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Siemens Core Learning Program

Estimation and Prioritization

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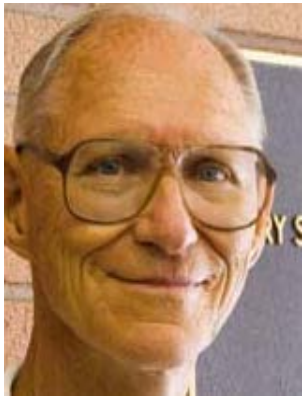
Good judgment comes from experience

**George Santayana's statement,
'Those who cannot remember the past are condemned to repeat it,' is only half true.**

The past also includes successful histories.

If you haven't been made aware of them, you're often condemned not to repeat their successes.

[Barry Boehm, 2006]



What makes projects successful? What causes failure?

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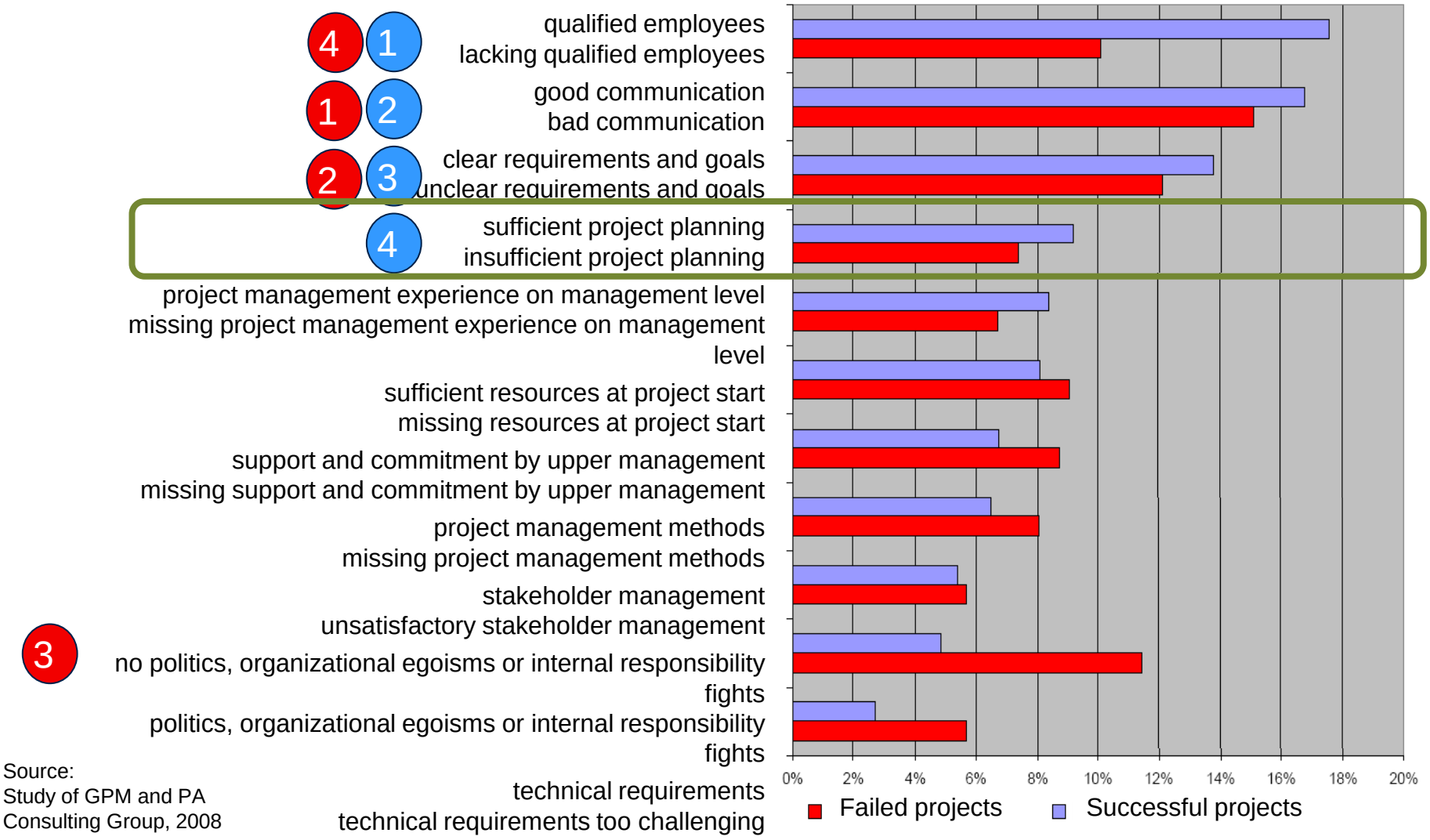

