1 Preliminaries

- See: `http://www.mancoosi.org/misc-2012/criteria/`

- Package universe: $\mathcal{P}$

- Installation: $\mathcal{I} \subseteq \mathcal{P}$

- Closure: $\mathcal{C} \subseteq \mathcal{P}$

- Removed (by explicit request): $\mathcal{R} \subseteq \mathcal{P}$

- Optimization criteria: $\mathcal{O}$

- Names: $X.\text{name} = \{p.\text{name} \mid p \in X\}$

- Versions: $X.\text{version}(p) = \{q.\text{version} \mid q \in X, p.\text{name} = q.\text{name}\}$

2 Closure

- Table 1 lists available selectors

  - S^{∞} is an upper bound for packages in a selector
  - $S^{-}(q)$ for $q \in S^{\infty}$ is the set of packages whose installation might remove q from the selector
  - $S^{+}(q)$ for $q \in S^{\infty}$ is the set of packages whose installation might add q to the selector

- a package $p \in \mathcal{P} \setminus \mathcal{R}$ is relevant if at least one of the following conditions holds

  - $+f \in \mathcal{O}$ where
    * $f = \text{count}(S)$, $q \in S^{\infty}$, and $p \in S^{+}(q)$,
    * $f = \text{sum}(S, attr)$, $q \in S^{\infty}$, $q.attr > 0$, and $p \in S^{+}(q)$,
    * $f = \text{sum}(S, attr)$, $q \in S^{\infty}$, $q.attr < 0$, and $p \in S^{-}(q)$,
    * $f = \text{notuptodate}(S)$, $q \in S^{\infty}$, $q.\text{version} \neq \max(\mathcal{P}.\text{version}(q))$, and $p \in S^{+}(q)$,
    * $f = \text{unsat\_recommends}(S)$, $q \in S^{\infty}$, $q.\text{recommends} \neq \emptyset$, and $p \in S^{+}(q)$, or
    * $f = \text{aligned}(S, group, value))$, $q \in S^{\infty}$, $q' \in S^{\infty}$, $q.group = q'.group$, $q.value \neq q'.value$, and $p \in S^{+}(q)$

  - $-f \in \mathcal{O}$ where
    * $f = \text{count}(S)$, $q \in S^{\infty}$, and $p \in S^{-}(q)$,
    * $f = \text{sum}(S, attr)$, $q \in S^{\infty}$, $q.attr > 0$, and $p \in S^{-}(q)$,
    * $f = \text{sum}(S, attr)$, $q \in S^{\infty}$, $q.attr < 0$, and $p \in S^{+}(q)$,
    * $f = \text{notuptodate}(S)$, $q \in S^{\infty}$, $q.\text{version} \neq \max(\mathcal{P}.\text{version}(q))$, and $p \in S^{-}(q)$,
    * $f = \text{unsat\_recommends}(S)$, $q \in S^{\infty}$, $q.\text{recommends} \neq \emptyset$, and $p \in S^{-}(q)$,
    * $f = \text{unsat\_recommends}(S)$, $q \in S^{\infty}$ and $p \in q.\text{recommends} \setminus \mathcal{R}$, or
    * $f = \text{aligned}(S, group, value))$, $q \in S^{\infty}$, $q' \in S^{\infty}$, $q.group = q'.group$, $q.value \neq q'.value$, and $p \in S^{-}(q)$

- the closure $\mathcal{C}$ is the least set that

  - contains all relevant packages, and
  - if $p \in \mathcal{C}$ then $p.\text{depends} \setminus \mathcal{R} \subseteq \mathcal{C}$

