

# 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 in **mod.rs** at commit f5bb719 (outdated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 **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..88acd19 rust/src/measurements/noise/mod.rs`