Linear programming

Note: Since the cats can’t be separated they are treated as a singel quantity with twice the value

maximize
f = 2500x1 + 5000x2 + 20000x3 + 40000x4 + 12000x5 + 12000x6 + 12000x7 + 3000x8 + 6000x9 + 10000x10 + 15000x11 + 10000x12 + 13000x13

subject to
0 <= x1-13 < 2
sum(f) <= 183000/2

Taylor Expansion

See next page

First denote functions and derivatives:

$$f(x) = \sqrt[3]{x} = x^{\frac{1}{3}}$$

$$f'(x) = \frac{1}{3}x^{\frac{1}{3}-\frac{3}{3}} = \frac{1}{3}x^{-\frac{2}{3}}$$

$$f''(x) = -\frac{2}{3}\cdot\frac{1}{3}x^{-\frac{2}{3}-\frac{3}{3}} = -\frac{2}{9}x^{-\frac{5}{3}}$$

Next, choose to evaluate around 1728. Fits nicely since

$12^3 = 1728$

$a = 1728$

Setup: Start wit 2nd degree

$$f(x) = f(a) + f'(a)(x-a) + \frac{f''(a)}{2}(x-a)^2$$

Plug in:

$$1729{,}03^{\frac{1}{3}} = 1728^{\frac{1}{3}} + \frac{1}{3}1728^{-\frac{2}{3}}(1729{,}03-1728) + \frac{-\frac{2}{9}\cdot 1728^{-\frac{5}{3}}}{2}(1729{,}03-1728)^2$$

$= 12 + 0{,}0023 - 0{,}000000947$

Considering that we needed to compute 4 decimals, 2nd degree is overkill and thus we stick with only first degree

$$\sqrt[3]{1729{,}03} \approx \sqrt[3]{1728} + \frac{1}{3} \cdot 1728^{-\frac{2}{3}}(1729{,}03 - 1728)$$

$$\underline{\underline{\approx 12{,}0023}}$$