

SE463

Software Requirements Specification & Analysis

Prioritizing Requirements

Prioritizing Requirements

- There are often more requirements than can be implemented
 - Customers ask for way too much
 - Need to balance requirements against limitations in budget, staff, schedule
 - Need to decide which features go into the next release
- Requirements triage
 - Some requirements must be implemented
 - Some requirements may be obvious choices to exclude
 - The rest are desirables that we need to select from

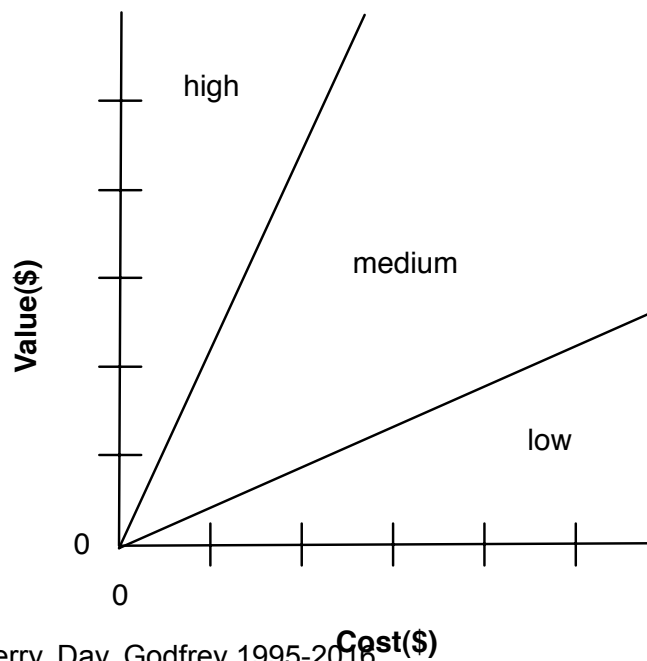
Prioritization Aspects

- Business Value Added
- Penalty / Harm Avoided
- Risk
- Cost
- Time

Combining Aspects

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

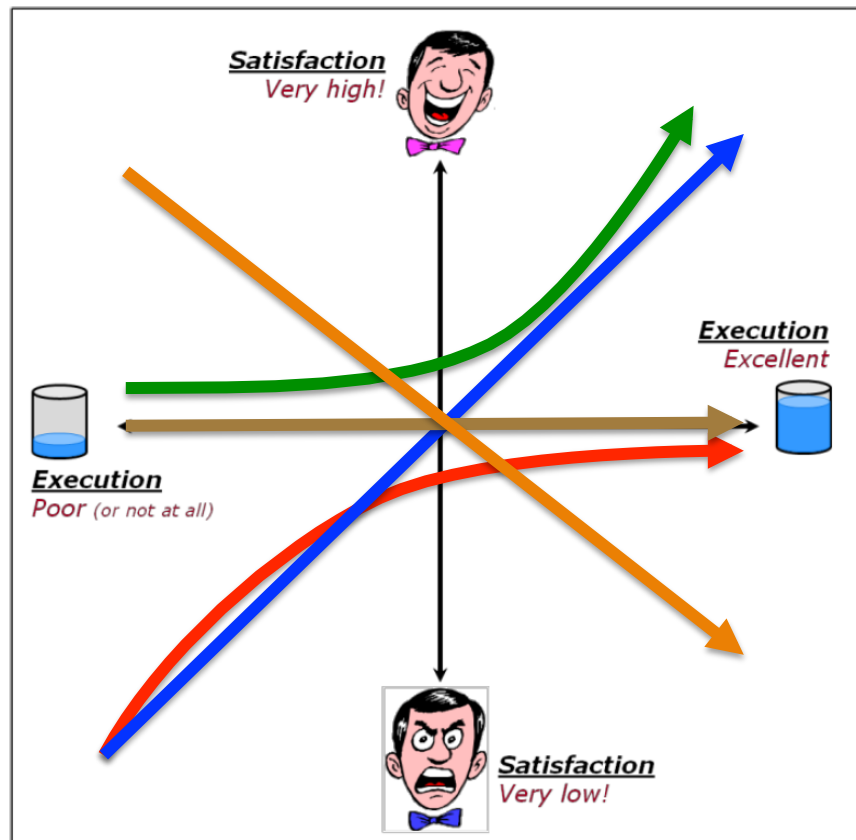
Optional

Ranking Requirements

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

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.



