

# distribution of the mean induced by a Dirichlet distribution

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Suppose I have a Dirichlet distribution,  $D$ , defined by parameters  $a_1, a_2, \dots, a_k$ , which describe the Bayesian probability that  $p_1, p_2, \dots, p_k$  are the parameters of some multinomial distribution,  $M$ .

The categories of the multinomial distribution represent monetary values. For example,  $p_3$  represents the probability of \$3. For this reason, it makes sense to talk about the expected value of the multinomial distribution, in the following sense:

$$E[M] = \text{sum}(1 \cdot p_1 + 2 \cdot p_2 + \dots + k \cdot p_k)$$

I would like to compute the distribution of  $E[M]$  from the Dirichlet distribution. Is there an analytical solution to this problem?

Any help would be greatly appreciated,  
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