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Math 666: Simulations of Stochastic Systems
Homework 2: Problem 1

```
2 pj <- 1:10
3 probabilities <- c(0.05, 0.05, 0.05, 0.05, 0.05, 0.15, 0.15, 0.15, 0.15, 0.15)
4 Qj <- rep(0.1, 10)
5
6 # Threshold constant
7 c <- 4
8 # Function to perform acceptance-rejection simulation
9 acceptance_rejection_simulation <- function(num_simulations) {
10   accepted_values <- c()
11
12   for (i in 1:num_simulations) {
13     while (TRUE) {
14       #Generate U
15       U <- runif(1)
16
17       # STransform U to variable y
18       y <- as.integer(10 * U) + 1
19
20       # Step 3: Compute the ratio
21       ratio <- probabilities[y] / Qj[y]
22
23       # Step 4: Generate another uniform
24       V <- runif(1)
25
26       # Step 5: Accept or reject
27       threshold <- ratio / c
28       if (V <= threshold) {
29         accepted_values <- c(accepted_values, y)
30         break
31       }
32     }
33   }
34   return(accepted_values)
35 }
36
37 # Perform simulation 1000 times
38 simulated_values <- acceptance_rejection_simulation(1000)
39
40 # Plot histogram
41 hist(simulated_values, breaks = 0:10, main = "Histogram of Simulated Values", xlab = "Value", ylab =
42 axis(side = 1, at = 1:10, labels = 1:10)
43
```

Histogram of Simulated Values

