Note: I'm pretty familiar with Python so I'm not going to go over that here. Most of this lecture and the next one are Python topics. I have a cse3380 repository in Github that hosts all my CSE 3380 related code. You can find some examples and (my) homework solutions there.

1   Dimensions of Vector Space, cont.

Theorem 1 (Rouche-Capelli Theorem) *A system of linear equations of n variables has a solution if, and only if, the rank of its coefficient matrix A is equal to the rank of its augmented matrix.*

If there are solutions, they form an affine subspace of $\mathbb{R}^n$ of dimension $n - rank\,(A)$. In particular,

- *if $n = rank\,(A)$, the solution is unique*

- *otherwise infinitely many solutions (because of free variables)*

- *the system is inconsistent if $rank\,([A\ b]) > rank\,(A)$*

Rank and IMT

Let $A \in \mathbb{R}^{m \times n}$. The following are true if A is invertible:

1. The columns of A form a basis of $\mathbb{R}^n$

2. Col $A = \mathbb{R}^n$

3. rank $(A) = n$

4. nullity $(A) = 0$

5. Nul $A = \left\{\vec{0}\right\}$