

STAT 30030 Homework 2, Exercise 7: Rejection Sampling

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1 Introduction

Implement rejection sampling to obtain 1,000 samples distributed with a Beta(2,2) distribution using samples from a $\mathcal{U}[0, 1]$ distribution. Plot a histogram with your 1,000 samples and superimpose the density of a Beta(2,2) distribution.

2 Analysis

```
# Obtain 2000 samples from the Unif[0, 1] distribution.
sample = data.frame(unif = runif(2000, 0, 1))

# Obtain 2000 samples from the Beta(2, 2) distribution based on our samples
↪ from the uniform distribution.
sample$betaDensity = dbeta(sample$unif, 2, 2)

# Set normalizing constant to be the maximum Beta density value
maxDens = max(sample$betaDensity, na.rm = T)

# Apply the acceptance / rejection criterion
sample$accepted = ifelse(runif(2000, 0, 1) < sample$betaDensity / maxDens,
  ↪ T, F)
```

```
# Filter down to the first 1000 samples accepted
sample <- sample %>%
  filter(accepted == T)
sample <- sample[c(1:1000),]
```

```
# Plot histogram
hist(sample$unif[sample$accepted], freq = F, main = "Beta(2,2) Data
  ↳ Generated Using Rejection Sampling", xlab = "Accepted Draws from
  ↳ U[0,1]")
```

```
# Plot the Beta(2, 2) distribution
curve(dbeta(x, 2, 2), from = 0, to = 1, add = T)
```

Beta(2,2) Data Generated Using Rejection Sampling

