

# 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Proves soundness of the implementation of `then_deintegerize_hashmap` in `mod.rs` at commit `f5bb719` (outdated<sup>1</sup>).

## 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 ( $k$ ,  $TK$ ,  $TV$ ) to `then_deintegerize_hashmap` such that the given preconditions hold, `then_deintegerize_hashmap` raises an exception (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 elements  $x, x'$  in `input_domain`, `function(x)`, `function(x')` either neither or both raise an error. If both raise an error, then they both raise the same 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.  $\square$

---

<sup>1</sup>See new changes with `git diff f5bb719..0444870 rust/src/measurements/noise_threshold/nature/float/mod.rs`