Source:
Study of GPM and PA Consulting Group, 2008

Estimation and Prioritization

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Learning objectives

- Get to know the basic estimation patterns and measures
- Get to know the basic prioritization patterns and measures
- Know your own required involvement in effort estimation and prioritization

Estimation and Prioritization

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Agenda

Prioritization

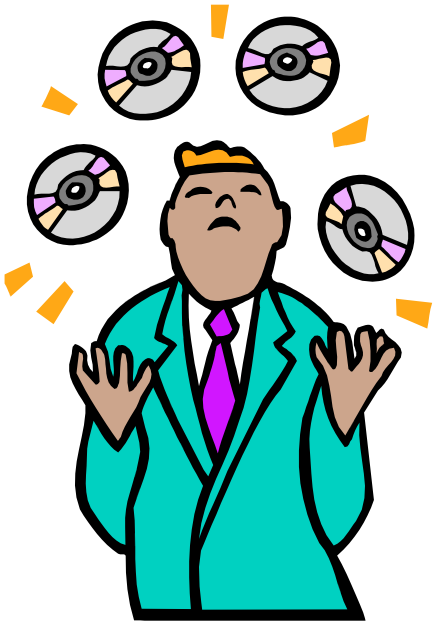
Effort Estimation

Summary

Prioritization for Test Architects

Test Architects may become involved in or drive test architecture requirements prioritization.

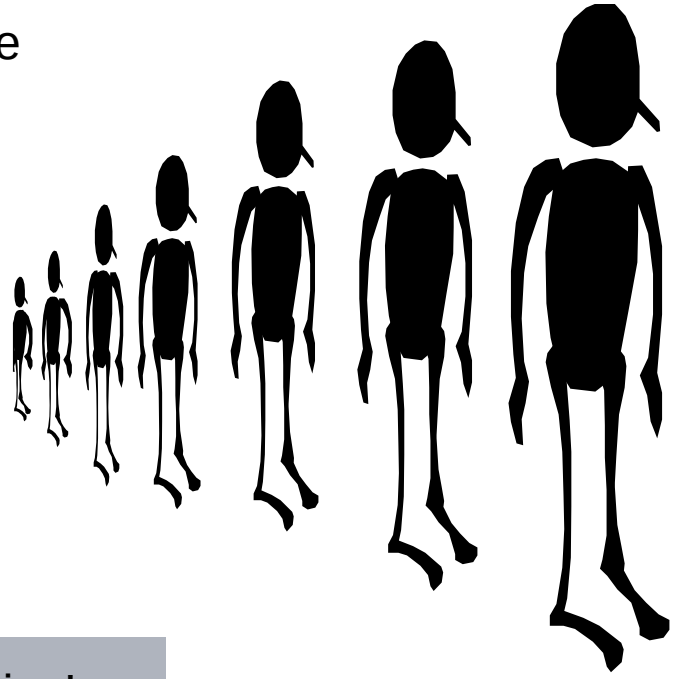
Even more likely Test Architects may need to prioritize test efforts (test approaches, test cases, …).



What Makes a Good Prioritization Technique?

As opposed to a bazaar approach, prioritization should…

- yield a quantitative and practicable outcome
- be transparent and measureable
- be adequate for your project
- consider context and dependencies (e.g. other projects)
- be simple: not too much levels; usually 3 priority levels are sufficient



Prioritization presumes that there is a choice!
"Must-Requirements" (e.g. given by safety standards) don't need a priority; they have to be fulfilled anyway

