UNIVERSIDAD NACIONAL DE ROSARIO

Facultad de Ciencias Económicas y Estadística

"Metropolis-Hastings"

Estadística Bayesiana - Trabajo Práctico Nº2

Alumnas: Agustina Mac Kay, Ailén Salas y Rocio Canteros

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```
#Punto 1:
sample_mh <- function(d_objetivo, r_propuesta, d_propuesta, p_inicial, n) {
  muestras <- matrix(nrow = n, ncol = length(p_inicial))
  muestras[1, ] <- p_inicial
```

```
  for(i in 2:n) {
    p_actual <- muestras[i-1,]
    p_nuevo <- r_propuesta(p_actual)

    f_nuevo <- d_objetivo(p_nuevo)
    f_actual <- d_objetivo(p_actual)

    q_actual <- d_propuesta(p_actual, mean = p_nuevo)
    q_nuevo <- d_propuesta(p_nuevo, mean = p_actual)

    alpha <- min(1, (f_nuevo/f_actual)*(q_actual/q_nuevo))
    aceptar <- rbinom(1, 1, alpha)

    if(aceptar) {
      muestras[i,] <- p_nuevo
    } else {
      muestras[i,] <- p_actual
    }
  }

  if (ncol(muestras) == 1) {
    muestras <- as.vector(muestras)
  }
  return(muestras)
}
```

```
#Punto 2
# Crear grilla para los valores de "x"
grid_n <- 200
x_grid <- seq(0, 1, length.out = grid_n)

kumaraswamy <- function(x, a, b){
  a*b*(x^(a-1))*((1-(x^a))^(b-1))
}

a <- c(0.2, 3, 4, 10, 1)
b <- c(0.2, 3, 9, 5, 7)

#Creamos un data frame para graficar la distribución de Kumaraswamy:

data1 <- data.frame(
  Funcion = rep(1:5, each = grid_n),
  Densidad = numeric(5 * grid_n),
  Grilla = rep(x_grid, times = 5)
)

#Completamos el data frame con las densidades:
for(i in 1:5) {
    indices <- seq(from = 1 + (i - 1) * 200, to = 200 + (i - 1) * 200)
    data1$Densidad[indices] <- kumaraswamy(x_grid, a[i], b[i])
}

library(ggplot2)
```

```r
# Definimos etiquetas personalizadas para cada función
# etiq <- c(
#   "1" = "alpha = 0.2 , beta = 0.2",
#   "2" = "alpha = 3 , beta = 3",
#   "3" = "alpha = 4 , beta = 9",
#   "4" = "alpha = 10, beta = 5",
#   "5" = "alpha = 1, beta = 7"
# )

# Quiero que se vean alpha y beta como simbolos pero no me sale
etiq <- c(
  "1" = expression(~ alpha ~ " = 0.2," ~ beta ~ "= 0.2"),
  "2" = expression(~ alpha ~ " = 3," ~ beta ~ "= 3"),
  "3" = expression(~ alpha ~ " = 4," ~ beta ~ "= 9"),
  "4" = expression(~ alpha ~ " = 10," ~ beta ~ "5"),
  "5" = expression(~ alpha ~ " = 1," ~ beta ~ "= 7")
)

ggplot(data = data1, aes(x = Grilla, y = Densidad)) +
  geom_line(size = 0.55) +
  facet_wrap(~Funcion, labeller = labeller(Funcion = etiq)) +
  theme_bw() +
  labs(x = "x",
       caption = "Gráfico 1: distribución Kumaraswamy con distintos parámetros") +
  theme(
    strip.background = element_rect(fill = "olivedrab3"),
    plot.caption = element_text(hjust = 0.5)
  )
```

```
## Warning: Using ‘size‘ aesthetic for lines was deprecated in ggplot2 3.4.0.

## Warning: Please use ‘linewidth‘ instead.
```

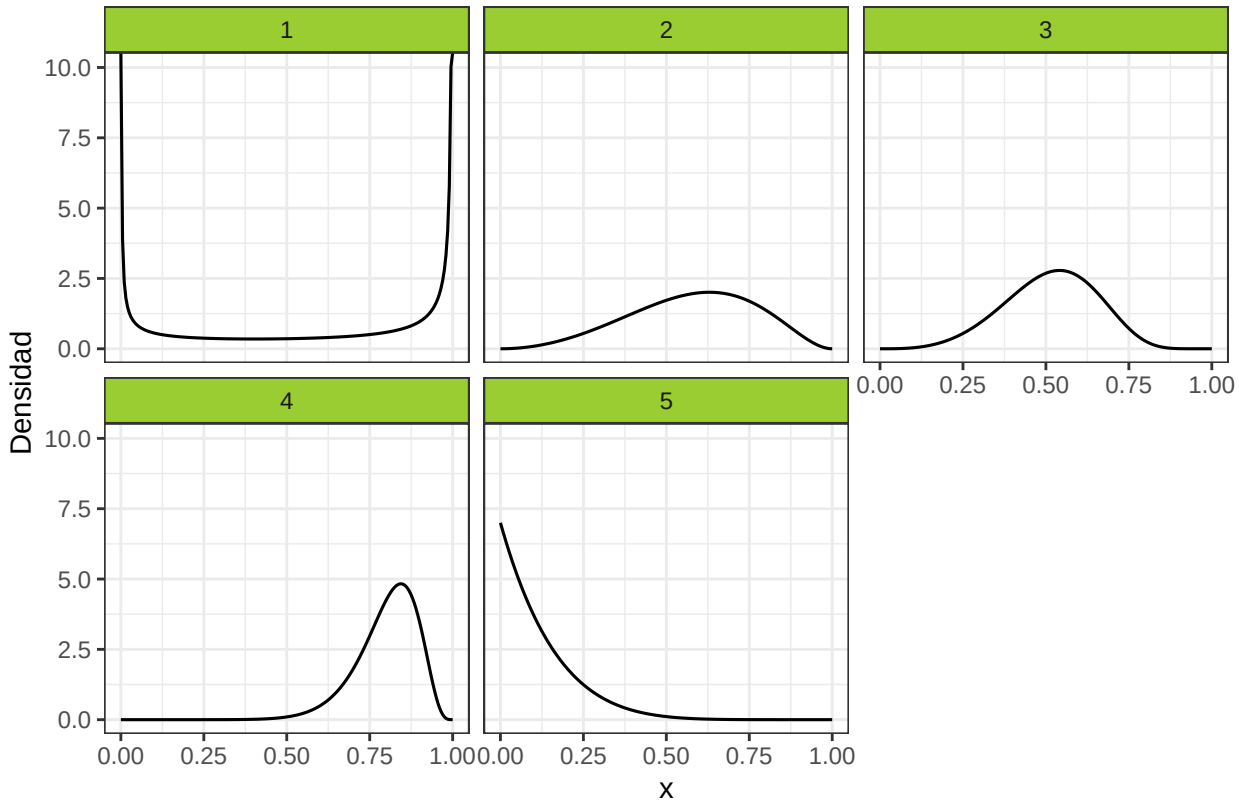

Gráfico 1: distribución Kumaraswamy con distintos parámetros

