

Fault Localization & Relevance Analysis

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Definition 1 (Execution). *Let π be an error trace of length n . An execution of π is a sequence of states $s_0, s_1 \dots s_n$ such that $s_i, s_{i+1} \models T$, where T is the transition formula of $\pi[i]$.*

Let ϵ represent the set of all possible executions of the error trace.

Definition 2 (Blocking Execution). *An execution of a trace π of size n is called a blocking execution if there exists a sequence of states $s_0, s_1 \dots s_j$ where $i < j \leq n$ such that $s_i, s_{i+1} \models T[i]$, where $T[i]$ is the transition formula of $\pi[i]$ and there exists an assume statement in the trace π at position j such that $s_j \not\models \text{guard}(\pi[j])$.*

Definition 3 (Relevancy of an assignment statement). *Let β represent the set of all blocking executions of a trace π . Let there be an assignment statement of the form $x := t$ at position i . Let π' represent the trace that we get after replacing $\pi[i]$ with a havoc statement of the form $\text{havoc}(x)$ and let β' represent the set of all blocking executions for π' .*

We say that the assignment statement $\pi[i]$ is relevant if the trace after the replacement has strictly more blocked executions than the trace before the replacement, i.e if $\beta \subsetneq \beta'$.

Lemma 1 (bla). *bla*

Lemma 2 (blaa). *blaa*

Theorem 1 (Relevancy). *Let π be an error trace of length n and $\pi[i]$ be an assignment statement at position i having the form $x := t$, where x is a variable and t is an expression. Let P and Q be two predicates where $P = \neg WP(\text{False}, \pi[i, n])$ and $Q = \neg WP(\text{False}, \pi[i + 1, n])$. The statement $\pi[i]$ is relevant iff:*

$$P \not\models WP(Q, \text{havoc}(x))$$

Proof.

□