CS 228 : Logic in Computer Science

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GNBA

- Generalized NBA, a variant of NBA
- Only difference is in acceptance condition
- Acceptance condition in GNBA is a set $\mathcal{F} = \{F_1, \ldots, F_k\}$, each $F_i \subseteq Q$
- An infinite run ρ is accepting in a GNBA iff

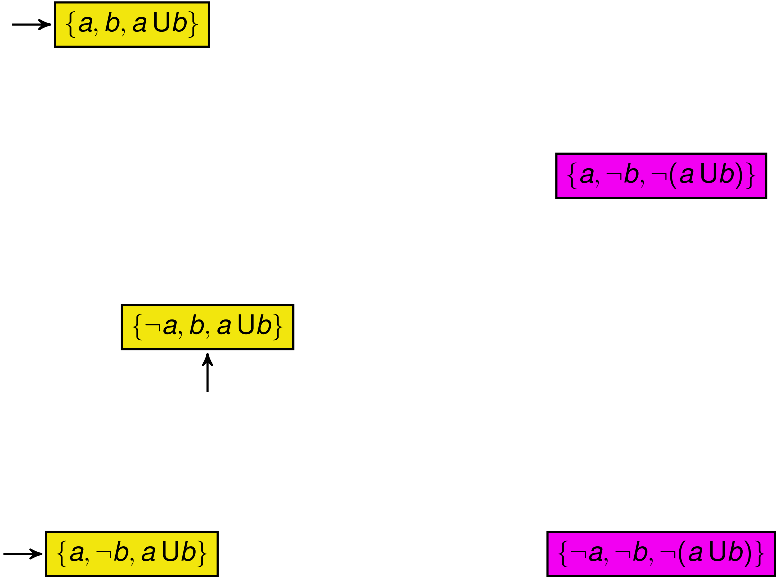
$$\forall F_i \in \mathcal{F}, \mathit{Inf}(\rho) \cap F_i \neq \emptyset$$

- Note that when $\mathcal{F} = \emptyset$, all infinite runs are accepting
- GNBA and NBA are equivalent in expressive power.

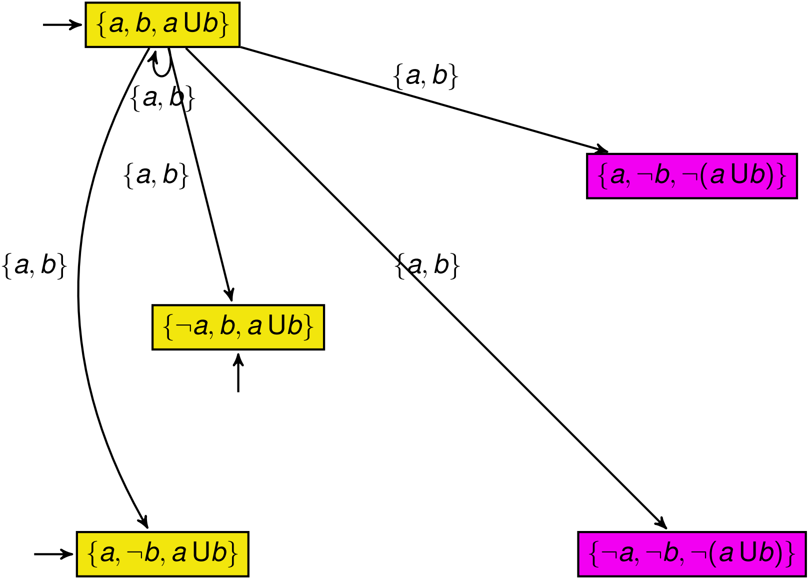
LTL to GNBA

- Let $\varphi = a \, \mathsf{U} b$.
- Subformulae of φ : $\{a, b, a \, \mathsf{U} b\}$. Let $B = \{a, \neg a, b, \neg b, a \, \mathsf{U} b, \neg(a \, \mathsf{U} b)\}$.
- Possibilities at each state : maximally consistent subsets of B
  - $\{a, \neg b, a \, \mathsf{U} b\}$
  - $\{\neg a, b, a \, \mathsf{U} b\}$
  - $\{a, b, a \, \mathsf{U} b\}$
  - $\{a, \neg b, \neg(a \, \mathsf{U} b)\}$
  - $\{\neg a, \neg b, \neg(a \, \mathsf{U} b)\}$
- Our initial state(s) must guarantee truth of $a \, \mathsf{U} b$. Thus, initial states: $\{a, b, a \, \mathsf{U} b\}$ and $\{\neg a, b, a \, \mathsf{U} b\}$ and $\{a, \neg b, a \, \mathsf{U} b\}$.

