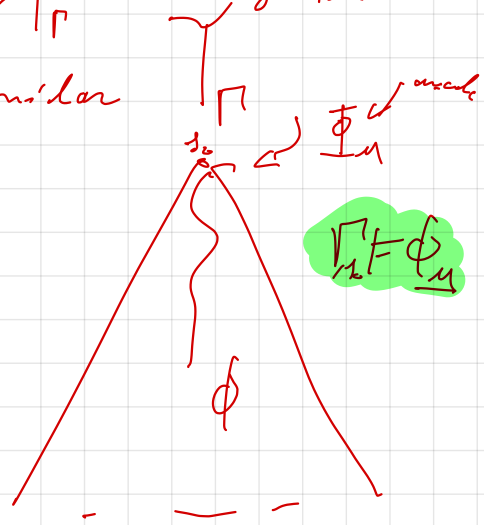
TS $\hookrightarrow \Gamma \sim \Upsilon_\Gamma$ ↙ TS' obtained by unfolding that infinitum

bisimilar

$\Gamma, s_0 \models \Phi$

TS — initial state — CTL



$\Gamma_{s_0} \models \Phi_\mu$

1. ∀ μ-calc formula evaluates to the same truth-value over all TS that are bisimilar

2. ∀ CTL formula can be translated into μ-calc.

$\underset{TS}{\Gamma, s_0} \models \underset{CTL}{\phi} \Rightarrow \Upsilon_{\Gamma, s_0} \models \phi_{CTL}$

$\Rightarrow \underset{\mu\text{-cal}}{\phi_\mu}$ $\quad \Gamma, s_0 \models \phi_\mu$

CTL   μ-calc

$$t(a) = a$$

$$t(\neg\phi) = \neg t(\phi)$$

$$t(\phi_1 \wedge \phi_2) = t(\phi_1) \wedge t(\phi_2)$$

$$t(EX\ \phi) = \langle next \rangle t(\phi)$$

$$t(AX\ \phi) = [next]\, t(\phi)$$

$$t(EF\ \phi) = \mu Z.\ t(\phi) \vee \langle next \rangle Z$$

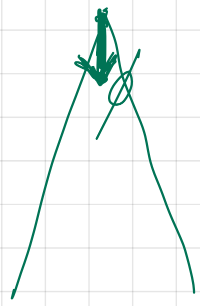
$$t(AF\ \phi) = \mu Z\ t(\phi) \vee [next]\, Z$$

$$t(EG\ \phi) = \nu Z.\ t(\phi) \wedge \langle next \rangle Z$$

$$t(AG\ \phi) = \nu Z.\ t(\phi) \wedge [next]\, Z$$

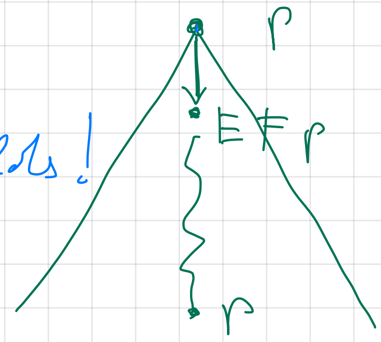
$$t(E(\phi_1\ U\ \phi_2)) = \mu Z.\ t(\phi_2) \vee (t(\phi_1) \wedge \langle next \rangle Z)$$

$$t(A(\phi_1\ U\ \phi_2)) = \mu Z\ t(\phi_2) \vee (t(\phi_1) \wedge [next]\, Z)$$



$\underbrace{\boxed{\cancel{EF\,p}}}_{Z} \equiv p \vee EX\, \overbrace{\boxed{\cancel{EF\,p}}}^{Z}$

this eq holds!



$Z \equiv p \vee EX\, Z$

$Z \equiv p \vee \langle next \rangle Z$

it's an eq on Z with

$Z = f(Z)$

$f(Z) = p \vee \langle next \rangle Z$

syntactically monotonic

rather gfp

lfp

$\boxed{\mu Z.\ p \vee \langle next \rangle Z}$

$$\underbrace{\boxed{AF\,p}}_{Z} \equiv p \vee AX\,\underbrace{\boxed{AF\,p}}_{Z}$$

