Theorem Random variates from the Pareto(λ, κ) distribution can be generated in closed form by inversion.

Proof The Pareto distribution has probability density function

$$f(x) = \frac{\kappa \lambda^\kappa}{x^{\kappa+1}} \qquad\qquad x \geq \lambda$$

and cumulative distribution function

$$F(x) = 1 - \left(\frac{\lambda}{x}\right)^\kappa \qquad\qquad x \geq \lambda.$$

Equating the cumulative distribution function to u, where $0 < u < 1$ yields an inverse cumulative distribution function

$$F^{-1}(u) = \lambda(1-u)^{-1/\kappa} \qquad\qquad 0 < u < 1.$$

So a closed-form variate generation algorithm using inversion for the Pareto distribution is

generate $U \sim U(0, 1)$
$X \leftarrow \lambda(1-U)^{-1/\kappa}$
return(X)