gamma simulation

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$f(x)$ $X \sim \text{Gamma}(\lambda, m)$

$h(x) = \mu e^{-\mu x} = \frac{\lambda}{m} e^{-\frac{\lambda}{m} x}$.

requirement $m > 1$ $\mu < \lambda$.

choose $\mu = \frac{\lambda}{m}$

```r
# sim a gamma(lambda, m) rv using rejection with an exp envelope
# assumes m > 1 and lambda > 0
gamma.sim <- function(lambda, m) {
  f <- function(x) lambda^m*x^(m-1)*exp(-lambda*x)/gamma(m)
  h <- function(x) lambda/m*exp(-lambda/m*x)
  k <- m^m*exp(1-m)/gamma(m)
  while (TRUE) {
    X <- -log(runif(1))*m/lambda
    Y <- runif(1, 0, k*h(X))
    if (Y < f(X)) return(X)
  }
}

set.seed(1999)
n <- 10000
g <- rep(0, n)
for (i in 1:n) g[i] <- gamma.sim(1, 2)
hist(g, breaks=20, freq=F, xlab="x", ylab="pdf f(x)",
  main="theoretical and simulated gamma(1, 2) density")
x <- seq(0, max(g), .1)
lines(x, dgamma(x, 2, 1))
```

simulate $h(x)$. $\frac{-\log U}{\frac{\lambda}{m}} = -\frac{m}{\lambda} \log U$

$k^* = \frac{m^m e^{-(m-1)}}{\Gamma(m)}$

theoretical and simulated gamma(1, 2) density