A notion of quantified conditional logics (QCLs) is provided that includes quantification over individual and propositional variables. The former is supported with respect to constant and variable domain semantics. In addition, a sound and complete embedding of this framework in classical higher-order logic (HOL) is presented. Using prominent examples from the literature it is demonstrated how this embedding enables effective automation of reasoning within (object-level) and about (meta-level) quantified conditional logics with off-the-shelf higher-order theorem provers and model finders.

**Quantified Conditional Logics (QCLs)**

\[ \phi \equiv \exists y \forall x (\psi x y) \]

**Classical Higher-order Logic (HOL)**

\[ \alpha, \beta \in \text{vars} \] (worlds), \( \wedge \) (and), \( \lor \) (or), \( \rightarrow \) (implies), \( \neg \) (not), \( \exists \) (there exists).

### Example: Pegasus, the winged horse

It can be consistently stated (in classical QCL+D+MP) that: "Horses (h) contingently do not have wings (w) but Pegasus (p) is a winged horse.

\[ \exists h (\neg w(h)) \land \neg \exists h (w(h)) \land p(h) \rightarrow w(h) \]

### Example: Opus, the penguin

"Birds (b) normally fly (f), but Opus (o) is a bird that normally does not fly."

\[ b(x) \rightarrow f(x), \quad o(x) \rightarrow \neg f(x) \]

H reports a finite model (H = 8.6). When \( \neg \exists b \) is used: H says unsatisfiable (H = 9.0, H = 7.7).

### Classical Higher-order Logic (HOL)

\[ \text{types} \quad \alpha, \beta \in \text{vars} \] (worlds), \( \wedge \) (and), \( \lor \) (or), \( \rightarrow \) (implies), \( \neg \) (not), \( \exists \) (there exists).

### Deduction

\[ \alpha, \beta \in \text{vars} \] (worlds), \( \wedge \) (and), \( \lor \) (or), \( \rightarrow \) (implies), \( \neg \) (not), \( \exists \) (there exists).

### Interpretation

\[ M = (S, D, F, G) \]

- **Types**
  - \( \alpha, \beta \in \text{vars} \) (worlds)
  - \( \wedge \) (and), \( \lor \) (or), \( \rightarrow \) (implies), \( \neg \) (not), \( \exists \) (there exists)

- **Terms**
  - \( \alpha, \beta \in \text{vars} \) (worlds)
  - \( \wedge \) (and), \( \lor \) (or), \( \rightarrow \) (implies), \( \neg \) (not), \( \exists \) (there exists)

- **Formulae**
  - \( \alpha, \beta \in \text{vars} \) (worlds)
  - \( \wedge \) (and), \( \lor \) (or), \( \rightarrow \) (implies), \( \neg \) (not), \( \exists \) (there exists)

### Predicates

- \( b(x) \rightarrow f(x), \quad o(x) \rightarrow \neg f(x) \)

H reports a finite model (H = 8.6). When \( \neg \exists b \) is used: H says unsatisfiable (H = 9.0, H = 7.7).

### References and Further Reading
