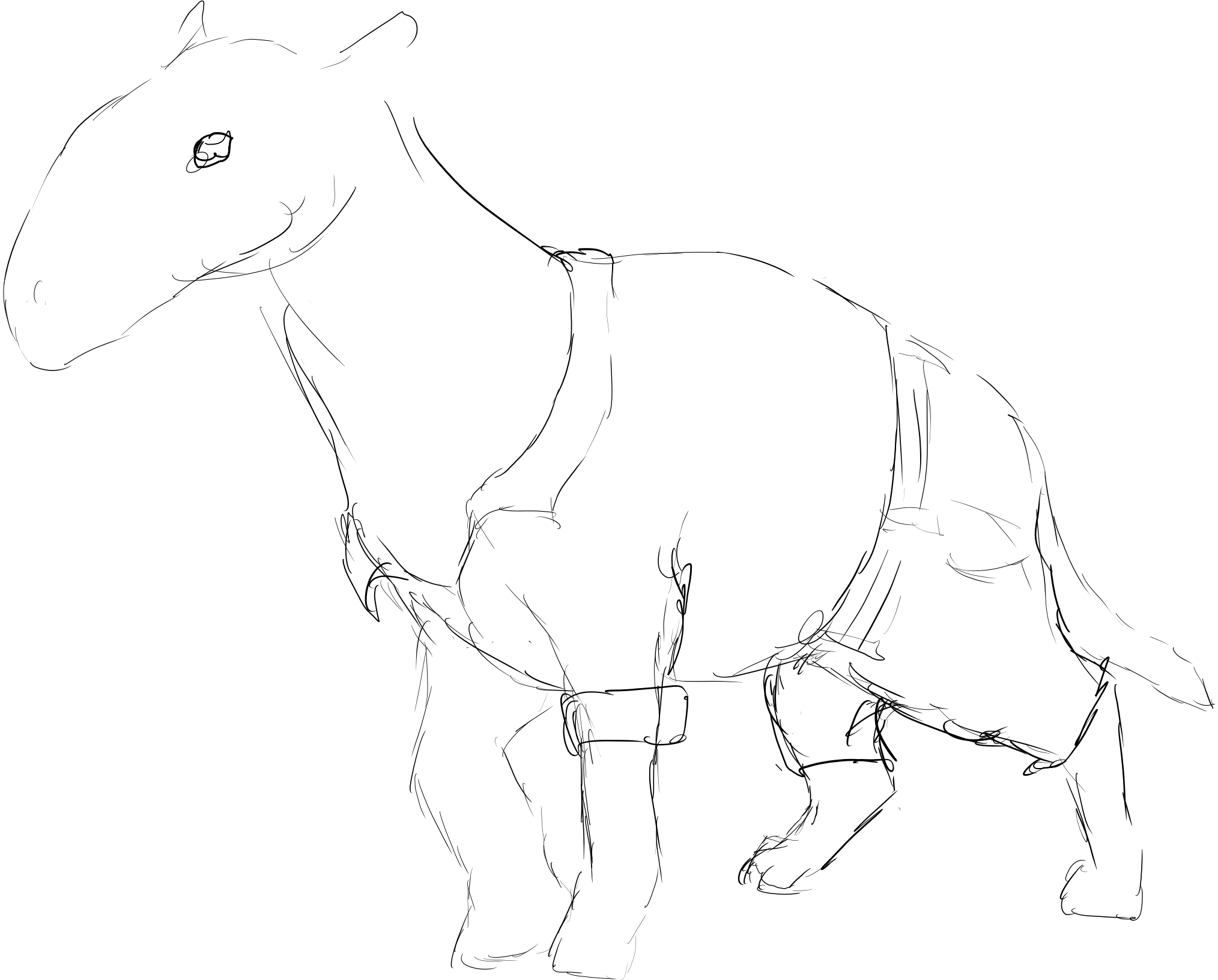

$\{\{\}\}$ 0

$\mathcal{P}(\{\{\}\}) = \{\{\},\{\{\}\}\}$ 1

$\mathcal{P}(\mathcal{P}(\{\{\}\})) = \{\underbrace{\{\}}_{1}, \underbrace{\{\{\}\}}_{1}\}$ 2

$x = \{3, \{4, 5\}\}$

$\{4\}$

$\{\{3, \{4, 5\}\}, 11\}$

True False

bool

$\top$ $\bot$

$\wedge$ $\vee$ $\neg$ $\rightarrow$

$\forall$ $\exists$

Sets

integers

Seq

String

functions

relations

Symbol

{0, 1}

{ , }

{a, b}

$0 = 0$

$0 \neq a$

	Change len	Change Element
tuple	no	no
array	no	yes
list	yes	yes

Sequences

math: Sequence

- contain
- in an order
- w/ duplicates allowed

pair

triple

quadruple

⋮

tuple

$(3, 1, 4, 1, 5, 9, 2, 6, 5, 3, 5)$

$(3) = 3$

Seq of 1 thing is that thing

Seq of zero things $\{\lambda, \varepsilon, \epsilon$

$$\{3\} \times \{4,5\} \triangleq \{(3,4),(3,5)\}$$

Cartesian Product

$$\{3,5\}^2 \triangleq \{(3,3),(3,5),(5,3),(5,5)\}$$

$$\{3,5\}^1 = \{(3),(5)\} = \{3,5\}$$

kleene

$$\{3,5\}^* = \{s \mid \exists n \in \mathbb{N}.\ s \in \{3,5\}^n\}$$

$$\{(),(3),(5),(3,3),(3,5),(5,5),(5,3),(3,3,3),($$

Code

alphabet $= \Sigma$

code $\in \Sigma^*$

User type $\in \Sigma^*$

$\forall$. data $\in$ Bytes* . $\neg$ (Hash (data)

$$\{1,2\} \times \{Q, q\}$$

$$\{(1, Q), (1, q), (2, Q), (2, q)\}$$

$$\{1,2\} \times \{3,4\} \times \{5\}$$

$$\{(3,5), (4,5)\}$$

String

= sequence of symbols

function

Proj

random()

Composable

Math

r() = 182300073

do not have state

predictable

pure

1 arg → 1 ans

√

domain : $\mathbb{R}$

$$f(x) = x^2$$

$\{(0,0),$
$(1,1),$
$(2,4),$
$(3,9),$
$(4,16),$
$(5,25),$
$\vdots$
$(0.2, 0.04)$
$\}$