SE463

Software Requirements Specification & Analysis

Prioritizing Requirements

Module Objectives

- Purposes of requirements prioritization

- Criteria for prioritization

- Prioritization techniques

- How techniques vary with respect to their efficiency, precision, and consistency

- Benefits and challenges of prioritizing requirements

Prioritizing Requirements

- There are more requirements than can be implemented

- Need to balance requirements against limitations in budget, staff, schedule

- Need to decide which features go into the next release
  - requirements triage
 - minimum viable product (MVP)
  - timeboxes

Prioritization Criteria

- Business Value Added

- Penalty / Harm Avoided

- Risk

- Cost

- Time

Prioritization Criteria

Most companies prioritize requirements by their potential value and cost.

- **Value** is a requirement's potential contribution to customer satisfaction
- **Cost** is the cost of implementing the requirement
- Can prioritize requirements according to their cost-value ratios
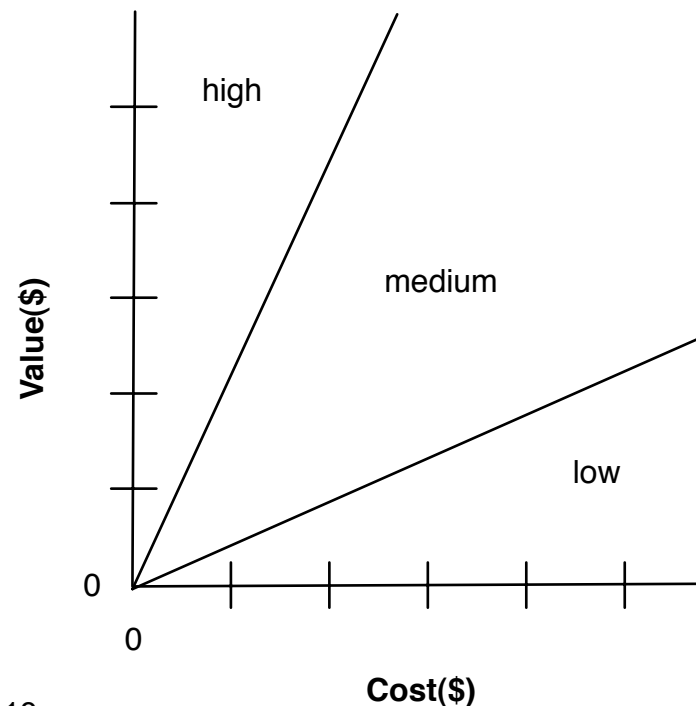
Grouping Requirements

The most common prioritization technique is
numerical assignment or grouping of requirements
into 3-4 priority groups.

Critical

Standard

Optional

Ranking Requirements

Each requirement is assigned a unique rank (1, 2, …), but it is not possible to see the relative difference between ranked requirements.

100-Dollar Test

In cumulative voting, or the 100-dollar test, stakeholders are given 100 prioritization points (votes) to distribute among the requirements.

