undefined, *if* $\mathcal{P}(M, \lfloor e_0 \rfloor_\sigma \downarrow_1, Q)$ *undefined,*
or if $M, \sigma \models_{\mathcal{O}} A(e_0, e_1, ... e_n)$ *undefined.*

- $M, \sigma \models_{\mathcal{O}} A_1 \wedge A_2$, *if* $M, \sigma \models_{\mathcal{O}} A_1$ *and* $M, \sigma \models_{\mathcal{O}} A_2$,
  $M, \sigma \not\models_{\mathcal{O}} A_1 \wedge A_2$, *if* $M, \sigma \not\models_{\mathcal{O}} A_1$ *or* $M, \sigma \not\models_{\mathcal{O}} A_2$
  undefined, if $M, \sigma \models_{\mathcal{O}} A_1$ *or* $M, \sigma \models_{\mathcal{O}} A_2$ *is undefined.*
- $M, \sigma \models_{\mathcal{O}} A_1 \rightarrow A_2$, *if* $M, \sigma \models_{\mathcal{O}} A_1$ *and* $M, \sigma \models_{\mathcal{O}} A_2$,
  or $M, \sigma \not\models_{\mathcal{O}} A_1$.
  $M, \sigma \not\models_{\mathcal{O}} A_1 \rightarrow A_2$, *if* $M, \sigma \models_{\mathcal{O}} A_1$ *and* $M, \sigma \not\models_{\mathcal{O}} A_2$,
  undefined, if $M, \sigma \models_{\mathcal{O}} A_1$ *or* $M, \sigma \models_{\mathcal{O}} A_2$ *is undefined.*
- $M, \sigma \models_{\mathcal{O}} \exists x.A$ *iff for some address* ι *and some fresh variable* $z \in VarId$*, we have* $M, \sigma[z \mapsto \iota] \models_{\mathcal{O}} A[z/x]$.
  $M, \sigma \not\models_{\mathcal{O}} \exists x.A$ *iff for all address* ι *and fresh variable* $z \in VarId$*, we have* $M, \sigma[z \mapsto \iota] \not\models_{\mathcal{O}} A[z/x]$.
  undefined, otherwise.
- $M, \sigma \models_{\mathcal{O}} \forall x.A$ *iff for all addresses* $\iota \in dom(\sigma)$*, and fresh variable* z*, we have* $M, \sigma[z \mapsto \iota] \models_{\mathcal{O}} A[z/x]$.
  $M, \sigma \not\models_{\mathcal{O}} \forall x.A$ *iff there exists an address* $\iota \in dom(\sigma)$*, and fresh variable* z*, such that* $M, \sigma[z \mapsto \iota] \not\models_{\mathcal{O}} A[z/x]$.
  undefined, otherwise.
- $M, \sigma \models_{\mathcal{O}} e{:}C$, *if* $\sigma(\lfloor e \rfloor_{M,\sigma}) \downarrow_1 = C$.
  $M, \sigma \not\models_{\mathcal{O}} e{:}C$, *if* $\sigma(\lfloor e \rfloor_{M,\sigma}) \downarrow_1 \neq C$.
  undefined, *if* $\sigma(\lfloor e \rfloor_{M,\sigma}) \notin dom(\sigma \downarrow_2)$.
- $M, \sigma \models_{\mathcal{O}} \mathcal{MayAffect}(e, e')$, *if* $\lfloor e \rfloor_{M,\sigma}$ *and* $\lfloor e' \rfloor_{M,\sigma}$ *are defined, and there exists a method* m*, arguments* $\bar{a}$*, state* σ'*, identifier* z*, such that* $M, \sigma[z \mapsto \lfloor e \rfloor_{M,\sigma}], z\,.\,m(\bar{a}) \leadsto \sigma'$*, and* $\lfloor e' \rfloor_{M,\sigma} \neq \lfloor e' \rfloor_{M,\sigma\downarrow_1,\sigma'\downarrow_1}$.
  $M, \sigma \models_{\mathcal{O}} \mathcal{MayAffect}(e, e')$, *undefined if* $\lfloor e \rfloor_{M,\sigma}$ *or* $\lfloor e' \rfloor_{M,\sigma}$ *are undefined.*
  $M, \sigma \not\models_{\mathcal{O}} \mathcal{MayAffect}(e, e')$, *otherwise.*
- $M, \sigma \models_{\mathcal{O}} \mathcal{MayAccess}(e, e')$, *if* $\lfloor e \rfloor_{M,\sigma}$ *and* $\lfloor e' \rfloor_{M,\sigma}$ *are defined, and there exist fields* $f_1, \ldots f_n$*, such that* $\lfloor z.f_1 \ldots f_n \rfloor_{M,\sigma[z \mapsto \lfloor e \rfloor_{M,\sigma}]} = \lfloor e' \rfloor_{M,\sigma}$.
  $M, \sigma \models_{\mathcal{O}} \mathcal{MayAccess}(e, e')$, *undefined if* $\lfloor e \rfloor_{M,\sigma}$ *or* $\lfloor e' \rfloor_{M,\sigma}$ *are undefined.*
  $M, \sigma \not\models_{\mathcal{O}} \mathcal{MayAccess}(e, e')$, *otherwise.*
- $M, \sigma \models_{\mathcal{O}} e$ ***obeys*** S, *undefined, if* $\lfloor e \rfloor_{M,\sigma}$ *undefined,*
  unknown, *if* $\lfloor e \rfloor_{M,\sigma}$ *unknown, or* $\mathcal{C}lass(e, \sigma) \notin dom(M)$.
  $M, \sigma \models_{\mathcal{O}} e$ ***obeys*** S, *if* $\mathcal{O}(M, C, S) = true$
  $M, \sigma \not\models_{\mathcal{O}} e$ ***obeys*** S, *if* $\mathcal{O}(M, C, S) = false$
  where $C = \mathcal{C}lass(e, \sigma)$.

In the above, the notation $\sigma[v \mapsto \iota]$ *is shorthand for* $(\phi[v \mapsto \iota], \chi)$ *for a state* $\sigma = (\phi, \chi)$.