# AAA616: Program Analysis

## Lecture 8 — Parametric Static Analysis

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## Parametric Static Analysis

- $P \in \mathbb{P}$: a program to analyze
- $\mathbb{Q}_P$: a set of queries in $P$
- $\mathbb{J}_P$: a set of program components
- The parameter space $(\mathcal{A}_P, \sqsubseteq)$:

$$a \in \mathcal{A}_P = \{0, 1\}^{\mathbb{J}_P}$$

  with $a \sqsubseteq a' \iff \forall j \in \mathbb{J}_P.\ a_j \leq a'_j$.
- The parametric static analysis:

$$F_P : \mathcal{A}_P \to \wp(\mathbb{Q}_P).$$

- Assume the monotonicity:

$$a \sqsubseteq a' \implies F_P(a) \subseteq F_P(a).$$

# Parametric Static Analysis Problems

- Find $a \in \mathcal{A}_P$ such that
  - $F_P(a) = F_P(1)$ and
  - $\{a' \sqsubseteq a \mid \hat{F}_P(a) = \hat{F}_P(a')\} = \{a\}$.
  - "Learning minimal abstractions". POPL'11.

- Find an abstraction $a \in \mathcal{A}_P$ such that
  - the precision of $F_P(a)$ is close to that of $F_P(1)$, and
  - the cost of $F_P(a)$ is close to that of $F_P(0)$.
  - "Selective context-sensitivity guided by impact pre-analysis". PLDI'14.
  - "Learning a strategy to adapt a program analysis via bayesian optimization". OOPSLA'15.
  - "Abstractions from Tests". POPL'12

- Find the set $R$ of all provable queries: i.e., $R = F_P(1)$.
  - "On abstraction refinement for program analyses in Datalog". PLDI'14.