LTL to GNBA

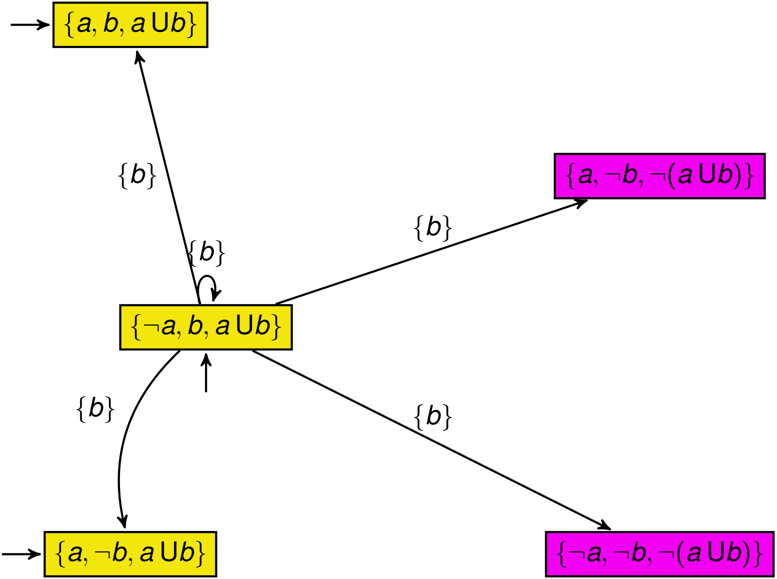

$\{a, b, a \,\mathsf{U}\, b\}$
$\{a, \neg b, \neg(a \,\mathsf{U}\, b)\}$
$\{\neg a, b, a \,\mathsf{U}\, b\}$
$\{a, \neg b, a \,\mathsf{U}\, b\}$
$\{\neg a, \neg b, \neg(a \,\mathsf{U}\, b)\}$

LTL to GNBA

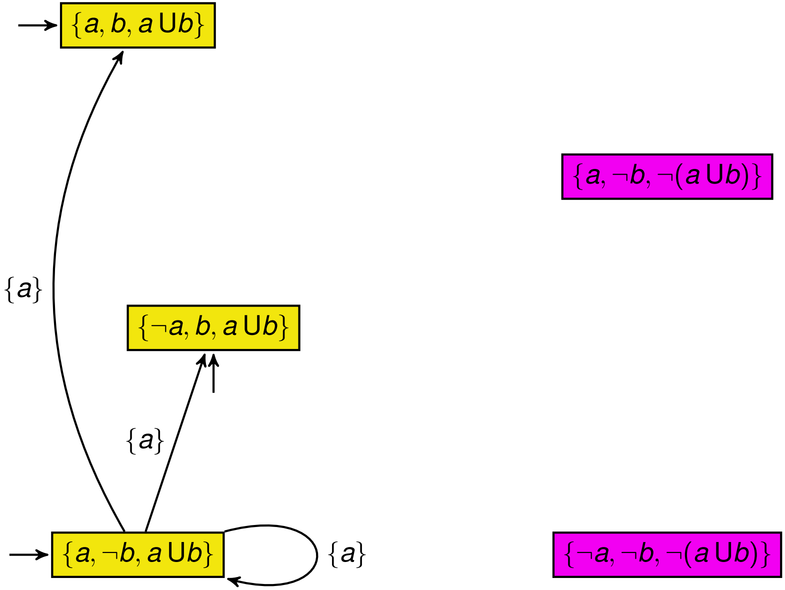


$\{a, b, a \,\mathsf{U}\, b\}$
$\{a, b\}$
$\{a, b\}$
$\{a, b\}$
$\{a, b\}$
$\{a, b\}$
$\{a, \neg b, \neg(a \,\mathsf{U}\, b)\}$
$\{\neg a, b, a \,\mathsf{U}\, b\}$
$\{a, \neg b, a \,\mathsf{U}\, b\}$
$\{\neg a, \neg b, \neg(a \,\mathsf{U}\, b)\}$