Kano Model

The Kano Model is a method for grouping requirements based on customer perception, in order to select the requirements that deliver the greatest customer satisfaction.
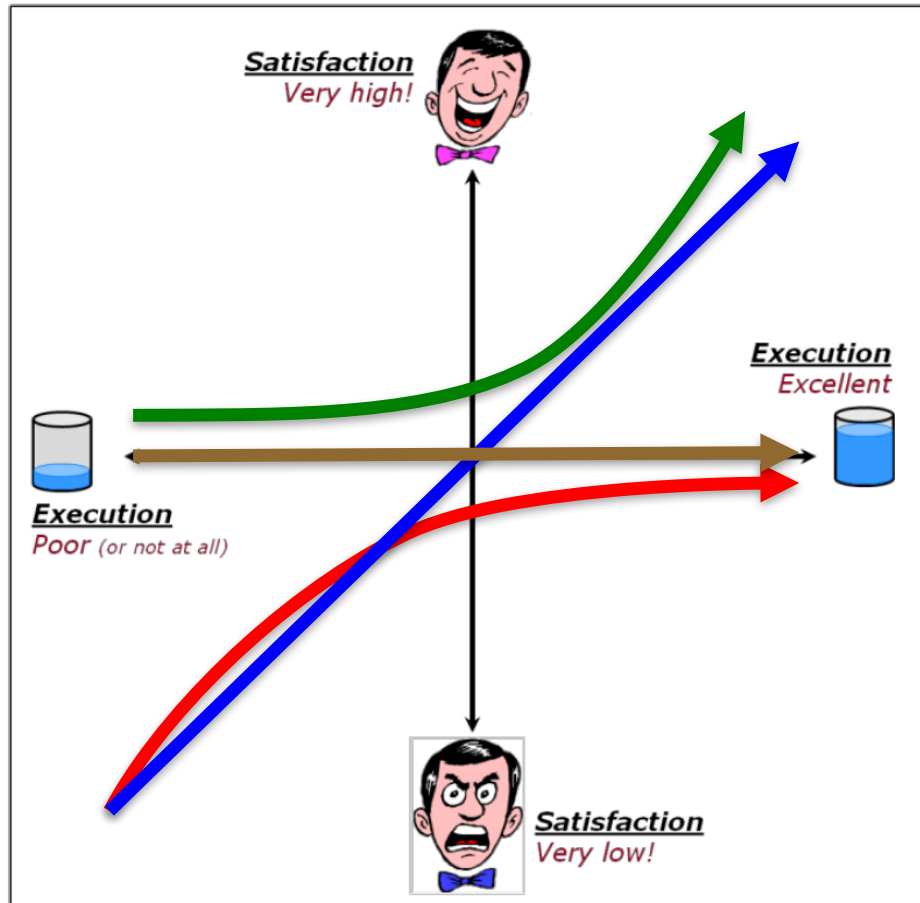
Performance: requirements that the customer specifically asked for

Basic: requirements that the customer takes for granted

Excitement: requirements that the customer does not request or expect

Indifferent: requirements that the customer does not care about

Kano Surveys

1. Ask customers what their reaction would be if the requirement were included in the product

2. Ask customers what their reaction would be if the requirement were NOT included in the product.

The possible answers are
- I like it
- I expect it
- I am neutral
- I can tolerate it
- I dislike it

Kano Evaluation Table

Customer Survey Responses		Disfunctional Question Answer				
		Like	Expect	Neutral	Tolerate	Dislike
Functional Question Answer	Like	*Questionable*	Excitement	Excitement	Excitement	Performance
	Expect	Reverse	*Questionable*	Indifferent	Indifferent	Basic
	Neutral	Reverse	Indifferent	Indifferent	Indifferent	Basic
	Tolerate	Reverse	Indifferent	Indifferent	*Questionable*	Basic
	Dislike	Reverse	Reverse	Reverse	Reverse	*Questionable*

Basic > Performance > Excitement > Indifferent

Categorization Plane

If combining the results of multiple surveys, better to score the survey results and plot the **averages** and **standard deviations**.

