Review (Part 2)

Today’s Outline

- Linear Algebra
- Discussion Questions
- The Bellman Equation
- Open Discussion

Vector Spaces

$x, y, z \in V$ $\quad 0 \in V$ $\quad -x \in V$ $\quad a, b \in \mathbb{R}$

$(x + y) + z = x + (y + z)$

$x + y = y + x$

$x + 0 = x$

$x + \text{inv}(x) = 0$

$x + (-x) = 0$

$(ab)x = a(bx)$

$1x = x$

$a(x + y) = ax + ay$

$(a + b)x = ax + bx$

additive associativity,
additive commutativity,
additive identity,
additive inverse,
mult. associativity,
mult. (scalar) identity,
mult. distributivity ,

Norms

$p : V \to \mathbb{R}^+$ $\quad x, y \in V$ $\quad a, b \in \mathbb{R}$

$p=0$

non-zero elements

$p=\infty$ "max-norm"

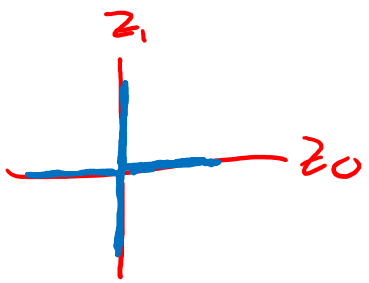
$\max(|x_0|, |x_1|, |x_2|)$

$\|x+y\| \leq \|x\| + \|y\|$ (triangle inequality)

$\|ax\| = |a| \, \|x\|$

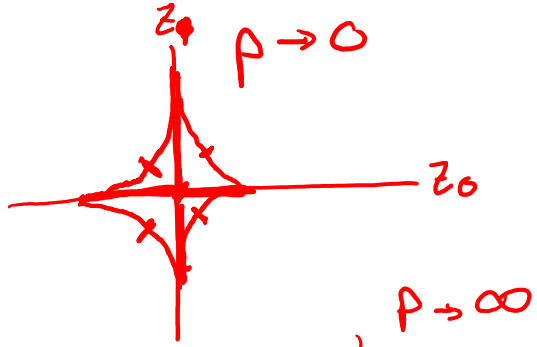
$\|x\| = 0$ iff $x = 0$

$p=0$

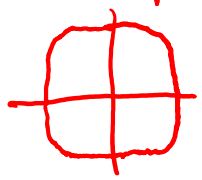


$z = [3.7, 0]$

$= [0, -1.6]$



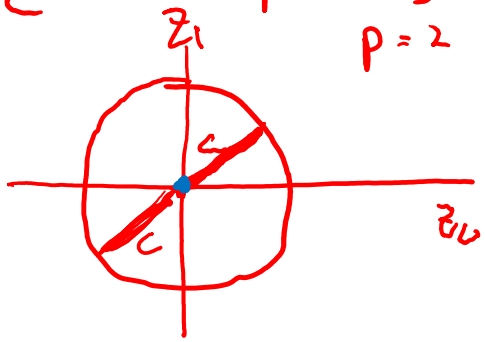
$p \to \infty$

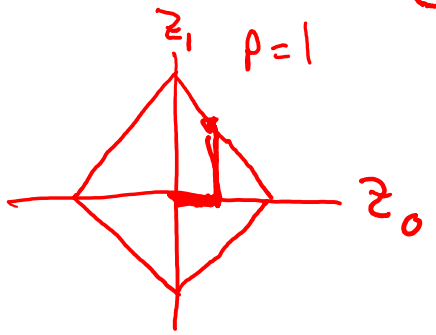


$z \in Q = \{z : \|z\|_p \leq c\}$

$Q \subset \mathbb{R}^2$

$c \in \mathbb{R}^+$





subadditivity,
absolute scalability,
positive definite,
p-norms,

Maps

$f: V \to Q$

$V \subset \mathbb{R}^m$

$Q \subset \mathbb{R}^n$

$a \in \mathbb{R}$

$x, y \in V$

$A \in \mathbb{R}^{n \times m}$

a map is linear if

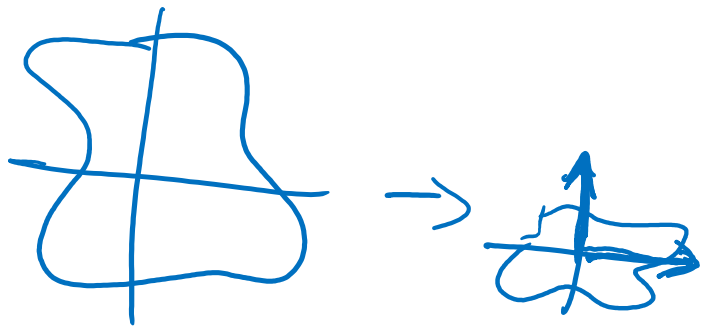
a) $af(x) = f(ax)$

b) $f(x+y) = f(x) + f(y)$

$f(x) = Ax$

$y = f(x)$

$y \in \mathbb{R}^n$



definition,
linearity,
norm,

Discussion Questions

- What is a “value function” and what is it trying to measure? Can we define other value functions besides the discounted returns, V(s) and Q(s, a)?

- In what types of real-world problems would we have known models of world dynamics?

- Can we define “optimal policy” with regards to other forms of optimality? For instance, lower variance of the return or better exploration?