Exercise 1 Consider the CTL* formula over propositions $P = \{a, b\}$: a.) $f = AF E (a U E G b)$ b.) $g = AF E X(a U E G b)$ and the transition system below:

Apply the CTL* model checking algorithm to compute all states for which the given formula is satisfied. (For LTL sub-formulas you may infer validity directly without applying the LTL model checking algorithm).

Exercise 2 Consider the CTL* formula over propositions $P = \{a, b\}$ $f = E (X (a \land \neg b) \land X A(b U G a))$. Apply the CTL* model checking algorithm to compute all states of the transition systems given below, for which the given formula is satisfied. (For LTL sub-formulas you may infer validity directly).

Exercise 3 Consider the CTL* formula over propositions $P = \{a, b, c\}$ $f = E (GF b \land GF Xa) \land AG F Xc$. Apply the CTL* model checking algorithm to compute all states of the transition systems given below, for which the given formula is satisfied. (For LTL sub-formulas you may infer validity directly).

Exercise 4 Consider the $\mu$-calculus formulae: $\mu Y.f_2 \lor (f_1 \land \Box Y)$ and $\nu Y.f_2 \lor (f_1 \land \Box Z)$. Reason about the paths that they determine. Now, consider the formula: $\mu Y.\nu Z. (p \land \Box Y) \lor (\neg p \land \Box Z)$.  

1. Using your understanding of the previous two formulas reason about the third $\mu$-calculus formula and the paths it determines.
2. Apply the $\mu$-calculus model checking algorithm to compute the states of the transition system given below, for which the given formula is satisfied.