3 Fact Format

- `unit(`$p.\text{name}$`,`$p.\text{version}$`,in).` for $p \in \mathcal{C}$

- `unit(`$p.\text{name}$`,`$p.\text{version}$`,out).` for $p \in \mathcal{R}$

- `installed(`$p.\text{name}$`,`$p.\text{version}$`).` for $p \in \mathcal{P}$

- `maxversion(`$p.\text{name}$`,`$p.\text{version}$`).` for $p \in \mathcal{P}$ and $p.\text{version} = \max(\mathcal{P}.\text{version}(p))$

selector S	S^∞	$S^-(q)$	$S^+(q)$
solution	$\mathcal{P} \setminus \mathcal{R}$	$\emptyset$	$\{q\}$
changed	$\mathcal{P} \setminus \mathcal{R} \cup \mathcal{I}$	$\{q\} \cap \mathcal{I} \setminus \mathcal{R}$	$\{q\} \setminus \mathcal{I}$
new	$\{p \in \mathcal{P} \setminus \mathcal{R} \mid p.\text{name} \notin \mathcal{I}.\text{name}\}$	$\emptyset$	$\{q\}$
removed	$\mathcal{I}$	$\{p \in \mathcal{P} \setminus \mathcal{R} \mid p.\text{name} = q.\text{name}\}$	$\emptyset$
up	$\{p \in \mathcal{P} \setminus \mathcal{R} \mid p.\text{name} \in \mathcal{I}.\text{name}, p.\text{version} > \max(\mathcal{I}.\text{version}(p))\}$	$\emptyset$	$\{q\}$
down	$\{p \in \mathcal{P} \setminus \mathcal{R} \mid p.\text{name} \in \mathcal{I}.\text{name}, p.\text{version} < \max(\mathcal{I}.\text{version}(p))\}$	$\emptyset$	$\{q\}$
installrequest	$\{p \in P \setminus \mathcal{R} \mid q \text{ mentioned in install request } p.\text{name} = q.\text{name}\}$	$\emptyset$	$\{q\}$
upgraderequest	$\{p \in P \setminus \mathcal{R} \mid q \text{ mentioned in upgrade request } p.\text{name} = q.\text{name}\}$	$\emptyset$	$\{q\}$
request	$\text{installrequest}^\infty \cup \text{upgraderequest}^\infty$	$\emptyset$	$\{q\}$

Table 1: Selectors

- `satisfies(Name,Version,Condition).` for $p \in \mathcal{C}$

  - applies to various parts of the CUDF-document
    * dependencies
    * conflicts
    * requests
    * recommendations
    * keep flags

- `depends(`$p.\text{name}$`,`$p.\text{version}$`,Condition).` for $p \in \mathcal{C}$

- `conflict(`$p.\text{name}$`,`$p.\text{version}$`,Condition).` for $p \in \mathcal{C}$

- `recommends(`$p.\text{name}$`,`$p.\text{version}$`,Condition,Weight).`

  - $\pm f \in \mathcal{O}$, $f = \text{unsat\_recommends}(S)$, and $p \in S^\infty$

- `request(Condition).`

  - requests
  - keep flags

- `attribute(`$p.\text{name}$`,`$p.\text{version}$`,Attribute,Value).`

  - $\pm f \in \mathcal{O}$, $f = \text{sum}(S, attr)$, and $p \in S^\infty$, or
  - $\pm f \in \mathcal{O}$, $f = \text{aligned}(S, group, value)$, and $p \in S^\infty$, or

- `installrequest(Name,Version).`

- `upgraderequest(Name,Version).`

- `clique(`I`,`$p.\text{name}$`,`$p.\text{version}$`)` where $p \in I$ and I is a non-singular clique in the graph
  $(\mathcal{C}, \{(p,q) \mid p, q \in \mathcal{C}, p \neq q, q \in p.\text{conflicts}\})$

  - no overlapping cliques will be added

- `criterion(Maximize,Selector,`count`,Priority).`

- `criterion(Maximize,Selector,`$\text{sum}(attr)$`,Priority).`

- `criterion(Maximize,Selector,`notuptodate`, Priority).`

- `criterion(Maximize,Selector,`unsat_recommends`,Priority).`

- `criterion(Maximize,Selector,`$\text{aligned}(group, value)$`,Priority).`