Basic Prioritization
Important versus Urgent

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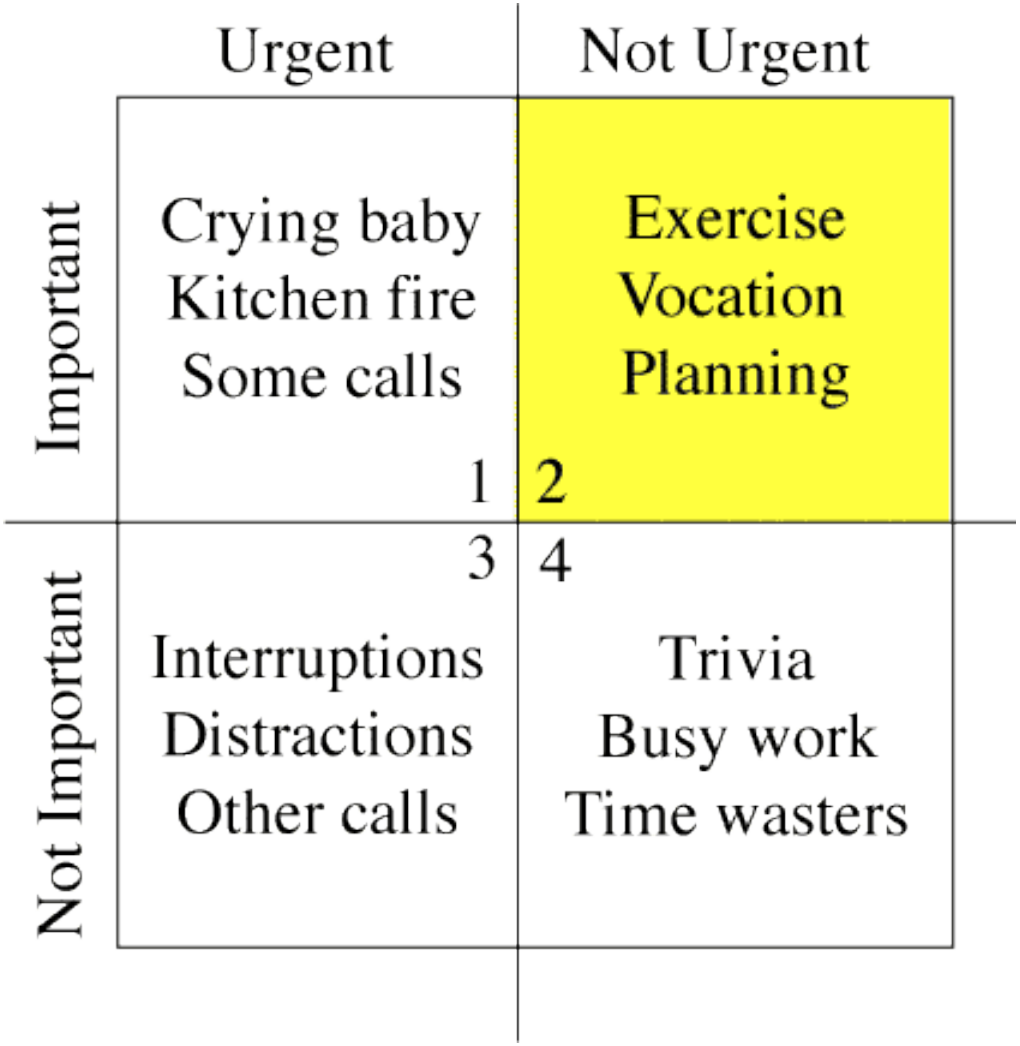
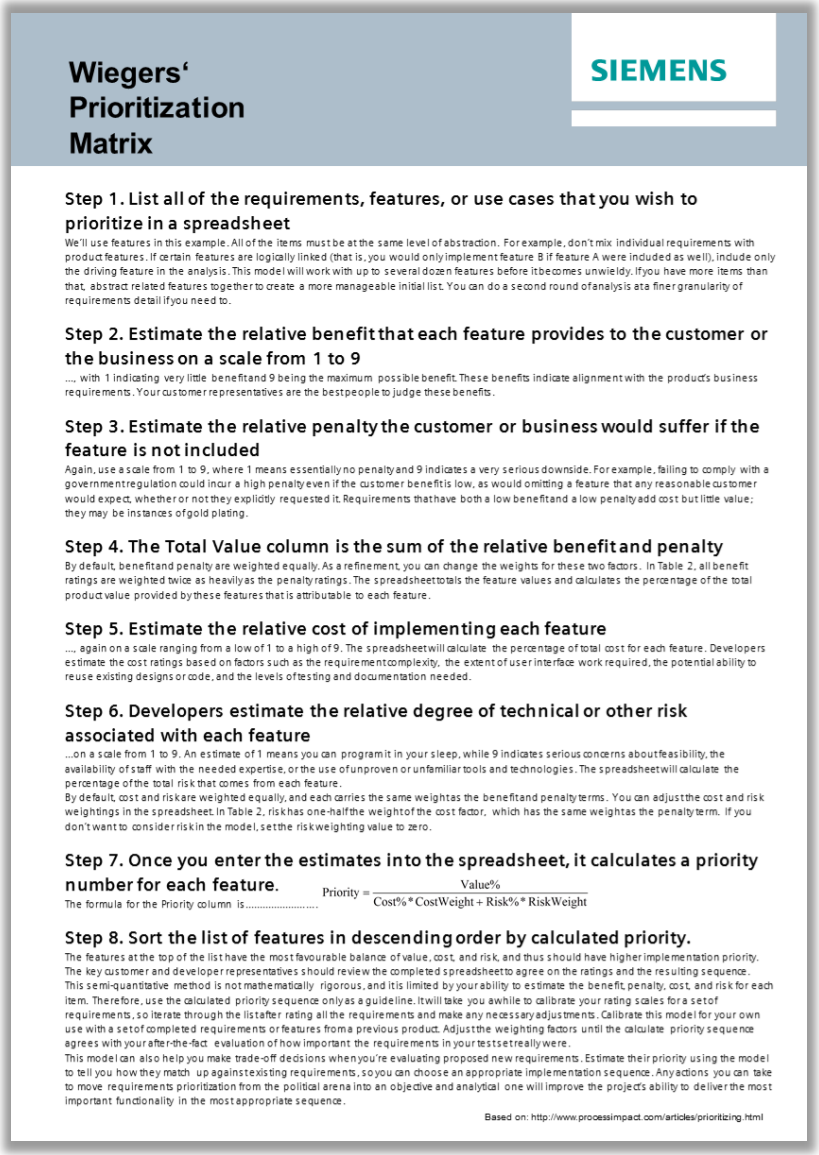