- **Functional**: -2 (Dislike), -1 (Live with), 0 (Neutral), 2 (Must-be), 4 (Like);
- **Dysfunctional**: -2 (Like), -1 (Must be), 0 (Neutral), 2 (Live with), 4 (Dislike);
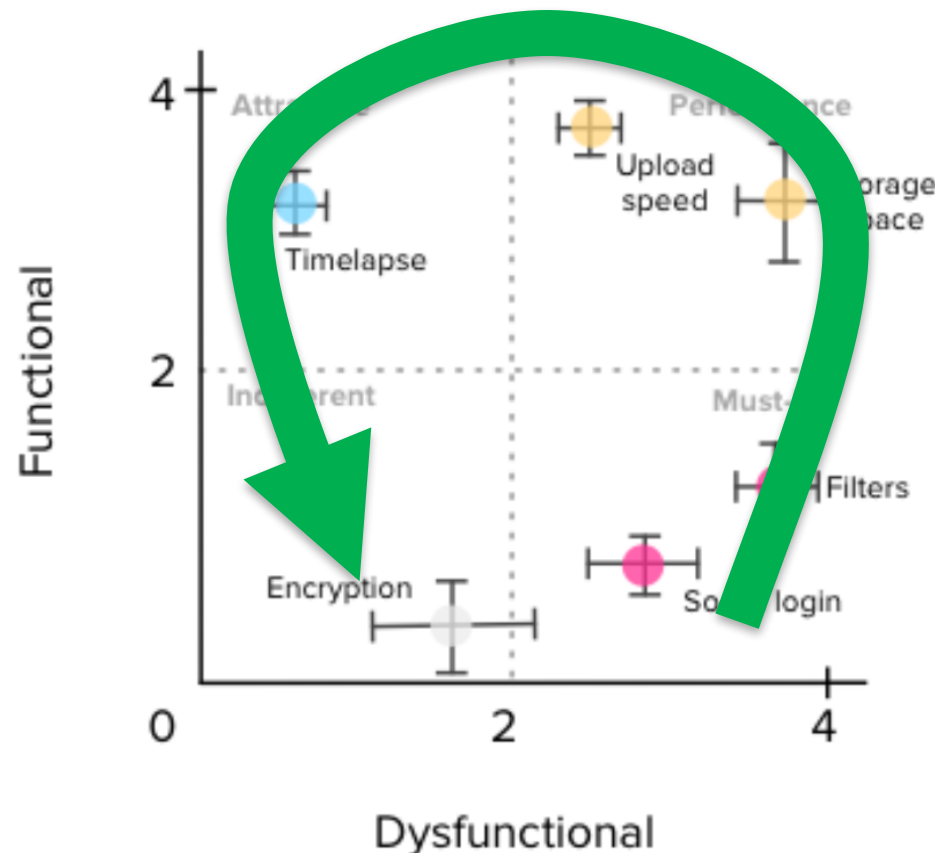
Analytic Hierarchy Process

Requirements prioritization technique that analyzes stakeholders' pairwise comparisons of requirements, and produces a relative ranking of requirements.

- Acknowledges that absolute values and costs are hard to estimate

- Relative comparisons are easier

AHP Pairwise Comparisons

Compare pairs of requirements

- 1 - requirements are of equal value
- 3 - one is slightly preferred over the other
- 5 - one is strongly preferred over the other
- 7 - one is very strongly preferred over the other
- 9 - one is extremely preferred over the other
- intermediate values 2, 4, 6, 8 used when compromise is needed
- if pair (x,y) has relative value n, complementary pair (y,x) has reciprocal value 1/n

	Req1	Req2	Req3	Req4
Req1	1	1/3	2	4
Req2	3	1	5	3
Req3	1/2	1/5	1	1/3
Req4	1/4	1/3	3	1

AHP Analysis

Estimate eigenvalues by "averaging over normalized columns"

Step 1: Compare pairs of requirements

	Req1	Req2	Req3	Req4
Req1	1	1/3	2	4
Req2	3	1	5	3
Req3	1/2	1/5	1	1/3
Req4	1/4	1/3	3	1

Step 3:
Sum each row

Sum
1.05
1.98
0.34
0.62

Step 4:
Normalize sums

Sum/4
0.26
0.50
0.09
0.16

Step 2: Normalize the columns
(i.e., divide each entry by the sum of its column

	Req1	Req2	Req3	Req4
Req1	0.21	0.18	0.18	0.48
Req2	0.63	0.54	0.45	0.36
Req3	0.11	0.11	0.09	0.04
Req4	0.05	0.18	0.27	0.12

Step 5:
Report relative values

Req1	26%
Req2	50%
Req3	9%
Req4	16%

AHP Checking Consistency

Step 1: Multiply comparison matrix by priority vector

	Req1	Req2	Req3	Req4
Req1	1	1/3	2	4
Req2	3	1	5	3
Req3	1/2	1/5	1	1/3
Req4	1/4	1/3	3	1

