Lecture 9 and 10

if- statement

Absolute Function

$$aa(x) := \begin{cases} -x & \text{if } x < 0 \\ x & \text{otherwise} \end{cases}$$

$aa(-3) = 3$

$aa(3) = 3$

$$ab(x) := \begin{cases} out \leftarrow \text{"negative number"} & \text{if } x < 0 \\ out \leftarrow \text{"Positive number"} & \text{if } x > 0 \\ out \end{cases}$$

$ab(-5) = \text{"negative number"}$

$ab(5) = \text{"Positive number"}$

Nested if- statement

write a function that takes numbers between 0 and 30 and return the size of the input as:
if 0<x<10 ==> small
if 10<x<20 ==>medium
if 20<x<30 ==> large

$$s(x) := \begin{cases} out \leftarrow \text{"small"} & \text{if } x \geq 0 \wedge x \leq 10 \\ out \leftarrow \text{"medium"} & \text{if } x > 10 \wedge x \leq 20 \\ out \leftarrow \text{"large"} & \text{if } x > 20 \wedge x \leq 30 \\ out \leftarrow \text{"error input"} & \text{if } x > 30 \vee x < 0 \\ out \end{cases}$$

$s(7) = \text{"small"}$

$s(12) = \text{"medium"}$

$s(-7) = \text{"error input"}$

$s(22) = \text{"large"}$

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d(x) := | if (x > 0) ∧ (x < 30)
        |     out ← "large"
        |     if x < 20
        |         out ← "medium"
        |         out ← "small" if x < 10
        | out ← "fail" otherwise
        | out
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d(10) = "medium"

d(21) = "large"

d(2) = "small"

for loop

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

$$\text{sum}(2) = 3$$

$$\text{sum}(6) = 21$$

Write the function that adding only even numbers
Write the function that adding only odd numbers

$$\text{sum\_e}(n) := \left|\begin{array}{l} s \leftarrow 0 \\ \text{for } i \in 0,2..n \\ \quad s \leftarrow s + i \end{array}\right.$$

$$\text{sum\_e}(6) = 12$$

$$\text{sum\_e}(20) = 110$$

$$\text{sum\_o}(n) := \left|\begin{array}{l} s \leftarrow 0 \\ \text{for } i \in 1,3..n \\ \quad s \leftarrow s + i \end{array}\right.$$

$$\text{sum\_o}(6) = 9$$

$$\text{sum\_o}(12) = 36$$

write the function that adding the odd numbers and the even numbers (more than one output)

$$\text{sum1eo}(n) := \left|\begin{array}{l} e \leftarrow 0 \\ o \leftarrow 0 \\ \text{for } i \in 0,2..n \\ \quad e \leftarrow e + i \\ \text{for } i \in 1,3..n \\ \quad o \leftarrow o + i \\ \text{out}_0 \leftarrow e \\ \text{out}_1 \leftarrow o \\ \text{out} \end{array}\right.$$

$$\text{sum2eo}(n) := \left|\begin{array}{l} e \leftarrow 0 \\ o \leftarrow 0 \\ \text{for } i \in 0,2..n \\ \quad e \leftarrow e + i \\ \text{for } i \in 1,3..n \\ \quad o \leftarrow o + i \\ \text{out} \leftarrow \text{augment}(e,o) \end{array}\right.$$

$$\text{sum2eo}(6) = (12 \;\; 9)$$

$$sum1eo(6) = \begin{pmatrix} 12 \\ 9 \end{pmatrix}$$

$$sum2eo(6) = (12 \;\; 9)$$

$aa := sum2eo(6)$

$aa = (12 \;\; 9)$

$aa_{0,0} = 12$

$aa_{0,1} = 9$

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write the function that adding a vector of given numbers

$$sum(y) := \left| \begin{array}{l} s \leftarrow 0 \\ \text{for } i \in 0..(length(y) - 1) \\ \quad s \leftarrow s + y_i \end{array} \right.$$

$$y := \begin{pmatrix} 2 \\ 7 \\ 3 \end{pmatrix}$$

$sum(y) = 12$

Combine if - statement and for - loop

Calculate how many numbers are positive:

$$\text{sumpositive}(x) := \left| \begin{array}{l} \text{pos} \leftarrow 0 \\ \text{for } i \in 0..\text{last}(x) \\ \quad \text{pos} \leftarrow \text{pos} + 1 \text{ if } x_i > 0 \\ \text{pos} \end{array} \right.$$

$$x := \begin{pmatrix} -1 \\ 9 \\ 6 \\ -5 \\ -3 \\ 6 \\ 1 \\ 8 \end{pmatrix}$$

$$\text{last}(x) = 7$$

$$\text{sumpositive}(x) = 5$$

last is a predefined function that returns the index of the last element in a vector

Calculate how many numbers are positive and how many are negative (two outputs):

$$\text{sumsign}(x) := \left| \begin{array}{l} \text{pos} \leftarrow 0 \\ \text{neg} \leftarrow 0 \\ \text{for } i \in 0..(\text{length}(x) - 1) \\ \quad \left| \begin{array}{l} \text{pos} \leftarrow \text{pos} + 1 \text{ if } x_i \geq 0 \\ \text{neg} \leftarrow \text{neg} + 1 \text{ if } x_i < 0 \end{array} \right. \\ \text{out}_0 \leftarrow \text{pos} \\ \text{out}_1 \leftarrow \text{neg} \\ \text{out} \end{array} \right.$$

$$\text{sumsign}(x) = \begin{pmatrix} 5 \\ 3 \end{pmatrix}$$

Function take more than one argument (value)

$$P(x,y) := \left| \begin{array}{l} \text{out} \leftarrow 0 \\ \text{out} \leftarrow x \cdot y \end{array} \right.$$

$$P(5,3) = 15$$