$P(ProgramSyntax)$	$Translation\ Set\ of\ Axoims$
`if B then P1 else P2`	$B \to \varphi$, for each $\varphi \in \Pi^{\vec{X}}_{P1}$, $\neg B \to \varphi$, for each $\varphi \in \Pi^{\vec{X}}_{P1}$,
`P1; P2`	$\varphi(\vec{X}1/\vec{Y}) \to \varphi$, for each $\varphi \in \Pi^{\vec{X}}_{P1}$, $\varphi(\vec{X}/\vec{Y}) \to \varphi$, for each $\varphi \in \Pi^{\vec{X}}_{P2}$ where $\vec{Y} = (Y_1, ..., Y_k)$ is a tuple of new program variables(array names) such that each Yi is of the same arity as X_i in $\vec{X}$, $\varphi(\vec{X}1/\vec{Y})$ is the result of replacing in φ each occurrence of X_i by Y_i, and similarly for $\varphi(X/\vec{Y})$. By renaming them if necessary, we assume here that $\Pi^{\vec{X}}_{P1}$ and $\Pi^{\vec{X}}_{P2}$ have no common program variables except those in $\vec{X}$.
`while B do P1`	$\varphi(n)$, for each $\varphi \in \Pi^{\vec{X}}_{P1}$, $X_i(\vec{x}) = X_i(\vec{x}, 0)$, for each $X_i \in \vec{X}$ $smallest(N, n, \neg B(n))$, $X1_i(\vec{x}) = X_i(\vec{x}, N)$, for each $X_i \in X$ where n is a new natural number variable not already in φ, and N a new constant not already used in $\Pi^{\vec{X}}_{P1}$. For each formula or term α, $\alpha(n)$ is defined inductively as follows: it is obtained from α by performing the following recursive substitutions: • for each $X_i \in \vec{X}$, replace all occurrences of $X_i1(e_1, ..., e_k)$ by $X_i(e_1(n), ..., e_k(n), n + 1)$, and • for each program variable X in α, replace all occurrences of $X(e_1, ..., e_k)$ by $X(e_1(n), ..., e_k(n), n)$. Notice that this replacement is for every program variable X, including those not in $\vec{X}$. $smallest(N, n, \neg B(n))$ is a shorthand for the following formula $\neg B(N), \quad (1)$ $\forall n.n < N \to B(n) \quad (2)$

Table 1: Set of rules used by the translation algorithm [1]. Given a program P and a set $\vec{X}$ of program variables including all variables used in P, our system constructs a set of axioms $\Pi^{\vec{X}}_{P}$ according to the these presented rules.

References

[1] F. Lin, "A formalization of programs in first-order logic with a discrete linear order," *Artificial Intelligence*, vol. 235, pp. 1 – 25, 2016.