# Learnings for 02-17~23

### What is the solution to the nullspace?

Given Ax = 0. The set of numbers 'x' that will transform A to 0.

### What is a rank?

The number of pivot columns.

Given a [n x m] matrix, rank = n – pivot columns

### What is a pivot column?

The columns with the pivot. Pivots are the numbers you used during elimination to transform matrix A to echelon form.

### What is a free column?

The columns without a pivot.

### What is echelon form?

Echelon means stairs. It's when below the matrix's pivot, are all 0s.

### What is the reduced echelon form?

It's when it's in echelon form but also the pivots are normalized to 1.

### How do you find the solutions to the nullspace?

Given Ax = 0

1. Elimination of A -> Echelon form
2. Echelon form -> Equations
3. Back-substitution -> Solutions
   1. set free columns to 1, then 0,
   2. then substitute into equations,
   3. then derive the rest.
4. Solution = c [x]
   1. because [x] is the basis for the nullspace
   2. but all the possible solutions are the scaling of [x]

Another way using reduced echelon form:

1. Elimination of A -> Echelon form
2. Echelon form -> Reduced Echelon form
3. Reduced Echelon form -> Solutions
   1. Reduced Echelon form = R
   2. R = [I F

0 0]

* 1. Given Rx = 0
  2. Then, N = [-F

I]

* 1. N = nullspace vector = basis for nullspace

1. Solutions = c [N]
   1. all the possible solutions are the scaling of the nullspace basis vector

## How can you approximate in calculus?

You only need this formula:

f'(a) ~~= f(x) – f(a) / x – a

What is the linear approximation formula?

f(x) = f(a) + (x-a)\*f'(a)

What is Newton's method formula?

Given f(x) = 0

x-a = -f(a)/f'(a)

## What is variance?

It represents the randomness of a random variable.

Expectation(X) = Mean of X

Variance = Summation[ (X – mean)^2 ] / N

Variance = E[X^2] – (E[X])^2

## What is generalized policy iteration?

The idea of policy evaluation and improvement interacting with each other (to reach an optimal policy).