$$Z \equiv p \vee AX\,Z$$

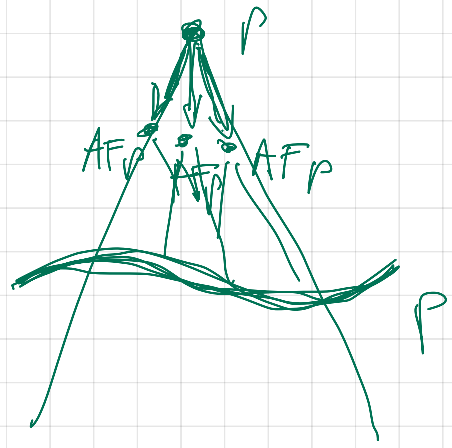
$$Z = p \vee [next]\,Z$$

$$Z = f(Z)$$

recursion

lfp gfp

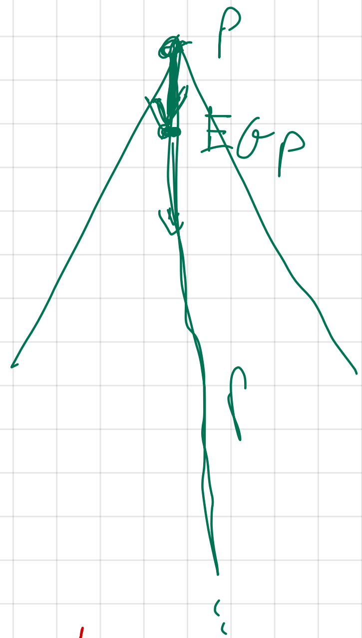
$$\boxed{\mu Z.\ p \vee [next]\,Z}$$



$f(Z) = p \vee [next]\,Z$ ✓

synth. monotonic

$$\underbrace{\boxed{EG\,p}}_{Z} \equiv p \wedge EX\,\underbrace{\boxed{EG\,p}}_{Z}$$



$$Z \equiv p \wedge EX\,Z$$

$$Z \equiv p \wedge \langle next \rangle Z$$

$$Z \equiv f(Z) \qquad f(Z) = p \wedge \langle next \rangle Z$$

new

synt. monotone

lfp $\qquad$ gfp

$$\boxed{\nu Z.\ p \wedge \langle next \rangle Z}$$

$$\boxed{AG\,p} \equiv p \wedge AX\, \boxed{AG\,p}$$

$$Z \equiv p \wedge AX\, Z$$

$$Z \equiv p \wedge [next]\, Z$$

$$Z \equiv f(Z) \qquad f(Z) = p \wedge [next]\, Z$$

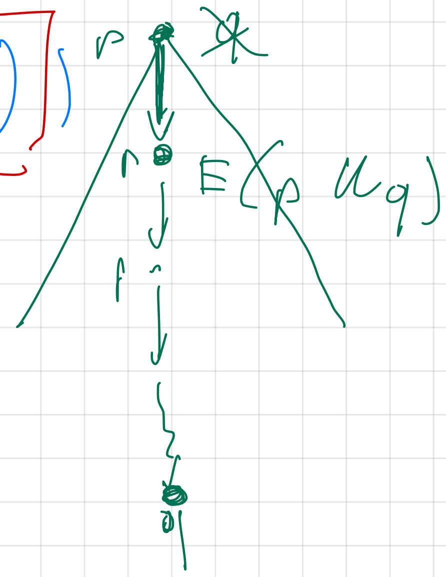
mono

synt. monoton z

lfp   gfp

$$\boxed{\nu Z.\ p \wedge [next]\, Z}$$

$$\underbrace{\boxed{E(p\,\mathcal{U}\,q)}}_{Z} \equiv q \lor (p \land EX\, \underbrace{\boxed{E(p\,\mathcal{U}\,q)}}_{Z})$$



$$Z \equiv q \lor (p \land EX\; Z)$$

$$Z \equiv q \lor (p \land \langle next \rangle Z)$$

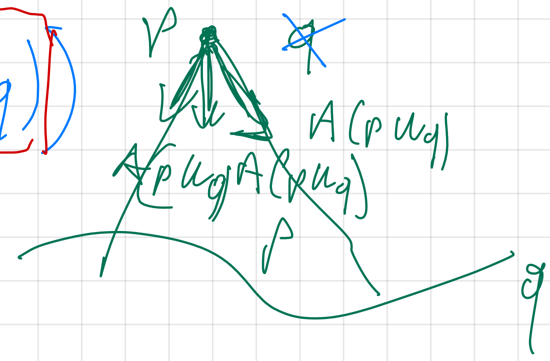
$$Z = \underset{\text{mono}}{f}(Z) \qquad f(Z) = q \lor \underset{\text{synt. mono}}{(p \land \langle next \rangle Z)}$$

lfp gfp

$$\boxed{\mu Z.\; q \lor (p \land \langle next \rangle Z)}$$

$$\boxed{A(p \,\mathcal{U}\, q)} = q \vee (p \wedge AX\, \boxed{A(p \,\mathcal{U}\, q)})$$

Z $\qquad\qquad\qquad\qquad\qquad\qquad$ Z



$$Z = q \vee (p \wedge \underline{AX}\, Z)$$

$$Z = q \vee (p \wedge [\text{next}]\, Z)$$

$$f(Z) = q \vee (p \wedge [\text{next}]\, Z)$$

synt. mono

$$z = f(z)$$

mono

lfp $\qquad$ ~~gfp~~

$$\boxed{\mu Z.\; q \vee (p \wedge [\text{next}]\, Z)}$$