Constructive Logic (15-317), Fall 2024
Assignment 12: Modal Logic

Constructive Logic Staff
(Instructor: Karl Crary)

Due: **Tuesday**, November 26, 2024, 11:59 pm

This assignment is coding only, using Dcheck. Please submit a file named "`hw.deriv`" to "Homework 12."

You can find documentation on Dcheck at `cs.cmu.edu/~crary/dcheck/dcheck.pdf` and a sample file at `cs.cmu.edu/~crary/dcheck/example.deriv`.

1 Modal Logic

Task 1 (30 points). Provide derivations for the following modal logic judgements using Dcheck. Derivation names are given in the starter code.

  a. $\Box T$ true

  b. $\Box A \supset \Diamond \neg A \supset \Diamond F$ true

  c. $(\Box A \wedge \Box B) \supset \Box (A \wedge B)$ true

  d. $\Diamond(\Box A \wedge \Diamond(A \supset B)) \supset \Diamond B$ true

  e. $\Diamond \Box \Diamond A \supset \Diamond A$ true

  f. $\Box A \supset \Diamond(A \supset \Diamond(A \supset B)) \supset \Diamond B$ true

2 Focused Logic Mastery

Task 2 (5 points). Define a derivation named `task2` that derives:

$$\cdot; \cdot \xrightarrow{R} (P^+ \wedge^+ \downarrow((P^+ \vee Q^+) \supset \uparrow Q^+)) \supset \downarrow(Q^+ \supset R^-) \supset R^-$$

(Remember that Dcheck takes the propositions P, Q and R to be atomic.) **Instant feedback is turned off for this task, so be extra careful.**

Since instant feedback is turned off, **pay special care to the assumption numbers**. Dcheck numbers assumptions from right to left, starting at zero. Thus, the rightmost assumption is numbered 0. No partial credit will be granted for submissions that would be correct except for assumption numbers.