Multinomial model with Dirichlet prior

Setting:

- $\theta = (\theta_1, \theta_2, ..., \theta_6)$ a vector of Multinomial parameter

- For i = 1,..,1000 sample $x_i \sim Mult(1, \theta)$

- prior distribution: $\theta \sim Dir(1)$ the non-informative prior

```r
# Specifying theta
theta = c(0.1, 0.2, 0.2, 0.3, 0.05, 0.15)

# Simulating the data set of size 1000
set.seed(0)
X = rmultinom(n = 1000, size = 1, prob = theta)

# Count the number of elements in each class
count = apply(X, MARGIN = 1, FUN = sum)

# Dirichlet parameter update
alpha = rep(1,6) + count

# Sample 10000 theta from posterior distribution
theta_X = rdirichlet(10000, alpha)

# Calculate average value for each category
posterior_mean = apply(theta_X,MARGIN = 2, FUN = mean)

# Report output
output = rbind(theta, posterior_mean)
output = round(output, 2)
rownames(output) = c('real value', 'Montecarlo approximate')
output
```

```
##                        [,1] [,2] [,3] [,4] [,5] [,6]
## real value              0.1 0.20  0.2 0.30 0.05 0.15
## Montecarlo approximate  0.1 0.21  0.2 0.31 0.04 0.14
```