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

Definition 2 (Blocked Execution). *An execution of a trace π of size n is called a blocked execution, if there exists a sequence of states $s_0, s_1 ... s_j$ where $i < j \leq n$ such that $s_i, s_{i+1} \vDash T$ where T is the transition formula of $\pi[i]$ and there exists an assume statement in the trace π at position j such that $s_j \nRightarrow guard(\pi[j])$*

Definition 3 (Relevant Statement). *Let $\pi = st_1, ..., st_n$ be an error trace of length n where st_i is an assignment statement of the form $x := t$. The assignemnt statement at position i is relevant if there exists an execution $s_1, ... s_{n+1}$ of π and some value v such that every execution of the trace $x := v; \pi[i+1, n]$ starting in s_i is has a blocked execution.*

Lemma 1. *For a predicate P and an assignment statement of the form $x := t$ where x is a variable and t is an expression, we have:*

$$SP(P; x := t) \subseteq SP(P; havoc(x))$$

Lemma 2 (nonempty post). *If $P := WP(Q, x := t) \nsubseteq WP(Q, havoc(x))$ for some Q then $Q \subsetneq SP(P, havoc(x))$.*

Proof. We will show that $Q \equiv SP(P, x := t) \subseteq SP(P, havoc(x)) \nsubseteq Q$ from which it follows that the first inclusion is strict. The first inclusion is immediate from Lemma **??**. By assumption $P \nsubseteq WP(Q, havoc(x))$, which by Lemma **??** is equivalent to the second part. □

Theorem 1 (Relevancy of an assignment statement). *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 $P = \neg WP(False; \pi[i, n])$ and $Q = \neg WP(False; \pi[i+1, n])$. The statement $\pi[i]$ is relevant iff:*

$$P \nRightarrow WP(Q, havoc(x))$$

Proof. Let $P' = WP(Q; havoc(x))$ and $Q' = SP(P; havoc(x))$. It is obvious that P can also be written as $WP(Q; x := t)$ and Q as $SP(P; x := t)$.
"$\Rightarrow$"
If $\pi[i]$ is relevant, then

$$P \nRightarrow WP(Q; havoc(x))$$

Relevancy of $x := t$ implies that replacing $x := t$ with $x := v$ takes us into a state $s \in \neg Q$.
It is obvious that

$$SP(P; x := v) \subseteq SP(P; havoc(x))$$

or

$$SP(P; x := v) \subseteq Q'$$

and

$$SP(P; x := v) \nsubseteq Q$$

That means

$$Q' \nsubseteq Q \tag{1}$$

From lemma(1), we know that:

$$SP(P; x := t) \subseteq SP(P; havoc(x))$$

or

$$Q \subseteq Q' \tag{2}$$

From1 and 2

$$Q \subsetneq Q'$$

Obviously all the transition from P' end up in Q. Relevancy of $x := t$ implies that there is a state in $s \in P$ such that there is a transition from s to $\neg Q$. That would mean:

$$P \not\Rightarrow P'$$

$$P \not\Rightarrow WP(Q; havoc(x))$$

"$\Leftarrow$"

If $P \not\Rightarrow WP(Q; havoc(x))$, then the assignment statement $x := t$ is relevant. By the definition of P:

$$WP(Q; x := t) \not\Rightarrow WP(Q; havoc(x))$$

By lemma 2:

$$Q \subsetneq SP(Q; havoc(x))$$

or

$$Q \subsetneq Q'$$

This shows the existence of a state in $Q' \in \neg Q$ and hence a value v for x such that if we replace $x := t$ with $x := v$, then every execution is becoming blocking.

$\square$