```
set.seed(123)

# Question 1: Gamma(4,5) using Acceptance-Rejection
a <- 4
b <- 5
l <- 5 / 4
n <- 1e4

U <- runif(n)
Y <- rexp(n, l)

c_emp <- max((b^a / gamma(a)) * Y^(a - 1) * exp(-b * Y) / (l * exp(-l * Y)))
accept <- U < ((b^a / gamma(a)) * Y^(a - 1) * exp(-b * Y)) / (c_emp * (l * exp(-l *
Y)))
X <- Y[accept]

cat("Mean:", mean(X), "\n")
cat("Variance:", var(X), "\n")
cat("Theoretical Mean:", a / b, "\n")
cat("Theoretical Variance:", a / b^2, "\n")
cat("Estimated c:", c_emp, "\n")

# Question 2: Uniform samples in unit circle
m <- 1e4
X <- runif(10 * m, -1, 1)
Y <- runif(10 * m, -1, 1)
inside <- X^2 + Y^2 <= 1

plot(X[inside][1:m], Y[inside][1:m], col = "blue", pch = 20, main = "Unit Circle
Samples", xlab = "X", ylab = "Y", asp = 1)
```