LTL to GNBA

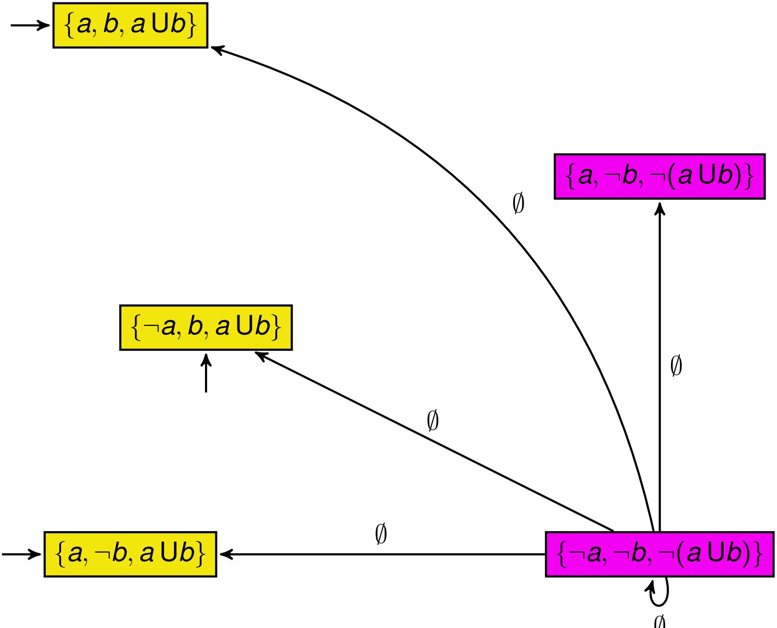

$\{a, b, a \mathsf{U} b\}$
$\{b\}$
$\{a, \neg b, \neg(a \mathsf{U} b)\}$
$\{b\}$
$\{b\}$
$\{\neg a, b, a \mathsf{U} b\}$
$\{b\}$
$\{b\}$
$\{a, \neg b, a \mathsf{U} b\}$
$\{\neg a, \neg b, \neg(a \mathsf{U} b)\}$

LTL to GNBA

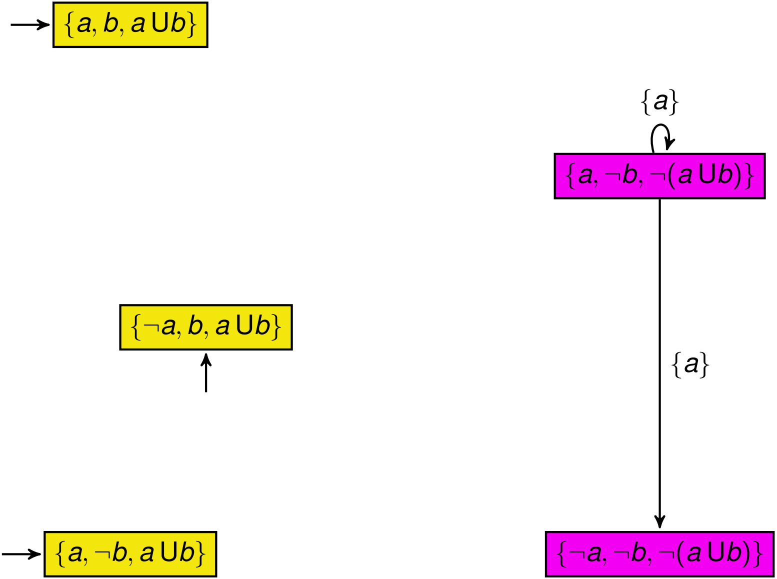


$\{a, b, a\,\mathsf{U}\,b\}$
$\{a, \neg b, \neg(a\,\mathsf{U}\,b)\}$
$\{a\}$
$\{\neg a, b, a\,\mathsf{U}\,b\}$
$\{a\}$
$\{a, \neg b, a\,\mathsf{U}\,b\}$
$\{a\}$
$\{\neg a, \neg b, \neg(a\,\mathsf{U}\,b)\}$