Prioritization

Please get in groups and agree on a certain order of implementation.
Please enter your order on this poster and present afterwards your rationale behind this prioritizaion scheme

Feature	Customer Demand	Risk of implementation	Prioritization				
A	↓	↓					
B	↓	↑					
C	↑	↓					
D	↑	↑					

More sophisticated…



Wiegers' Prioritization Matrix

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Step 1. List all of the requirements, features, or use cases that you wish to prioritize in a spreadsheet

We'll use features in this example. All of the items must be at the same level of abstraction. For example, don't mix individual requirements with product features. If certain features are logically linked (that is, you would only implement feature B if feature A were included as well), include only the driving feature in the analysis. This model will work with up to several dozen features before it becomes unwieldy. If you have more items than that, abstract related features together to create a more manageable initial list. You can do a second round of analysis at a finer granularity of requirements detail if you need to.

Step 2. Estimate the relative benefit that each feature provides to the customer or the business on a scale from 1 to 9

..., with 1 indicating very little benefit and 9 being the maximum possible benefit. These benefits indicate alignment with the product's business requirements. Your customer representatives are the best people to judge these benefits.

Step 3. Estimate the relative penalty the customer or business would suffer if the feature is not included

Again, use a scale from 1 to 9, where 1 means essentially no penalty and 9 indicates a very serious downside. For example, failing to comply with a government regulation could incur a high penalty even if the customer benefit is low, as would omitting a feature that any reasonable customer would expect, whether or not they explicitly requested it. Requirements that have both a low benefit and a low penalty add cost but little value; they may be instances of gold plating.

Step 4. The Total Value column is the sum of the relative benefit and penalty

By default, benefit and penalty are weighted equally. As a refinement, you can change the weights for these two factors. In Table 2, all benefit ratings are weighted twice as heavily as the penalty ratings. The spreadsheet totals the feature values and calculates the percentage of the total product value provided by these features that is attributable to each feature.

Step 5. Estimate the relative cost of implementing each feature

..., again on a scale ranging from a low of 1 to a high of 9. The spreadsheet will calculate the percentage of total cost for each feature. Developers estimate the cost ratings based on factors such as the requirement complexity, the extent of user interface work required, the potential ability to reuse existing designs or code, and the levels of testing and documentation needed.

Step 6. Developers estimate the relative degree of technical or other risk associated with each feature

...on a scale from 1 to 9. An estimate of 1 means you can program it in your sleep, while 9 indicates serious concerns about feasibility, the availability of staff with the needed expertise, or the use of unproven or unfamiliar tools and technologies. The spreadsheet will calculate the percentage of the total risk that comes from each feature.

By default, cost and risk are weighted equally, and each carries the same weight as the benefit and penalty terms. You can adjust the cost and risk weightings in the spreadsheet. In Table 2, risk has one-half the weight of the cost factor, which has the same weight as the penalty term. If you don't want to consider risk in the model, set the risk weighting value to zero.

Step 7. Once you enter the estimates into the spreadsheet, it calculates a priority number for each feature.

The formula for the Priority column is.....

$$\text{Priority} = \frac{\text{Value\%}}{\text{Cost\%} * \text{CostWeight} + \text{Risk\%} * \text{RiskWeight}}$$

Step 8. Sort the list of features in descending order by calculated priority.

