Qualifying Exam 2017 Solution

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1 Add fail/otherwise and ABORT

These rules are in addition to the given Operational Semantics.

$$\textbf{Fail}: \frac{}{(fail, \sigma) \Rightarrow \textbf{ABORT}} \qquad \textbf{AsgnAbrt}: \frac{(E, \sigma) \Rightarrow \textbf{ABORT}}{(x := E, \sigma) \Rightarrow \textbf{ABORT}}$$

$$\textbf{OK}: \frac{(E_1, \sigma) \Rightarrow (n, \sigma')}{(E_1 \text{ otherwise } E_2, \sigma) \Rightarrow (n, \sigma')} \qquad \textbf{OF}: \frac{(E_1, \sigma) \Rightarrow \textbf{ABORT} \;\; (E_2, \sigma) \Rightarrow r}{(E_1 \text{ otherwise } E_2, \sigma) \Rightarrow r}$$

$$\textbf{AAL}: \frac{(E_1, \sigma) \Rightarrow \textbf{ABORT}}{(E_1 + E_2, \sigma) \Rightarrow \textbf{ABORT}} \qquad \textbf{AAR}: \frac{(E_1, \sigma) \Rightarrow (n, \sigma') \;\; (E_2, \sigma') \Rightarrow \textbf{ABORT}}{(E_1 + E_2, \sigma) \Rightarrow \textbf{ABORT}}$$

2 Derivation of an Example Program

$$\dfrac{\dfrac{\dfrac{\dfrac{\dfrac{(3,\sigma)\Rightarrow(3,\sigma) \quad \dfrac{}{(fail,\sigma)\Rightarrow\textbf{ABORT}}\,\textbf{Fail}}{(3+fail,\sigma)\Rightarrow\textbf{ABORT}}\,\textbf{AAR}}{((a:=3+fail),\sigma)\Rightarrow\textbf{ABORT}}\,\textbf{Asgn}}{(((a:=3+fail)\ otherwise\ a),\sigma)\Rightarrow(3,\sigma)}\,\textbf{OF} \quad \textbf{Asgn} \quad \dfrac{}{(b,\sigma')\Rightarrow(3,\sigma')}\,\textbf{Var}}{(((b := ((a := 3 + fail)\ otherwise\ a)) + b), \{a : 3, b : 8\}) \Rightarrow (4, \{a : 3, b : 3\})}\,\overset{4=1+3}{\textbf{Add}}$$

$$\sigma = \{a : 3, b : 8\}$$

$$\sigma' = \{a : 3, b : 3\}$$