

In this question, you will use the Parametric Bootstrap to solve a problem in Bayesian inference. The **Parametric** Bootstrap is useful in those cases where you don't have the original data.

We could use the Normal Distribution for this problem because test scores are likely normally distributed. However, we run into a problem when doing simulations because we're likely to generate test scores outside the range 0-100.

We can use the Truncated Normal Distribution (``truncnorm``) instead. From the `scipy` docs `truncnorm` page:
<https://docs.scipy.org/doc/scipy/reference/generated/scipy.stats.truncnorm.html>

"The standard form of this distribution is a standard normal truncated to the range `[a, b]` – notice that `a` and `b` are defined over the domain of the standard normal. To convert clip values for a specific mean and standard deviation, use:

```
a, b = (myclip_a - my_mean) / my_std, (myclip_b - my_mean) / my_std
```

"

Plus further clarification on `a` and `b` from
<https://stackoverflow.com/questions/18441779/how-to-specify-upper-and-lower-limits-when-using-numpy-random-normal>

```
a, b = (lower - mu) / sigma, (upper - mu) / sigma
```

```
> "Within a school district, students were randomly assigned to one of two  
Math teachers - Mrs. Smith and Mrs. Jones. After the assignment, Mrs. Smith  
had 30 students, and Mrs. Jones had 25 students.  
> At the end of the year, each class took the same standardized test. Mrs.  
Smith's students had an average test score of 78, with a standard deviation  
of 10; and Mrs. Jones' students had an average test score of 85, with a  
standard deviation of 15.  
> What is the probability that Mrs. Smith and Mrs. Jones are equally  
effective teachers."
```

The method is to take `M` bootstrap samples of size `N` from the parameterized distribution. Use `M=1000` and the respective class sizes as `N`.

Problem 5.1

What might "equally effective" might mean in the context of Bayesian inference (ie, how do we operationalize this in Bayesian Inference?).

Problem 5.2

Now determine if it is **believable**.

Problem 5.3

Answer one additional question of inference using the posterior distribution.