

24-10-01

October 11, 2024

```
[3]: K = 5

#  $f(x)f(y/x) = f(x,y)$ 
prob_marg = runif(K, 0,1)
# $f(x)$ 
prob_marg = prob_marg/sum(prob_marg)
prob_marg

prob_cond = matrix(NA, nrow=K, ncol = K)
for(k in 1:K)
{
  prob_cond[k,] = runif(K, 0,1)
  prob_cond[k,] = prob_cond[k,]/sum(prob_cond[k,])
}
prob_cond
```

1. 0.199062378393444 2. 0.258282034986432 3. 0.138124791711028 4. 0.121329693929523
5. 0.283201100979573

	0.03982392	0.06558127	0.2807581	0.28988687	0.32394983
	0.07920191	0.41534936	0.2153309	0.07219177	0.21792603
A matrix: 5 x 5 of type dbl	0.40499153	0.13899264	0.2799602	0.12189084	0.05416483
	0.48074374	0.14095076	0.3299245	0.02501322	0.02336780
	0.18215889	0.09495431	0.4284321	0.18925928	0.10519546

```
[8]: ## res
nsim = 1000
res = matrix(0, nrow = K , ncol=K)
for(i in 1:nsim)
{
  x = sample(1:K,1, prob = prob_marg)
  y = sample(1:K,1, prob = prob_cond[x,])
  res[x,y] = res[x,y] + 1
}
res
```

	6	13	44	64	62
	14	104	59	13	67
A matrix: 5 x 5 of type dbl	70	12	44	13	11
	63	20	34	5	1
	60	23	111	57	30

$$P(X = a, Y = b) = \int \int 1_a(x)1_b(y)f(x, y)dxdy \approx \sum \frac{1_a(x_i)1_b(y_i)}{n}$$

$$P(X = a) = P(X = a|Y = 1)P(Y = 1) + P(X = a|Y = 2)P(Y = 2) + ... P(X = a|Y = K)P(Y = K) = P(X = a, Y = 1) + P(X = a, Y = 2) + ... P(X = a, Y = K)$$

[9]: `res / nsim`

	0.006	0.013	0.044	0.064	0.062
	0.014	0.104	0.059	0.013	0.067
A matrix: 5 x 5 of type dbl	0.070	0.012	0.044	0.013	0.011
	0.063	0.020	0.034	0.005	0.001
	0.060	0.023	0.111	0.057	0.030