Barcan Up the Wrong Tree

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Barcan Formulas

$$\exists x \Diamond \varphi \leftrightarrow \Diamond \exists x \varphi$$

BQML

Structural Rules

$$\mathrm{Id}_s \ \frac{}{A \wr G; (\Gamma, \varphi \Rightarrow \varphi, \Sigma); H \int B} \qquad \mathrm{Id}_t \ \frac{}{A, t \wr G \int t, B}$$

$$\mathrm{W}_s \ \frac{A \wr G; (\Gamma \Rightarrow \Sigma); H \int}{A \wr G; (\Gamma, \Delta \Rightarrow \Lambda, \Sigma); H \int B} \qquad \mathrm{W}_t \ \frac{A \wr G \int B}{A, C \wr G \int B, D}$$

Operational Rules

$$\mathrm{L}\neg \ \frac{A \wr G; (\Gamma \Rightarrow \varphi, \Sigma); H \int B}{A \wr G; (\Gamma, \neg\varphi \Rightarrow \Sigma); H \int B} \qquad \mathrm{R}\neg \ \frac{A \wr G; (\Gamma\varphi \Rightarrow \Sigma); H \int B}{A \wr G; (\Gamma \Rightarrow \neg\varphi, \Sigma); H \int B}$$

$$\mathrm{L}\wedge \ \frac{A \wr G; (\Gamma, \varphi, \psi \Rightarrow \Sigma); H \int B}{A \wr G; (\Gamma, \varphi \wedge \psi \Rightarrow \Sigma); H \int B} \qquad \mathrm{R}\wedge \ \frac{A \wr G; (\Gamma \Rightarrow \varphi, \Sigma); H \int B \qquad A \wr G; (\Gamma \Rightarrow \psi, \Sigma); H \int B}{A \wr G; (\Gamma \Rightarrow \varphi \wedge \psi); H \int B}$$

$$\mathrm{L}\Diamond \ \frac{A \wr G; (\varphi \Rightarrow \quad); (\Gamma \Rightarrow \Sigma); H \int B}{A \wr G; (\Gamma, \Diamond\varphi \Rightarrow \Sigma); H \int B} \qquad \mathrm{R}\Diamond \ \frac{A \wr G; (\Gamma \Rightarrow \varphi, \Sigma); (\Delta \Rightarrow \Lambda); H \int B}{A \wr G; (\Gamma \Rightarrow \Sigma); (\Delta \Rightarrow \Diamond\varphi, \Lambda); H \int B}$$

$$\mathrm{L}\exists \ \frac{A, t \wr G; (\Gamma, \varphi[t/x] \Rightarrow \Sigma); H \int B}{A \wr G; (\Gamma \Rightarrow \exists x \varphi \Sigma); H \int B} \qquad \mathrm{R}\exists \ \frac{A \wr G; (\Gamma \Rightarrow \varphi[t/x], \Sigma); H \wr B \qquad A \wr G; (\Gamma \Rightarrow \Sigma); H \wr B, t}{A \wr G; (\Gamma \Rightarrow \exists x \varphi, \Sigma); H \wr B}$$

t does not occur in the conclusion of $\mathrm{L}\exists$

CQML

Structural Rules

$$\mathrm{Id}_s \frac{}{G;(A:\Gamma,\varphi\Rightarrow\varphi,\Sigma:B);H} \qquad \mathrm{Id}_t \frac{}{G;(A,t:\Gamma\Rightarrow\Sigma:t,B);H}$$

$$\mathrm{W}_s \frac{G;(A:\Gamma\Rightarrow\Sigma:B);H}{G;(A:\Gamma,\Delta\Rightarrow\Lambda,\Sigma:B);H} \qquad \mathrm{W}_t \frac{G;(A:\Gamma\Rightarrow\Sigma:B);H}{G;(A,C:\Gamma\Rightarrow\Sigma:B,D);H}$$

Operational Rules

$$\mathrm{L}\neg \frac{G;(B:\Gamma\Rightarrow\varphi,\Sigma:B);H}{G;(A:\Gamma,\neg\varphi\Rightarrow\Sigma:B);H} \qquad \mathrm{R}\neg \frac{G;(A:\Gamma\varphi\Rightarrow\Sigma:B);H}{G;(A:\Gamma\Rightarrow\neg\varphi,\Sigma:B);H}$$

$$\mathrm{L}\wedge \frac{G;(A:\Gamma,\varphi,\psi\Rightarrow\Sigma:B);H}{G;(\Gamma,\varphi\wedge\psi\Rightarrow\Sigma:B);H} \qquad \mathrm{R}\wedge \frac{G;(A:\Gamma\Rightarrow\varphi,\Sigma:B);H \qquad G;(A:\Gamma\Rightarrow\psi,\Sigma:B);H}{G;(A:\Gamma\Rightarrow\varphi\wedge\psi:B);H}$$

$$\mathrm{L}\Diamond \frac{G;(A:\varphi\Rightarrow\quad:B);(C:\Gamma\Rightarrow\Sigma:D);H}{G;(A:\Gamma,\Diamond\varphi\Rightarrow\Sigma:B);H} \qquad \mathrm{R}\Diamond \frac{G;(A:\Gamma\Rightarrow\varphi,\Sigma:B);(C:\Delta\Rightarrow\Lambda:D);H}{G;(:A\Gamma\Rightarrow\Sigma:B);(C:\Delta\Rightarrow\Diamond\varphi,\Lambda:D);H}$$

$$\mathrm{L}\exists \frac{G;(A,t:\Gamma,\varphi[t/x]\Rightarrow\Sigma:B);H}{G;(A:\Gamma\Rightarrow\exists x\varphi\Sigma:B);H} \qquad \mathrm{R}\exists \frac{G;(A:\Gamma\Rightarrow\varphi[t/x],\Sigma:B);H \qquad G;(A:\Gamma\Rightarrow\Sigma:B,t);H}{G;(A:\Gamma\Rightarrow\exists x\varphi,\Sigma:B);H}$$

t does not occur in the conclusion of L$\exists$

NQML

$$\mathrm{EX}_t \frac{G;(A,t:\Gamma\Rightarrow\Sigma:B);(C:\Delta\Rightarrow\Lambda:D);H}{G;(A:\Gamma\Rightarrow\Sigma:B);(C,t:\Delta\Rightarrow\Lambda:D);H}$$