Priority
0.26
0.50
0.09
0.16

$\bullet$ ... $=$

1.22
2.18
0.37
0.64

Step 2: Divide each element by the corresponding element in priority vector

1.22 / 0.26
2.18 / 0.50
0.37 / 0.09
0.64 / 0.16

$=$

4.66
4.40
4.29
4.13

Step 3: Compute principle eigenvalue

$$\frac{4.66 + 4.40 + 4.29 + 4.13}{4} = 4.37$$

Step 4: Calculate consistency index

$$CI = \frac{4.37 - n}{n-1} = 0.12$$

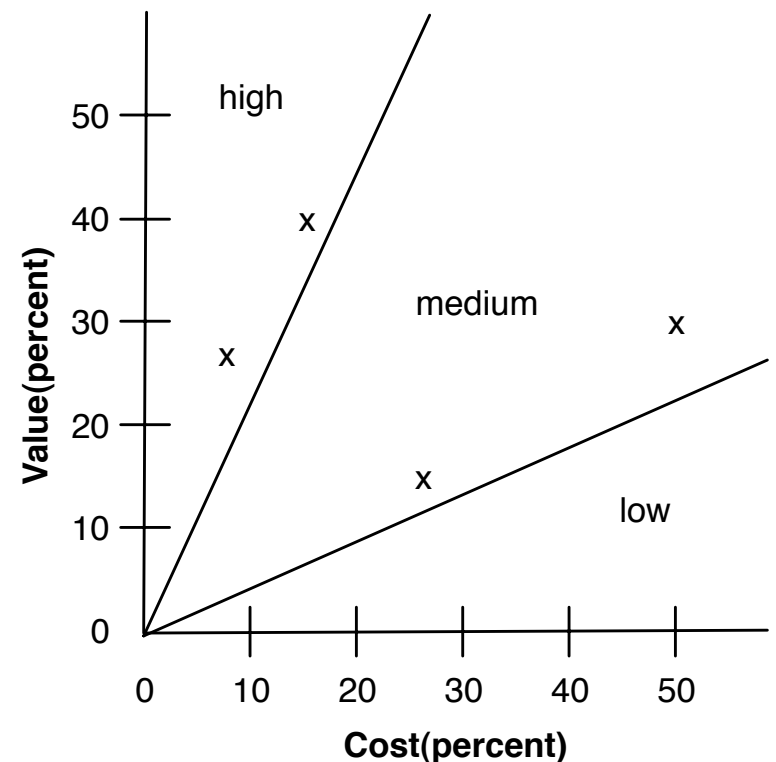**Step 5: Compare against consistency index of random matrix (<0.10)**

$$CR = \frac{0.12}{0.90} = 0.14$$

Combining Different Techniques

Categorize requirements into groups, and then prioritize within each group

Plot return-on-investment ratios
- Relative value / relative cost

Challenges

- All requirements deemed to be essential

- Large number of requirements to prioritize

- Conflicting priorities

- Changing priorities

- Stakeholder and developer collaboration

- Subjective prioritization

Benefits

- Improves customer satisfaction, by implementing most important requirements first

- Helps to determine how to prioritize the allocation of limited project resources

- Encourages stakeholders to consider all requirements (not just their own)

Deliverable #6
Wednesday June 20, noon

(20%) 100-Dollar Prioritization of quality attributes

- Identify 6 quality attributes that you believe are important to your project.
- State what the quality attributes mean in the context of your project
- Use 100-dollar technique to prioritize quality attributes
  - 3 real stakeholders (champion stakeholder, 2 external to the team)

(10%) Rich Fit Criteria

- Elicit fit criteria for top 2 quality attributes
  - champion stakeholder

(30%) Kano Prioritization of Use Cases

- Survey 3 real stakeholders external to the team
- Compute average Functional and Disfunctional values and standard deviation for each use case and plot on a categorization plane

(40%) AHP Prioritization of Use Cases

- relative importance (champion stakeholder)
- relative difficulty to implement (survey all team members)
- plot relative value / relative difficulty of the 10 most valuable scenarios