We take as given:

$p =$ fraction of Morlocks in population

$r =$ fraction of professors who are Morlocks

$t =$ fraction of population who are professors

We assume:

Log(talent) is normally distributed among Morlocks, with mean 0 and standard deviation 1. Write f for the corresponding cumulative distribution function.

Log(talent) is normally distributed among Eloi, with mean 0 and standard deviation σ, where σ is to be determined later. Write g_σ for the corresponding cumulative distribution function.

Let C_M and C_E be the minimum talents necessary for a Morlock or an Eloi to become a professor.

Then we have three equations in the three unknowns C_M, C_E, σ:

$$1 - f(C_M) = tr/p \tag{1}$$

$$1 - g_\sigma(C_E) = t(1-r)/(1-p) \tag{2}$$

$$C_M = C_E \tag{3}$$

Solving these gives us (among other things) an explicit value for σ; in particular

$$\sigma = \frac{\xi(1 - 2rt/p)}{\xi(1 - 2(1-r)t/(1-p))} \tag{4}$$

where ξ is the inverse error function.

Now let $h_\sigma = pf + (1-p)g_\sigma$ be the cumulative distribution function for talent across the entire population.

Then a Morlock of talent x is at percentile $1 - h_\sigma(x)$, and the average percentile of all Morlock professors is

$$\frac{\int_{C_M}^{\infty} (1 - h_\sigma(x)) f'(x) dx}{1 - f(C_M)} \tag{5}$$

Because we have explicit values for C_M and σ coming from (1)-(3), we can compute the value of equation (5) explicitly. For example, with $p = .5$, $r = .2$, $t = .001$, we get a value of 0.000547843.

Now impose affirmative action, requiring the fraction of professors who are Morlocks to be p, matching the population. The new talent cutoffs for a Morlock or an Eloi to be a professor are D_M and D_E.

Then we have

$$t = 1 - f(D_M) \tag{6}$$

$$t = 1 - g_\sigma(D_E) \tag{7}$$

These are two equations in two unknowns D_M, D_E (because t is fixed throughout and σ has been determined already in equation (4)).

The new expected percentile of a Morlock professor is

$$\frac{\int_{D_M}^{\infty} (1 - h_\sigma(x)) f'(x) dx}{1 - f(D_M)} (8)$$

For example if $p = .5$, $r = .2$, $t = .001$, we get a value of .00117117.

We can then attach prestiges to the values of expressions (5) and (8) using an auxiliary prestige model, and then calculate the prestige loss as the difference between (8) and (5) (which we express as a fraction of (5)).

The above describes the sigma-model; the mu-model works similarly.