LTL to GNBA

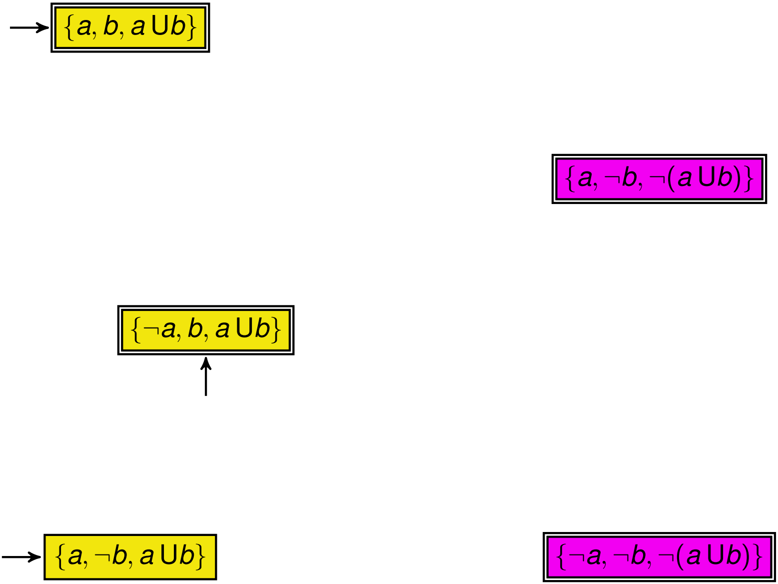


LTL to GNBA



$\{a, b, a \mathsf{U} b\}$
$\{a\}$
$\{a, \neg b, \neg(a \mathsf{U} b)\}$
$\{\neg a, b, a \mathsf{U} b\}$
$\{a\}$
$\{a, \neg b, a \mathsf{U} b\}$
$\{\neg a, \neg b, \neg(a \mathsf{U} b)\}$

LTL to GNBA : Accepting States



LTL to GNBA

Construct GNBA for $\neg(a \,\mathsf{U}\, b)$.

LTL to GNBA

- Let $\varphi = a \, \mathsf{U} (\neg a \, \mathsf{U} c)$. Let $\psi = \neg a \, \mathsf{U} c$
- Subformulae of φ : $\{a, \neg a, c, \psi, \varphi\}$. Let $B = \{a, \neg a, c, \neg c, \psi, \neg\psi, \varphi, \neg\varphi\}$.
- Possibilities at each state : some consistent subset of B holds
  - $\{a, c, \psi, \varphi\}$
  - $\{\neg a, c, \psi, \varphi\}$
  - $\{a, \neg c, \neg\psi, \varphi\}$
  - $\{a, \neg c, \neg\psi, \neg\varphi\}$
  - $\{\neg a, \neg c, \psi, \varphi\}$
  - $\{\neg a, \neg c, \neg\psi, \neg\varphi\}$

