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par(family = 'serif')
setwd("/Users/mikhailgaerlan/Box Sync/Education/UC Davis/2016-2017
Spring/STA 243 Computational Statistics/Assignments/Assignment 2")
rm(list=ls())

alpha1 = 1
alpha2 = pi/2

q = function(x){
  return(exp(-x)/(1+x^2))
}
g1 = function(x){
  return(exp(-x))
}
g2 = function(x){
  return(2/(pi*(1+x^2)))
}
sampleg1 = function(n){
  x = 0*(1:n)
  for(i in 1:n){
    u = runif(1)
    x[i] = -log(1-u)
  }
  return(x)
}
sampleg2 = function(n){
  x = 0*(1:n)
  for(i in 1:n){
    u = runif(1)
    x[i] = tan(pi*u/2)
  }
  return(x)
}
samplef = function(n,o){
  x2 = 0*(1:n)
  j = 0
  for (i in 1:n){
    test = T
    while (test){
      if (o == 1){
        test2 = T
        while (test2){
          x = sampleg1(1)
          if (x < 5){
            test2 = F
          }
        }
      }
      j = j + 1
      if (runif(1) < q(x)/(alpha1*g1(x))){
        x2[i] = x
      }
    }
  }
}

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        test = F
    }
} else {
    test2 = T
    while (test2){
        x = sampleg2(1)
        if (x < 5){
            test2 = F
        }
    }
    j = j + 1
    if (runif(1) < q(x)/(alpha2*g2(x))){
        x2[i] = x
        test = F
    }
}
}
}
print(j)
return(x2)
}

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x = samplef(5000,1)
h = hist(x,plot=F)
hcum = h
hcum$counts=cumsum(hcum$counts)
plot(hcum)
plot(h,add=T,col='grey')
d = density(x)
lines(d$x,d$y*length(x)*diff(h$breaks)[1],lwd=2)
lines(d$x,cumsum(d$y)/max(cumsum(d$y))*length(x),lwd=2)

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x = samplef(5000,2)
h = hist(x,plot=F)
hcum = h
hcum$counts=cumsum(hcum$counts)
plot(hcum)
plot(h,add=T,col='grey')
d = density(x)
lines(d$x,d$y*length(x)*diff(h$breaks)[1],lwd=2)
lines(d$x,cumsum(d$y)/max(cumsum(d$y))*length(x),lwd=2)

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