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$$9. \quad f(x) + (1-x)f\left(\frac{y}{1-x}\right) = f(y) + (1-y)f\left(\frac{x}{1-y}\right).$$

Basic equation of information theory. Here, $x, y, x+y$ can assume values from zero to one.

Solution:

$$f(x) = C[x \ln x + (1-x) \ln(1-x)],$$

where C is an arbitrary constant.

Reference

Aczél, J. and Dhombres, J., *Functional Equations in Several Variables*, Cambridge Univ. Press, Cambridge, 1989.

Basic Equation of Information Theory

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<http://eqworld.ipmnet.ru/en/solutions/fe/fe3109.pdf>