

# impl Sample for ZExpFamily<2>

Michael Shoemate

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

Proves soundness of the implementation of `Sample` for `ZExpFamily<2>` in `mod.rs` at commit `f5bb719` (outdated<sup>1</sup>).

## 1 Hoare Triple

### Precondition

`self` represents a valid probability distribution.

### Pseudocode

```
1 class ZExpFamily2: # analogous to impl Sample for ZExpFamily<1> in Rust
2     def sample(self, shift):
3         return shift + sample_discrete_gaussian(self.scale) #
```

### Postcondition

**Theorem 1.1.** Either returns `Err(e)` independently of the input `shift`, or `Ok(shift + Z)` where `Z` is a sample from the distribution defined by `self`.

*Proof.* By the precondition, since `self` represents a valid probability distribution, then by the definition of `ZExpFamily`, `self.scale` is non-negative.

Since the preconditions for `sample` are met (non-negative scale), then we claim the postcondition that the returned value follows a given distribution. This distribution matches that defined by `self`.

By the addition on line 3, the implementation satisfies the postcondition. □

---

<sup>1</sup>See new changes with `git diff f5bb719..76ab1a9 rust/src/measurements/noise/mod.rs`