```
#Punto 3

#Funciones a usar
d_objetivo <- function(x) kumaraswamy(x, 6, 2)
d_propuesta <- function(x, mean) dbeta(x, shape1 = mean * 4, shape2 = (1-mean) * 4)
r_propuesta <- function(x) rbeta(1, shape1 = x * 4, shape2 = (1-x) * 4)
#Donde x hace referencia a mu

sample_mh(d_objetivo, r_propuesta, d_propuesta, 0.5, 200)
```

```
##   [1] 0.5000000 0.5000000 0.7135299 0.7135299 0.6193801 0.7054886 0.6383528
##   [8] 0.6383528 0.6273347 0.7078665 0.7962885 0.7962885 0.7962885 0.4213356
##  [15] 0.6280331 0.3706437 0.3706437 0.3705135 0.3705135 0.3349688 0.3349688
##  [22] 0.5757528 0.7160183 0.7216315 0.6854484 0.8088271 0.8088271 0.8088271
##  [29] 0.8088271 0.8088271 0.8878664 0.8114725 0.7533827 0.7562750 0.8620420
##  [36] 0.8620420 0.8620420 0.7603897 0.7616691 0.7616691 0.7793353 0.7793353
##  [43] 0.7666201 0.7666201 0.7666201 0.7666201 0.7940833 0.7940833 0.7216384
##  [50] 0.5590698 0.5590698 0.6371758 0.5747373 0.4797372 0.4797372 0.4765425
##  [57] 0.4765425 0.4765425 0.4768583 0.6158976 0.6158976 0.7400964 0.7400964
##  [64] 0.7400964 0.7400964 0.7400964 0.7595353 0.8358192 0.8431035 0.8431035
##  [71] 0.8431035 0.8431035 0.8431035 0.8431035 0.8757063 0.8757063 0.8757063
##  [78] 0.8317917 0.8317917 0.9327101 0.9327101 0.9327101 0.9327101 0.9327101
##  [85] 0.9327101 0.9327101 0.9327101 0.7996765 0.7996765 0.7996765 0.6906507
##  [92] 0.8447714 0.8447714 0.8447714 0.8969281 0.8969281 0.9042580 0.7595515
##  [99] 0.8573465 0.7865430 0.9093058 0.9093058 0.9093058 0.9093058 0.8845913
## [106] 0.8845913 0.8454351 0.8454351 0.7270952 0.7588396 0.8484418 0.7380378
```

```
## [113] 0.8100480 0.8100480 0.8100480 0.8100480 0.7810306 0.5980072 0.5980072
## [120] 0.6011752 0.7777638 0.7777638 0.9310272 0.9783859 0.9783859 0.9562760
## [127] 0.9562760 0.9562760 0.7858531 0.7858531 0.9008031 0.9008031 0.9008031
## [134] 0.9008031 0.8613042 0.8613042 0.6423243 0.8636195 0.8636195 0.8636195
## [141] 0.8636195 0.8636195 0.8313157 0.8313157 0.8373323 0.8373323 0.8404685
## [148] 0.8990364 0.8661591 0.8661591 0.8184306 0.8184306 0.8184306 0.6840066
## [155] 0.6840066 0.7167028 0.8336142 0.9617493 0.9617493 0.9617493 0.9617493
## [162] 0.9617493 0.9617493 0.9617493 0.9617493 0.9617493 0.9096563 0.8863919
## [169] 0.9170574 0.8928251 0.8928251 0.8351198 0.8351198 0.8351198 0.6216436
## [176] 0.7323356 0.8017615 0.8017615 0.8953857 0.8953857 0.8234056 0.6961587
## [183] 0.6961587 0.6961587 0.6961587 0.6961587 0.6961587 0.7114494 0.7610584
## [190] 0.7610584 0.9234614 0.9175645 0.6777848 0.8524130 0.8524130 0.5410027
## [197] 0.5410027 0.5410027 0.5348662 0.6907011
```