YD := ...\GY.xls

RD := ...\GR.xls

Definition

Objective function

$$T := \left| \begin{array}{l} \text{for } i \in 1..Vol11_{0,1} \\ \quad T_i \leftarrow T0_i - T0_{i-1} \\ T \end{array} \right.$$

$$a1 := 0.467$$

$$Y(a2, aa, ab, ac, ad) := \left| \begin{array}{l} \text{for } i \in 0..Vol11_{0,1} \\ \quad Y_i \leftarrow \sum_{i=0}^{i} \left[\left[a1 \cdot aa \cdot \exp\left[\frac{-ac}{R\cdot\left(TT1_i + 273\right)}\right] + a2 \cdot ab \cdot \exp\left[\frac{-ad}{R\cdot\left(TT1_i + 273\right)}\right] \right] \cdot \exp\left[-\sum_{i=0}^{i} \left[aa \cdot \exp\left[\frac{-ac}{R\cdot\left(TT1_i + 273\right)}\right] + ab \cdot \exp\left[\frac{-ad}{R\cdot\left(TT1_i + 273\right)}\right] \right] \cdot T_1 \right] \cdot T_1 \right] \\ Y \end{array} \right.$$

You fooled me (and maybe yourself) by using "i" in different places for different things. And I was wrong when I said that Mathcad would handle it anyway.

You have to decide which of the folling two interpretations is the one you had in mind:

note the upper limit "i" in the second sum

$$Y1(a2, aa, ab, ac, ad) := \left| \begin{array}{l} \text{for } n \in 0..Vol11_{0,1} \\ \quad Y_n \leftarrow \sum_{i=0}^{n} \left[\left[a1 \cdot aa \cdot \exp\left[\frac{-ac}{R\cdot\left(TT1_i + 273\right)}\right] + a2 \cdot ab \cdot \exp\left[\frac{-ad}{R\cdot\left(TT1_i + 273\right)}\right] \right] \cdot \exp\left[-\sum_{k=0}^{i} \left[aa \cdot \exp\left[\frac{-ac}{R\cdot\left(TT1_k + 273\right)}\right] + ab \cdot \exp\left[\frac{-ad}{R\cdot\left(TT1_k + 273\right)}\right] \right] \cdot T_1 \right] \cdot T_1 \right] \\ Y \end{array} \right.$$

or is it rather this one:

note the upper limit "n" in the second sum

$$Y2(a2, aa, ab, ac, ad) := \left| \begin{array}{l} \text{for } n \in 0..Vol11_{0,1} \\ \quad Y_n \leftarrow \sum_{i=0}^{n} \left[\left[a1 \cdot aa \cdot \exp\left[\frac{-ac}{R\cdot\left(TT1_i + 273\right)}\right] + a2 \cdot ab \cdot \exp\left[\frac{-ad}{R\cdot\left(TT1_i + 273\right)}\right] \right] \cdot \exp\left[-\sum_{k=0}^{n} \left[aa \cdot \exp\left[\frac{-ac}{R\cdot\left(TT1_k + 273\right)}\right] + ab \cdot \exp\left[\frac{-ad}{R\cdot\left(TT1_k + 273\right)}\right] \right] \cdot T_1 \right] \cdot T_1 \right] \\ Y \end{array} \right.$$

Both variants can be speeded up significantly:

$$Y1_{speed}(a2, aa, ab, ac, ad) := \left| \begin{array}{l} \text{for } i \in 0..Vol11_{0,1} \\ \quad Tmp_i \leftarrow \exp\left[-T_1 \cdot \sum_{k=0}^{i} \left[aa \cdot \exp\left[\frac{-ac}{R\cdot\left(TT1_k + 273\right)}\right] + ab \cdot \exp\left[\frac{-ad}{R\cdot\left(TT1_k + 273\right)}\right] \right] \right] \\ \text{for } n \in 0..Vol11_{0,1} \\ \quad Y_n \leftarrow T_1 \cdot \sum_{i=0}^{n} \left[\left[a1 \cdot aa \cdot \exp\left[\frac{-ac}{R\cdot\left(TT1_i + 273\right)}\right] + a2 \cdot ab \cdot \exp\left[\frac{-ad}{R\cdot\left(TT1_i + 273\right)}\right] \right] \cdot Tmp_i \right] \\ Y \end{array} \right.$$

