Contents

1 Aliasing

1.1 Definitions

An **object variable** is one of the following:

- a class instance variable i.e. a variable v such that $v : C$ for some class C.
- a class instance field reference i.e. a field reference $e.f$ where $e.f : C$ for some class C.

Let $\mathcal{O}$ be a set of object variables. An $O \subset \mathcal{O}$ **aliases** if and only if each $o \in O$ refers to the same memory in the heap as each other, written propositionally as

$$\forall o, o' \in O : o = o' \iff \mathsf{aliases}(O)$$

An $O \subset \mathcal{O}$ **non-aliases** if and only if each $o \in O$ refers to separate memory in the heap as each other, written propositionally as

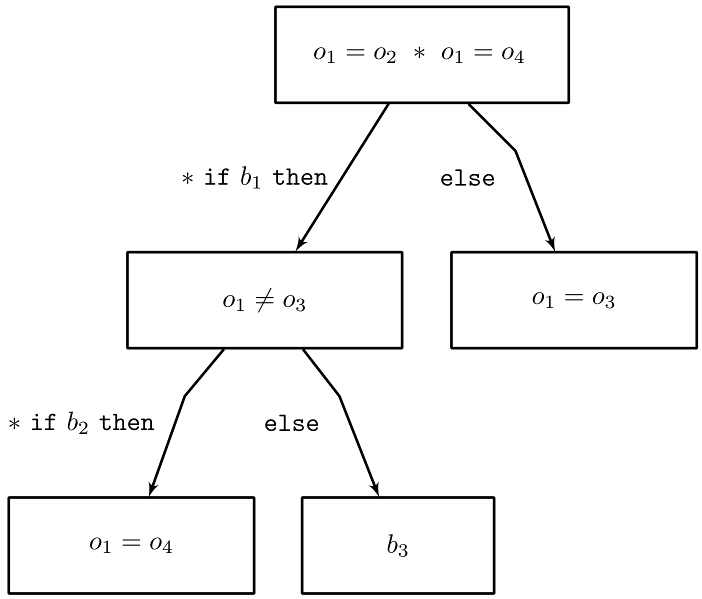
$$\forall o, \tilde{o} : o \neq \tilde{o} \iff \mathsf{non\text{-}aliases}(O)$$

1.2 Aliasing Context

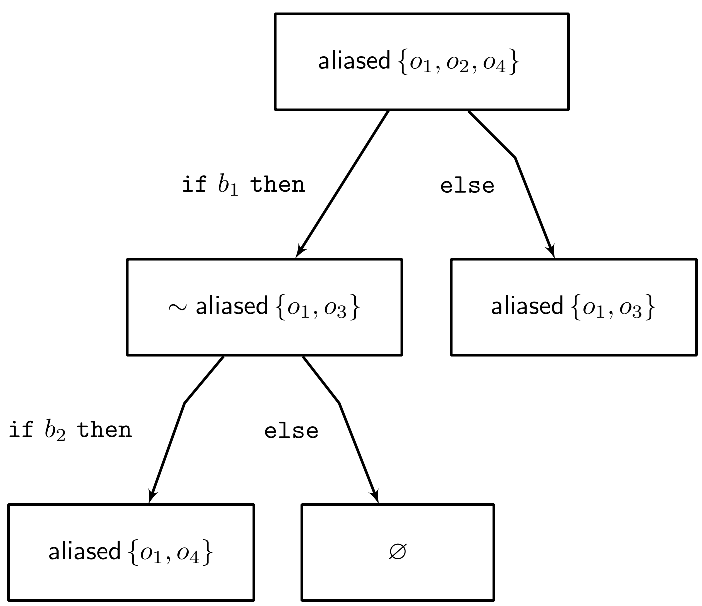
Let ϕ be a formula. The **aliasing context** $\mathcal{A}$ of ϕ is a tree of set of aliasing proposition about aliasing of object variables that appear in ϕ. $\mathcal{A}$ needs to be a tree because the conditional sub-formulas that may appear in ϕ allow for branching aliasing contexts not expressible flatly at the top level. Each node in the tree corresponds to a set of aliasing propositions, and each branch refers to a branch of a unique conditional in ϕ. The parts of the tree are labeled in such a way that modularly allows a specified sub-formula of ϕ to be matched to the unique aliasing sub-context that corresponds to it.
For example, consider the following formula:

$$\phi := (o_1 = o_2) * (\texttt{if}\ (b_1)\ \texttt{then}\ ((o_1 \neq o_3) * (\texttt{if}\ (b_2)\ \texttt{then}\ (o_1 = o_4)\ \texttt{else}\ (b_3)))\ \texttt{else}\ (o_1 = o_3)) * (o_1 = o_4)$$

ϕ has a formula-structure represented by the following tree:



The formula-structure tree for ϕ corresponds node-for-node and edge-for-edge to the following aliasing context:



where a node inherits all the aliasing assertions of its parents. So for example, the aliasing context for the sub-formula $(o_1 = o_4)$ of ϕ is:

$$\mathcal{A}_\phi(o_1 = o_4) := \{\mathsf{aliased}\,\{o_1, o_2, o_4\}\,, \sim \mathsf{aliased}\,\{o_1, o_3\}\,, \sim \mathsf{aliased}\,\{o_2, o_3\}\,, \sim \mathsf{aliased}\,\{o_3, o_4\}\}$$

More generally, for ϕ a formula and ϕ' a sub-formula of ϕ, write $\mathcal{A}_\phi(\phi')$ as the total aliasing context of ϕ', including inheritance from its place in the aliasing context of ϕ. Usually $\mathcal{A}_\phi(\phi')$ is abbreviated to $\mathcal{A}(\phi')$ when the top level formula ϕ is implicit.