

fn then_deintegerize_hashmap

Michael Shoemate

This proof resides in “**contrib**” because it has not completed the vetting process.

Proves soundness of the implementation of `then_deintegerize_hashmap` in `mod.rs` at commit `f5bb719` (outdated¹).

1 Hoare Triple

Precondition

Compiler-Verified

- Generic TV implements trait `CastInternalRational`

User-Verified

None

Pseudocode

```
1 def then_deintegerize_hashmap(k: i32) -> Function[HashMap[TK, IBig], HashMap[TK, TV]]:
2     if k == i32.MIN: #
3         raise ValueError("k must not be i32.MIN")
4
5     def value_function(v_i):
6         return TV.from_rational(x_mul_2k(RBig.from_(v_i), k))
7
8     return Function.new(lambda x: {k_i: value_function(v_i) for k_i, v_i in x.items()})
```

Postcondition

Theorem 1.1. For every setting of the input parameters $(k, \text{TK}, \text{TV})$ to `then_deintegerize_hashmap` such that the given preconditions hold, `then_deintegerize_hashmap` raises an error (at compile time or run time) or returns a valid postprocessor. A valid postprocessor has the following property:

1. (Data-independent errors). For every pair of members x and x' in `input_domain`, $\text{function}(x), \text{function}(x')$ either both raise the same error, or neither raise an error.

Proof. By the postcondition of `TV.from_rational`, the outcome of the function is the nearest representable float, and may saturate to positive or negative infinity. The precondition of `x_mul_2k` that k is not `i32.MIN` is satisfied on line 2. Since `TV.from_rational` and `x_mul_2k` are both infallible, the function is infallible, meaning that the function cannot raise data-dependent errors. Therefore the function is a valid postprocessor. \square

¹See new changes with `git diff f5bb719..bffbbf2 rust/src/measurements/noise_threshold/nature/float/mod.rs`