LTL to GNBA

$\{a, c, \psi, \varphi\}$

$\{\neg a, \neg c, \psi, \varphi\}$

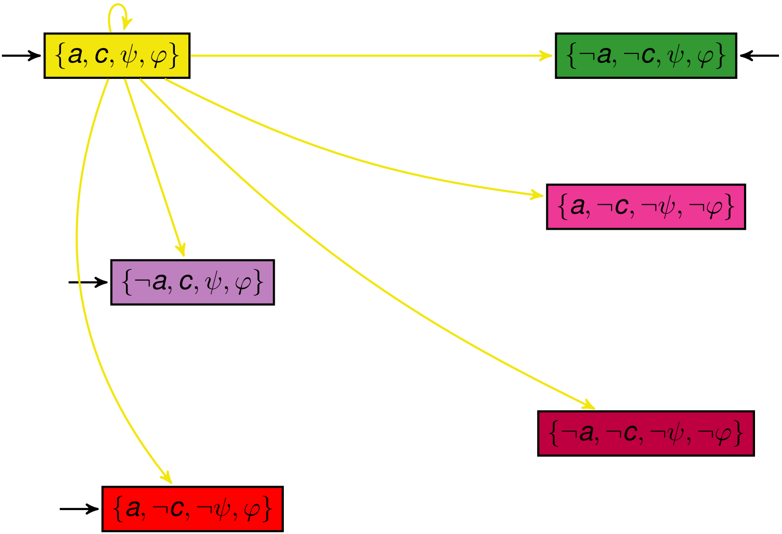
$\{a, \neg c, \neg\psi, \neg\varphi\}$

$\{\neg a, c, \psi, \varphi\}$

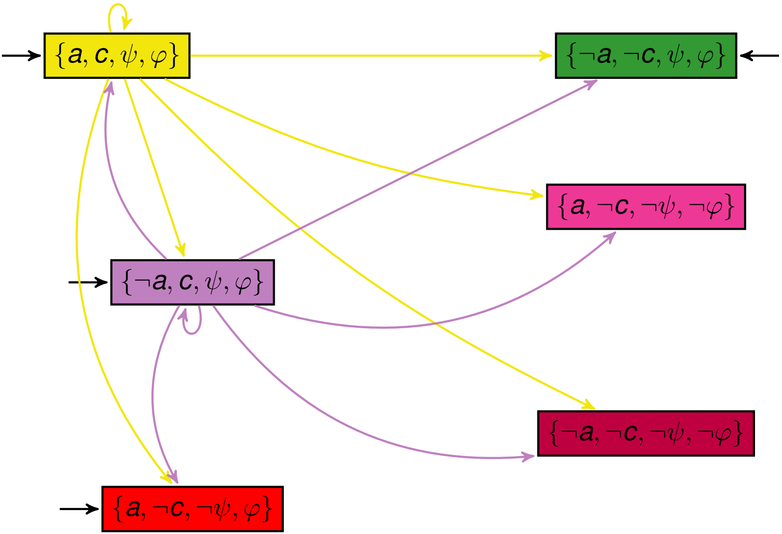
$\{\neg a, \neg c, \neg\psi, \neg\varphi\}$

$\{a, \neg c, \neg\psi, \varphi\}$

LTL to GNBA


$\{a, c, \psi, \varphi\}$
$\{\neg a, \neg c, \psi, \varphi\}$
$\{a, \neg c, \neg\psi, \neg\varphi\}$
$\{\neg a, c, \psi, \varphi\}$
$\{\neg a, \neg c, \neg\psi, \neg\varphi\}$
$\{a, \neg c, \neg\psi, \varphi\}$

LTL to GNBA



$\{a, c, \psi, \varphi\}$
$\{\neg a, \neg c, \psi, \varphi\}$
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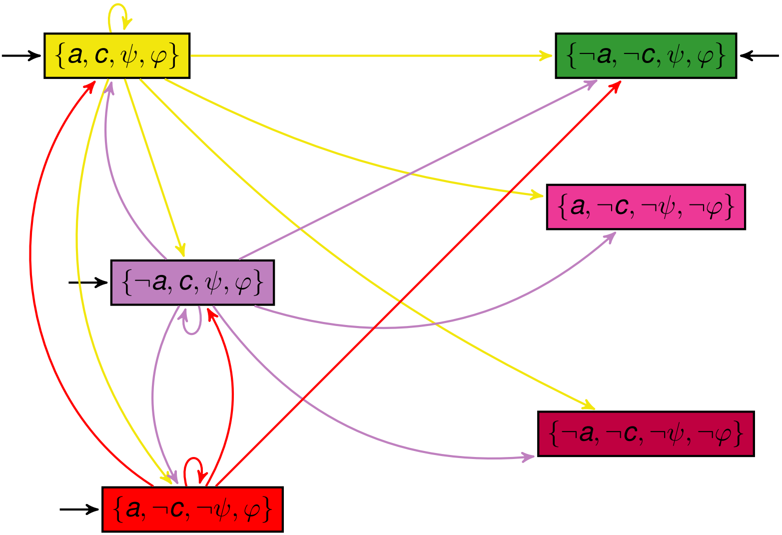

