Theorem Random variates from the TSP distribution can be generated in closed-form by inversion.

Proof The TSP(a, b, m, n) distribution has cumulative distribution function

$$F(x) = \begin{cases} \frac{(x-a)^n (m-a)^{1-n}}{b-a} & a < x < m \\ -\frac{a+b(b-x)^n(b-m)^{-n}-b-m(b-x)^n(b-m)^{-n}}{b-a} & m \le x < b. \end{cases}$$

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

$$F^{-1}(u) = \begin{cases} \left(\frac{u(b-a)}{(m-a)^{1-n}}\right)^{1/n} + a & 0 < u < \frac{m-a}{b-a} \\ -\left(\frac{(-u)(b-a)-a+b}{(b-m)^{-n+1}}\right)^{1/n} + b & \frac{m-a}{b-a} \le u < 1. \end{cases}$$

So a closed-form variate generation algorithm using inversion for the TSP(a, b, m, n) distribution is

generate $U \sim U(0, 1)$
if $(U < (m-a)/(b-a))$ then
    $X \leftarrow (u(b-a)/(m-a)^{1-n})^{1/n} + a$
else
    $X \leftarrow -(((-u)(b-a)-a+b)/(b-a)^{-n+1})^{1/n} + b$
endif
return(X)