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CS743 Software Verification and Validation Assignment 5

Formal Verification Using Predicate Logic

**Predicate Problem:**

* A file is said to be edited when it is opened and its contents are changed.
* A file is not closed unless it was opened.
* If a file is closed and saved, then its contents must have been changed.
* If a file is closed but not saved, then its contents are not changed.
* This file's contents are changed and it is closed.

**Prove: this file must have been edited and saved.**

- Notation: I have replaced the standard **p**  with **f**

∀ f : File • opened(f) ∧ contentsChanged(f) ⇒ edited(f) (1)

∀ f : File • closed(f) ⇒ opened(f) (2)

∀ f : File • closed(f) ∧ saved(f) ⇒ contentsChanged(f) (3)

∀ f : File • closed(f) ∧ ¬saved(f) ⇒ ¬contentsChanged(f) (4)

∃ f : File • f = file ∧ contentsChanged(f) ∧ closed(f) (5)

Using (5) and One-point rule, infer

contentsChanged(file) ∧ closed(file) (6)

Using Conjunctive simplification on rule 6, derive

contentsChanged(file) (7)

closed(file) (8)

Using (2), (8), Modus ponens, infer

opened(file) (9)

Using (7), (9), Conjunctive addition, infer

opened(file) ∧ contentsChanged(file) (10)

Using (1), (10), Modus ponens, infer

edited(file) (11)

Rewrite (4) using Modus tollens

∀ f : File • contentsChanged(f) ⇒ ¬closed(f) v saved(f) (12)

Using (7), (12), and modus ponens, infer

¬closed(f) v saved(f) (13)

Using (13), (9), and disjunctive syllogism, infer

saved(file) (14)

Using (11), (14), and conjunctive ponens, infer

edited(file) ∧ saved(file) (15)

Therefore, the conclusion is the “This file has bas been edited and saved”.