Theorem A standard uniform random variable X can be transformed to a Pareto random variable Y through the transformation

$$Y = \lambda X^{-1/\kappa},$$

where λ and κ are positive.

Proof Let the random variable X have the standard uniform distribution with probability density function

$$f_X(x) = 1 \qquad\qquad 0 < x < 1.$$

The transformation $Y = g(X) = \lambda X^{-1/\kappa}$ is a 1–1 transformation from $\mathcal{X} = \{x \,|\, 0 < x < 1\}$ to $\mathcal{Y} = \{y \,|\, y > 0\}$ with inverse $X = g^{-1}(Y) = (\lambda/y)^{\kappa}$ and Jacobian

$$\frac{dX}{dY} = \kappa \lambda^{\kappa} Y^{-\kappa-1}.$$

Therefore, by the transformation technique, the probability density function of Y is

$$\begin{aligned} f_Y(y) &= f_X(g^{-1}(y)) \left| \frac{dx}{dy} \right| \\ &= (1) \left| \kappa \lambda^{\kappa} y^{-\kappa-1} \right| \\ &= \frac{\kappa \lambda^{\kappa}}{y^{\kappa+1}} \qquad\qquad y > 0, \end{aligned}$$

which is the probability density function of a Pareto random variable.