Heat Index Formula

A good example of matrix multiplication

1. The formula to find the Heat Index, HI, when given the temperature, T, in Fahrenheit degrees and the Relative Humidity, R, is:

$$HI = \begin{bmatrix} 1 & T & T^2 & T^3 \end{bmatrix} \begin{bmatrix} 16.923 & 5.37941 & 7.28898 \times 10^{-3} & 2.91583 \times 10^{-5} \\ 1.85212 \times 10^{-1} & -1.00254 \times 10^{-1} & -8.14971 \times 10^{-4} & 1.97483 \times 10^{-7} \\ 9.41695 \times 10^{-3} & 3.45372 \times 10^{-4} & 1.02102 \times 10^{-5} & 8.43296 \times 10^{-10} \\ -3.8646 \times 10^{-5} & 1.42721 \times 10^{-6} & -2.18429 \times 10^{-8} & -4.81975 \times 10^{-11} \end{bmatrix} \begin{bmatrix} 1 \\ R \\ R^2 \\ R^3 \end{bmatrix}.$$

Expand by multiplying these three matrices together to get a polynomial of sixteen terms.

2. Now use this expansion to determine the Heat Index if the Temperature is 93 degrees Fahrenheit and the Relative Humidity is 21%.

3. Use this formula to determine the Heat Index if the Temperature is 100 degrees Fahrenheit and the Relative Humidity is 60%.

4. Use this formula to determine the Heat Index if the Temperature is 92 degrees Fahrenheit and the Relative Humidity is 46%.

Answers:

1.

$$\begin{aligned}\mathrm{HI} = {} & 16.923 + \left(1.85212x10^{-1}\bullet T\right) + \left(9.41695x10^{-3}\bullet T^{2}\right) - \left(3.8646x10^{-5}\bullet T^{3}\right) \\ & + \left(5.37941\bullet R\right) - \left(1.00254x10^{-1}\bullet T\bullet R\right) + \left(3.45372x10^{-4}\bullet T^{2}\bullet R\right) + \left(1.42721x10^{-6}\bullet T^{3}\bullet R\right) \\ & + \left(7.28898x10^{-3}\bullet R^{2}\right) - \left(8.14971x10^{-4}\bullet T\bullet R^{2}\right) \\ & + \left(1.02102x10^{-5}\bullet T^{2}\bullet R^{2}\right) - \left(2.18429x10^{-8}\bullet T^{3}\bullet R^{2}\right) \\ & + \left(2.91583x10^{-5}\bullet R^{3}\right) - \left(1.97483x10^{-7}\bullet T\bullet R^{3}\right) \\ & + \left(8.43296x10^{-10}\bullet T^{2}\bullet R^{3}\right) - \left(4.81975x10^{-11}\bullet T^{3}\bullet R^{3}\right)\end{aligned}$$

2. HI = 89.31 degrees.

3. HI = 129 degrees.

4. HI = 96 degrees.