
```
if luakeys == nil then luakeys = require('luakeys')() luakeys.depublishfunctions(luakeys)end

penlight = require'penlight'

penlight.stringx.import()(penlight.stringx.formatoperator)(penlight.utils.import(penlight.func)

require'penlightplus'

YAMLvars = require('YAMLvars')

YAMLvars.setts2default()

info.yaml
```

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Contents

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Lecture 2: Test

$A = (a_{ij})$ $m \times n$ matrix $A : \mathbb{R}^n \mapsto \mathbb{R}^m$ $A\vec{x} = \vec{b}$, $\vec{x} \in \mathbb{R}^n$, $\vec{b} \in \mathbb{R}^m$

$(A : \vec{b}) \xrightarrow{\text{reduce}} (B : \vec{c})$ echelon form.

1) Solving a system of m equation with n unknowns

- (a) no solution no pivot on the left with non-zero on the rightmost column
- (b) unique solution want pivot in every column reduced echelon form yields identity matrix
- (c) infinitely many solutions number of pivots is less than the number of columns

column with no pivot or free variable

Just like DEs $A\vec{x} = \vec{b}$

2) Answer questions about the map.

- (a) $\ker A = \vec{0}$ or A not injective $\ker \neq \vec{0}$ iff there is a free variable. iff number of pivots equals the number of columns the number of free variables is the number of vectors which will generate $\ker A$.
- (b) A surjective A surjective iff $A\vec{x} = \vec{b}$ has a solution for any \vec{b} . iff there is a pivot in every row. so, the number of pivots equals the number of rows (number of pivots is less than or equal to the number of rows by the definition of a pivot)
- (c) A invertible A is invertible iff the number of rows equals the number of pivots equals the number of columns. A is square and its reduced echelon form is I .