$\{a, c, \psi, \varphi\}$
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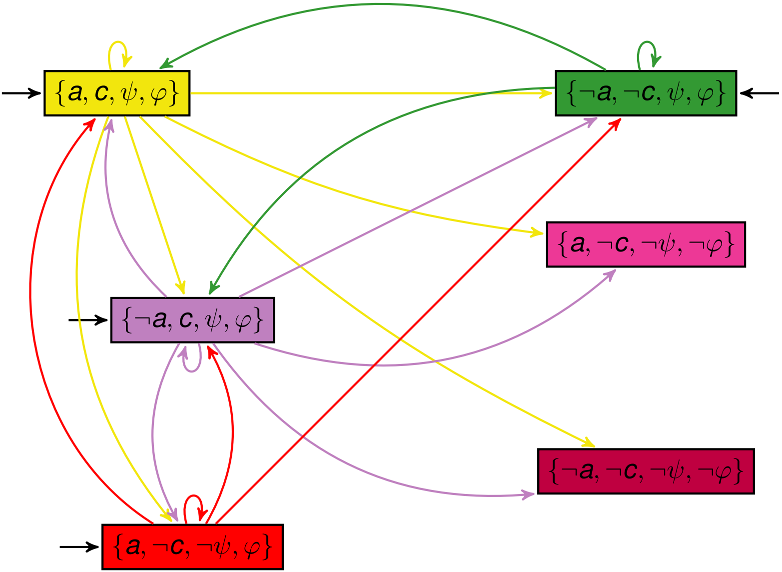

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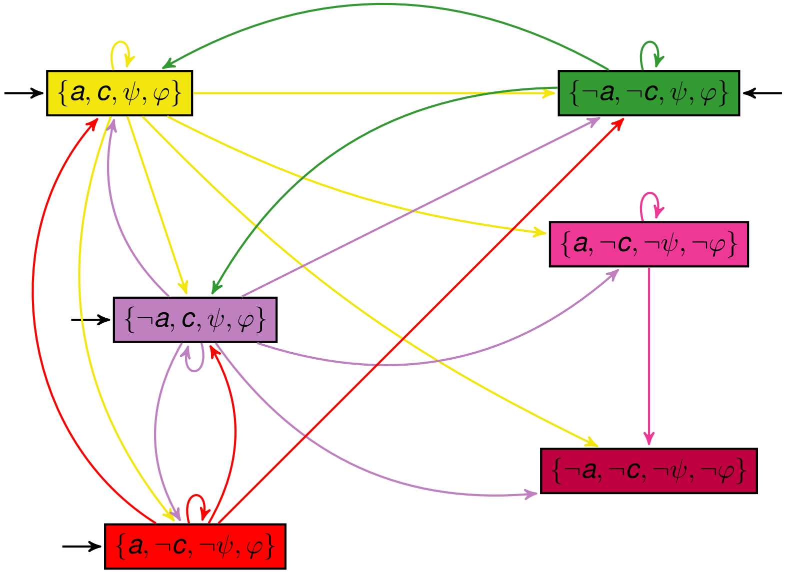
$\{a, c, \psi, \varphi\}$
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$\{a, \neg c, \neg\psi, \neg\varphi\}$
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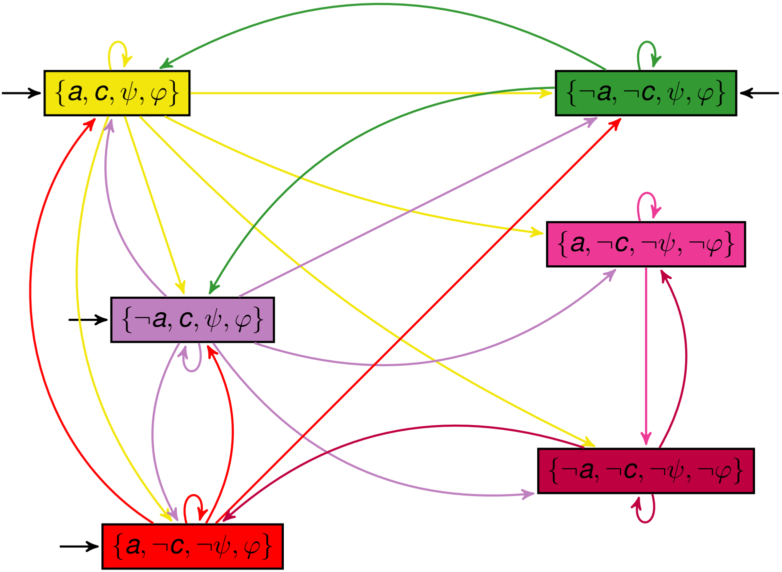
LTL to GNBA



$\{a, c, \psi, \varphi\}$
$\{\neg a, \neg c, \psi, \varphi\}$
$\{a, \neg c, \neg\psi, \neg\varphi\}$
$\{\neg a, c, \psi, \varphi\}$
$\{\neg a, \neg c, \neg\psi, \neg\varphi\}$
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