Basic: requirements that the customer takes for granted

Performance: requirements that the customer specifically asked for

Excitement: requirements that the customer does not request or expect

Indifferent: requirements that the customer does not care about

Reverse: “requirements” that the customer hates

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 Surveys

Customer Survey Responses		Disfunctional Question Answer				
		Like	Expect	Neutral	Tolerate	Dislike
Functional Question Answer	Like	<i>Questionable</i>	Excitement	Excitement	Excitement	Performance
	Expect	Reverse	<i>Questionable</i>	Indifferent	Indifferent	Basic
	Neutral	Reverse	Indifferent	Indifferent	Indifferent	Basic
	Tolerate	Reverse	Indifferent	Indifferent	<i>Questionable</i>	Basic
	Dislike	Reverse	Reverse	Reverse	Reverse	<i>Questionable</i>

Basic > Performance > Excitement > Indifferent

100-Dollar Test

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

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 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 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 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

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Priority
0.26
0.50
0.09
0.16

 $=$

1.22
2.18
0.37
0.64

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

1.22 / 0.26	$=$	4.66
2.18 / 0.50		4.40
0.37 / 0.09		4.29
0.64 / 0.16		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)

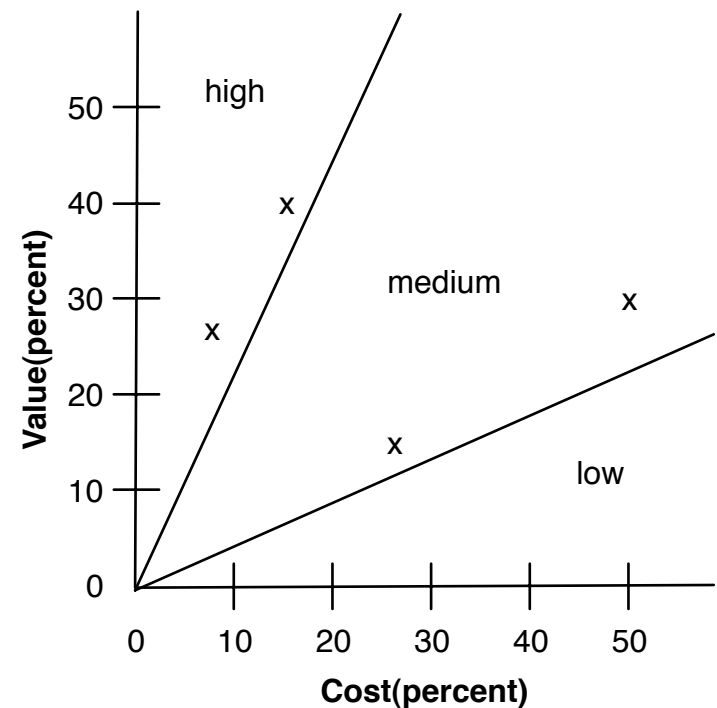
$$CR = \frac{0.12}{0.90} = 0.14$$

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)

Summary

- Purposes of prioritization
- Aspects of prioritization
- Prioritization techniques
- How techniques vary with respect to their efficiency, precision, consistency
- Benefits and challenges of prioritizing requirements

Deliverable #6

- 100-Dollar Prioritization of all Use Cases
 - with respect to importance/value
 - by 4 stakeholders, 3 not on your team
- Kano Prioritization of Scenarios (main, alternatives, and exceptions) of the two highest-priority Use Cases
 - with respect to importance/value
 - by 4 stakeholders, 3 not on your team
- 100-Dollar Prioritization of Atomic Requirements of the highest-priority Scenarios
 - with respect to relative importance/value
 - by 2 stakeholders not on your team
- AHP Prioritization of Atomic Requirements of the highest-priority Scenarios
 - with respect to relative difficulty to implement
 - by all members your team
- Plot relative value / relative difficulty of Atomic Requirements