

impl Sample for ZExpFamily<1>

Michael Shoemate

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

Proves soundness of the implementation of `Sample` for `ZExpFamily<1>` in `mod.rs` at commit `f5bb719` (outdated¹).

1 Hoare Triple

Precondition

`self` represents a valid probability distribution.

Pseudocode

```
1 class ZExpFamily1: # analogous to impl Sample for ZExpFamily<1> in Rust
2     def sample(self, shift):
3         return shift + sample_discrete_laplace(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. □

¹See new changes with `git diff f5bb719..c3b1c15 rust/src/measurements/noise/mod.rs`