

Programming with Mathcad

Defining a function....

$$\text{Thermostat}(T) := \text{if}(T < 23, 1, \text{if}(T > 25, -1, 0))$$

Using the function:

$$\text{Thermostat}(15) = 1$$

$$\text{Thermostat}(30) = -1$$

Writing a small program...

$$\text{Thermo}(T) := \begin{cases} \text{RV} \leftarrow 0 \\ \text{RV} \leftarrow 1 \quad \text{if } T < 23 \\ \text{RV} \leftarrow -1 \quad \text{if } T > 25 \end{cases}$$

Testing the program:

$$\text{Thermo}(20) = 1$$

$$\text{Thermo}(24) = 0$$

$$\text{Thermo}(30) = -1$$

Using worksheet variables in a program (NOT GOOD):

$$\underline{T} := 24$$

$$\text{Thermos} := \begin{cases} \text{RV} \leftarrow \text{"unchanged"} \\ \text{RV} \leftarrow 1 \quad \text{if } T < 23 \\ \text{RV} \leftarrow -1 \quad \text{if } T > 25 \end{cases}$$

$$\text{Thermos} = \text{"unchanged"}$$

$$\text{RV} := \blacksquare$$

Local variables can not be seen outside the program

Problem 6.8

IF STATEMENT used to count parts that are outside of a range

$$c := \begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix}$$

$$\text{last}(c) = 2$$

$$\text{countw}(w, w_a, w_b) := \begin{array}{l} s \leftarrow 0 \\ \text{for } i \in 0.. \text{last}(w) \\ \quad \left| \begin{array}{l} s \leftarrow s + 1 \text{ if } w_i < w_a \\ s \leftarrow s + 1 \text{ if } w_i > w_b \end{array} \right. \\ s \end{array}$$

$$\text{countw}(c, 1.5, 1.99) = 3$$

$$v := \begin{pmatrix} 1.65 \\ 1.45 \\ 1.72 \\ 2.01 \\ 1.55 \\ 1.5 \end{pmatrix}$$

$$\text{countw}(v, 1.55, 1.95) = 3$$

Programming Operations

$$\text{Resultant}(fx, fy) := \left\{ \begin{array}{l} F_x \leftarrow \sum fx \\ F_y \leftarrow \sum fy \\ F_R \leftarrow \sqrt{F_x^2 + F_y^2} \\ \theta \leftarrow \text{atan}\left(\frac{F_y}{F_x}\right) \\ \left(\begin{array}{c} F_R \\ \theta \cdot \frac{180}{\pi} \end{array} \right) \end{array} \right.$$

$$fx := \left(\begin{array}{c} 400 \cdot \cos(20\text{deg}) \\ -200 \cdot \cos(45\text{deg}) \end{array} \right)$$

$$fy := \left(\begin{array}{c} 400 \cdot \sin(20\text{deg}) \\ 200 \cdot \sin(45\text{deg}) \end{array} \right)$$

$$\text{Resultant}(fx, fy) = \left(\begin{array}{c} 363.842 \\ 49.88 \end{array} \right)$$

$$V1 := \left(\begin{array}{c} 25 \\ 34 \\ 52 \\ 108 \end{array} \right)$$

$$V2 := \left(\begin{array}{c} 12 \\ 57 \\ 100 \end{array} \right)$$

$$\text{Resultant}(V1, V2) = \left(\begin{array}{c} 276.626 \\ 37.657 \end{array} \right)$$

Using the If Statement

$$\text{MassofSolids}(D, \theta, \rho, h) := \left\{ \begin{array}{l} R \leftarrow \frac{D}{2} \\ H_c \leftarrow \frac{R}{\tan(\theta)} \\ V_s \leftarrow \frac{1}{3} \cdot \pi \cdot (h \cdot \tan(\theta))^2 \cdot h \quad \text{if } h \leq H_c \\ V_s \leftarrow \frac{1}{3} \cdot \pi \cdot R^2 \cdot H_c + \pi \cdot R^2 \cdot (h - H_c) \quad \text{otherwise} \\ \text{Mass} \leftarrow V_s \cdot \rho \\ \left(\begin{array}{c} V_s \\ \text{Mass} \end{array} \right) \end{array} \right.$$

$$\text{MassofSolids}(12, 30 \cdot \text{deg}, 20, 21) = \left(\begin{array}{c} 1591.48 \\ 31829.65 \end{array} \right)$$

For Loop in Mathcad

$$\text{addnumbers}(n) := \left| \begin{array}{l} s \leftarrow 0 \\ \text{for } k \in 0..n \\ \quad s \leftarrow s + k \\ s \end{array} \right.$$

$\text{addnumbers}(5) = 15$

$\text{addnumbers}(10) = 55$

$$\text{addOdds}(n) := \left| \begin{array}{l} s \leftarrow 0 \\ \text{for } k \in 0..n \\ \quad \left| \begin{array}{l} \text{continue if } \text{mod}(k,2) = 0 \\ s \leftarrow s + k \end{array} \right. \\ s \end{array} \right.$$

$\text{addOdds}(5) = 9$

$\text{addOdds}(10) = 25$

$$\text{addelem}(M) := \left| \begin{array}{l} s \leftarrow 0 \\ \text{for } i \in 0..(\text{rows}(M) - 1) \\ \quad \text{for } j \in 0..(\text{cols}(M) - 1) \\ \quad \quad s \leftarrow s + M_{i,j} \\ s \end{array} \right.$$

$$M := \begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{pmatrix}$$

$$\text{addelem}(M) = 45$$

$$\underline{S} := \begin{pmatrix} 2 & 4 & 6 \\ 8 & 10 & 12 \end{pmatrix}$$

$$\text{addelem}(S) = 42$$

Problem 6.10

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DS(f, xo) := | tol ← 0.0001
              | error ← 1
              | while error > tol
              |   | x ← f(xo)
              |   | return "Solution not found" if x > 10100
              |   | error ← |x - xo|
              |   | xo ← x
              | x
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$$F(x) := \frac{x^2 + 28}{11}$$

$$DS(F, 1) = 4$$

$$DS(F, 0) = 4$$

$$DS(F, 10) = \text{"Solution not found"}$$