

# fn then\_deintegerize\_vec

Michael Shoemate

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

Proves soundness of the implementation of `then_deintegerize_vec` in `mod.rs` at commit f5bb719 (outdated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

## 1 Hoare Triple

### Precondition

#### Compiler-Verified

- Generic T0 implements trait `CastInternalRational`

#### User-Verified

None

### Pseudocode

```
1 def then_deintegerize_vec(k: i32) -> Function[Vec[IBig], Vec[T0]]:
2
3     if k == i32.MIN: #
4         raise ValueError("k must be greater than i32.MIN")
5
6     def element_function(x_i):
7         return T0.from_rational(x_mul_2k(RBig.from_(x_i), k))
8
9     return Function.new(lambda x: [element_function(x_i) for x_i in x])
```

### Postcondition

**Theorem 1.1.** For every setting of the input parameters ( $k$ ,  $T0$ ) to `then_deintegerize_vec` such that the given preconditions hold, `then_deintegerize_vec` 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 `T0.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 3. Since `T0.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..d7a6cc0 rust/src/measurements/noise/nature/float/mod.rs`