$$Y2_{speed}(a2, aa, ab, ac, ad) := \left| \begin{array}{l} \text{for } n \in 0..Vol11_{0,1} \\ \quad \left| \begin{array}{l} Tmp \leftarrow \exp\left[-\sum_{k=0}^{n} \left[aa \cdot \exp\left[\frac{-ac}{R\cdot\left(TT1_k + 273\right)}\right] + ab \cdot \exp\left[\frac{-ad}{R\cdot\left(TT1_k + 273\right)}\right] \right] \cdot T_1 \right] \\ Y_n \leftarrow Tmp \cdot T_1 \cdot \sum_{i=0}^{n} \left[a1 \cdot aa \cdot \exp\left[\frac{-ac}{R\cdot\left(TT1_i + 273\right)}\right] + a2 \cdot ab \cdot \exp\left[\frac{-ad}{R\cdot\left(TT1_i + 273\right)}\right] \right] \end{array} \right. \\ Y \end{array} \right.$$

OK, before going any further lets check whats different and lets introduce a timer to see if the "speed" routines do what they are supposed to do (the caclulation take a few seconds/minutes, be patient):

$$\text{timer}(f) := \left| \begin{array}{l} t1 \leftarrow \text{time}(0) \\ R \leftarrow f\left(0.86, 10^5, 10^5, 76800, 14000\right) \\ \begin{pmatrix} \text{time}(0) - t1 \\ R \end{pmatrix} \end{array} \right.$$

$$\begin{pmatrix} \text{time\_Y} \\ \text{YY} \end{pmatrix} := \text{timer}(Y) \quad \begin{pmatrix} \text{time\_Y1} \\ \text{YY1} \end{pmatrix} := \text{timer}(Y1) \quad \begin{pmatrix} \text{time\_Y2} \\ \text{YY2} \end{pmatrix} := \text{timer}(Y2) \quad \begin{pmatrix} \text{time\_Y1}_{sp} \\ \text{YY1}_{sp} \end{pmatrix} := \text{timer}\left(Y1_{speed}\right) \quad \begin{pmatrix} \text{time\_Y2}_{sp} \\ \text{YY2}_{sp} \end{pmatrix} := \text{timer}\left(Y2_{speed}\right)$$

$\text{time\_Y} \cdot s = 11.549\,s$ $\quad$ $\text{time\_Y1} \cdot s = 11.755\,s$ $\quad$ $\text{time\_Y2} \cdot s = 22.861\,s$ $\quad$ $\text{time\_Y1}_{sp} \cdot s = 0.158\,s$ $\quad$ $\text{time\_Y2}_{sp} \cdot s = 0.14\,s$

So I guess we can speak about a significant improvement by both "speed" variants

$\left|YY - YY1\right| = 0$ $\quad$ $\left|YY1 - YY1_{sp}\right| = 7.699 \times 10^{-15}$

The shown deviation is within the numerical tolerance. We can probably say that your original routine Y and my modifications Y1 and $Y1_{speed}$ yield the very same result.

$\left|YY - YY2\right| = 18.997$ $\quad$ $\left|YY2 - YY2_{sp}\right| = 0$

*So the second interpretation of your expression with the many equal indices "i" **differs** from your original but I have no idea which interpretation is the correct one for your task*

Anyway, Y2 and $Y2_{speed}$ yield the very same result.

