(3.12) How much separative work is needed in order to produce 1 kg of uranium containing 4% ^{235}U from a feed of natural uranium and leaving 0.25% in the tail?

First we define the separation potential, eqn (3.74), as follows:

$$V\left(x_i\right) := \left(2 \cdot x_i - 1\right) \cdot \ln\left(\frac{x_i}{1 - x_i}\right)$$

and decide to use index 1 for the feed, 2 for the waste, and 3 for the product.

Hence: $x_1 := 0.724 \cdot \%$ $x_2 := 0.25 \cdot \%$ $x_3 := 4 \cdot \%$

A simple mass balace gives:

$$W \cdot x_2 + P \cdot x_3 = F \cdot x_1$$

$$W + P = F$$

$$P := 1$$

Solve these eqn:s for F:

$$W = F - 1$$

$$(F - 1) \cdot x_2 + 1 \cdot x_3 = F \cdot x_1$$

$$F := \frac{-\left(-x_2 + x_3\right)}{\left(x_2 - x_1\right)} \qquad F = 7.911$$

$$W := F - 1 \qquad W = 6.911$$

Hence we get:

$$SepWk := W \cdot V\left(x_2\right) + P \cdot V\left(x_3\right) - F \cdot V\left(x_1\right)$$

$SepWk = 5.742$ SWU or kgSW