

**ECE 215** Spring 2025

**Objective 1.8:**

**Decision Matrices**



UNITED STATES  
**AIR FORCE  
ACADEMY**

## Objective 1.8

I can use a decision matrix to quantitatively compare various measures of merit.

# DECISION MATRICES

- **Quantitative** approach to decision making
- What we care about: **Measures of Merit**
- Suppose we have 2 systems (A and B) to compare

	Cost	Efficiency
Sys A	\$600	75.50%
Sys B	\$1,500	99.19%

- How we do it:
  - **Normalize** each value
  - **Weight** each measure of merit
  - **Add** scores for each system

# NORMALIZATION

- Normalization, removes units, levels playing field
- Best option gets a score of 1.0, other scores are calculated by:

$$\text{Score}_{\text{normalized}} = \frac{\text{Lowest Raw Value}}{\text{Raw Value}} \longrightarrow \text{Minimize Parameter}$$

-OR-

$$\text{Score}_{\text{normalized}} = \frac{\text{Raw Value}}{\text{Highest Raw Value}} \longrightarrow \text{Maximize Parameter}$$

- Which formula do we use?
- What if we pick the wrong one?!?!

# NORMALIZATION IN ACTION

Back to our example:

	Cost		Efficiency	
	Value	Normalized	Value	Normalized
Sys A	\$600		75.50%	
Sys B	\$1,500		99.19%	

## WEIGHTING AND COMBINING

- Weights assign relative importance to Measures of Merit
- Weights must add up to 1
- Total score is:

### Total Score

$$(\text{Weight}_1 \times \text{Score}_{1,\text{normalized}}) + (\text{Weight}_2 \times \text{Score}_{2,\text{normalized}}) + \dots$$

	Cost			Efficiency			Total
	Value	Normalized	Weighted	Value	Normalized	Weighted	
Sys A	\$600	1		75.50%	0.761		
Sys B	\$1,500	0.4		99.19%	1		

## REAL WORLD EXAMPLE

	Cost	Camera	Display	Battery	RAM
Galaxy S22 Ultra	\$ 1199	108 MP (triple)	500 ppi	5000 mAh	8 GB
Pixel 6pro	\$1049	50 MP (triple)	512 ppi	5003 mAh	12 GB
OnePlus 10	\$700	48 MP (triple)	525 ppi	5000 mAH	12 GB

- What if all the attributes are equally important?
- What if you're flush with cash and don't care about money, but battery life is really important?