Put any of the two speed-functions (whichever you think is the correct one) in the definition of OF and see if the solve block yields a result in reasonable time now.
At least OF calculates now approx. 50000 times faster than in your original sheet ;-)

$$\text{OF1}(a2, aa, ab, ac, ad) := \left| \begin{array}{l} YY \leftarrow 100\, Y1_{speed}(a2, aa, ab, ac, ad) \\ \displaystyle\sum_{i=0}^{Vol11_{0,1}} \left(Yexp_i - YY_i\right)^2 \end{array} \right.$$

Just a test:

$$\text{timer}(OF1) = \begin{pmatrix} 0.155 \\ 1.981 \times 10^6 \end{pmatrix}$$

$aa := 10^5$ $\quad$ $ab := 10^5$ $\quad$ $ac := 76800$ $\quad$ $ad := 140000$ $\quad$ $a2 := 0.86$

$t1 := \text{time}(0)$

Given

$10^3 \le aa \le 10^6$ $\quad$ $10^5 \le ab \le 10^8$ $\quad$ $70000 \le ac \le 120000$

$120000 \le ad \le 170000$ $\quad$ $a1 \le a2 \le 1$

$$\begin{pmatrix} a2 \\ aa \\ ab \\ ac \\ ad \end{pmatrix} := \text{Minimize}(OF1, a2, aa, ab, ac, ad) = \begin{pmatrix} 0.531 \\ 1.672 \times 10^5 \\ 1.037 \times 10^5 \\ 7 \times 10^4 \\ 1.7 \times 10^5 \end{pmatrix}$$

$(\text{time}(0) - t1)s = 1.372 \cdot \text{min}$ $\quad$ *Time it took for the solve block to finish*

$$\begin{pmatrix} 0.531 \\ 1.672 \times 10^5 \\ 1.037 \times 10^5 \\ 7 \times 10^4 \\ 1.7 \times 10^5 \end{pmatrix}$$

Check if the constraints are all OK:

$10^3 \le aa \le 10^6 = 1$ $\quad$ $10^5 \le ab \le 10^8 = 1$ $\quad$ $70000 \le ac \le 120000 = 1$

$120000 \le ad \le 170000 = 1$ $\quad$ $a1 \le a2 \le 1 = 1$

$\text{OF1}(a2, aa, ab, ac, ad) = 1.622 \times 10^4$

Now the same with variant 2:

$$OF2(a2, aa, ab, ac, ad) := \left| \begin{array}{l} YY \leftarrow 100\,Y2_{speed}(a2, aa, ab, ac, ad) \\ \displaystyle\sum_{i=0}^{Vol11_{0,1}} \left(Yexp_i - YY_i\right)^2 \end{array} \right.$$

$$timer(OF2) = \begin{pmatrix} 0.135 \\ 4.955 \times 10^5 \end{pmatrix}$$

$aa := 10^5$ $\quad ab := 10^5$ $\quad ac := 76800$ $\quad ad := 140000$ $\quad a2 := 0.86$

$t1 := time(0)$

Given

$10^3 \le aa \le 10^6$ $\quad 10^5 \le ab \le 10^8$ $\quad 70000 \le ac \le 120000$

$120000 \le ad \le 170000$ $\quad a1 \le a2 \le 1$

$$\begin{pmatrix} a2 \\ aa \\ ab \\ ac \\ ad \end{pmatrix} := Minimize(OF2, a2, aa, ab, ac, ad) = \begin{pmatrix} 1 \\ 1000 \\ 1.557 \times 10^7 \\ 1.2 \times 10^5 \\ 1.2 \times 10^5 \end{pmatrix}$$

$(time(0) - t1)s = 3.099 \cdot min$ *Time it took for the solve block to finish*

Check if the constraints are all OK:

$10^3 \le aa \le 10^6 = 0$ $\quad 10^5 \le ab \le 10^8 = 1$ $\quad 70000 \le ac \le 120000 = 1$

$120000 \le ad \le 170000 = 1$ $\quad a1 \le a2 \le 1 = 0$

So we see that two constraints were not respected!

$OF2(a2, aa, ab, ac, ad) = 3.014 \times 10^4$

Objective function

$$\text{Time111} := \left| \begin{array}{l} \text{for } i \in 0 .. \text{Voll11}_{0,1} - \text{Voll11}_{0,1} \\ \quad \text{Time111}_i \leftarrow \text{Time11}_{i+\text{Voll11}_{0,1}} \\ \text{Time111} \end{array} \right.$$