The features at the top of the list have the most favourable balance of value, cost, and risk, and thus should have higher implementation priority. The key customer and developer representatives should review the completed spreadsheet to agree on the ratings and the resulting sequence. This semi-quantitative method is not mathematically rigorous, and it is limited by your ability to estimate the benefit, penalty, cost, and risk for each item. Therefore, use the calculated priority sequence only as a guideline. It will take you awhile to calibrate your rating scales for a set of requirements, so iterate through the list after rating all the requirements and make any necessary adjustments. Calibrate this model for your own use with a set of completed requirements or features from a previous product. Adjust the weighting factors until the calculate priority sequence agrees with your after-the-fact evaluation of how important the requirements in your test set really were.

This model can also help you make trade-off decisions when you're evaluating proposed new requirements. Estimate their priority using the model to tell you how they match up against existing requirements, so you can choose an appropriate implementation sequence. Any actions you can take to move requirements prioritization from the political arena into an objective and analytical one will improve the project's ability to deliver the most important functionality in the most appropriate sequence.

Based on: http://www.processimpact.com/articles/prioritizing.html

Wiegers' Proritization Matrix (Example)

Relative Weights:	2,0	1,0			1,0		0,5		
Feature	**Relative Benefit**	**Relative Penalty**	**Total Value**	**Value %**	**Relative Cost**	**Cost %**	**Relative Risk**	**Risk %**	**Priority**
	2	4	8	5,2	1	2,7	1	3,0	1,22
Query status of a vendor order	5	3	13	8,4	2	5,4	1	3,0	1,21
Generate a Chemical Stockroom inventory report	9	7	25	16,1	5	13,5	3	9,1	0,89
See history of a specific chemical container	5	5	15	9,7	3	8,1	2	6,1	0,87
Search vendor catalogs for a specific chemical	9	8	26	16,8	3	8,1	8	24,2	0,83
Maintain a list of hazardous chemicals	3	9	15	9,7	3	8,1	4	12,1	0,68
Modify a pending chemical request	4	3	11	7,1	3	8,1	2	6,1	0,64
Generate an individual laboratory inventory report	6	2	14	9,0	4	10,8	3	9,1	0,59
Check training database for hazardous chemical training record	3	4	10	6,5	4	10,8	2	6,1	0,47
Import chemical structures from structure drawing tools	7	4	18	11,6	9	24,3	7	21,2	0,33
Totals	**53**	**49**	**155**	**100,0**	**37**	**100,0**	**33**	**100,0**	

$$\text{Priority} = \frac{\text{Value\%}}{\text{Cost\%} * \text{CostWeight} + \text{Risk\%} * \text{RiskWeight}}$$

Test Drive your own

Applying Wiegers' Prioritization

Relative Weights:

Feature / Task / Test Case / Test Method	Relative Benefit	Relative Penalty	Total Value	Value %	Relative Cost	Cost %	Relative Risk	Risk %	Priority
Totals									

$$\text{Priority} = \frac{\text{Value\%}}{\text{Cost\%} * \text{CostWeight} + \text{Risk\%} * \text{RiskWeight}}$$

Backup material (Prioritization)

Prioritization Techniques – Simple priority estimation

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Items	Priority		
	High	Medium	Low
Item 1		x	
Item 2			x
Item 3			x
Item 4	x		
Item 5		x	
Item 6	x		
Item 7		x	
Item 8		x	
Item 9			x
Item 10	x		
Item 11	x		
Item 12		x	

1. Define the meaning of each requirement level
2. Parse the list of items (e.g. requirements)
3. For each item estimate a priority;
   any expert estimation method can be used

Typical Priorities are:

- High / Medium / Low
  (or A / B / C)
- Exciting / Expected / Nice to have

Prioritization Techniques – 100 Points

Items	Priority			Ranking	
	Person 1	Person 2	Person 3		
Item 1	20	20	10	50	H
Item 2	20	30	10	60	H
Item 3				0	L
Item 4			40	40	M
Item 5				0	L
Item 6	20	30		50	H
Item 7				0	L
Item 8		10	20	30	M
Item 9	20	10		30	M
Item 10				0	L
Item 11	20		20	40	M
Item 12				0	L
Sum	100	100	100		

1. Index a list of items (e.g. requirements)
2. Each participant gets a budget of 100[1)] points [2)]
3. Participants spend their points according to their individual rating
4. Accumulate total amount per item
5. Sort items by total amount
6. Ask participants for their thoughts

1) Could be 1000 or more, for a large list of items
2) Sometimes money is used to remind participants of the purpose

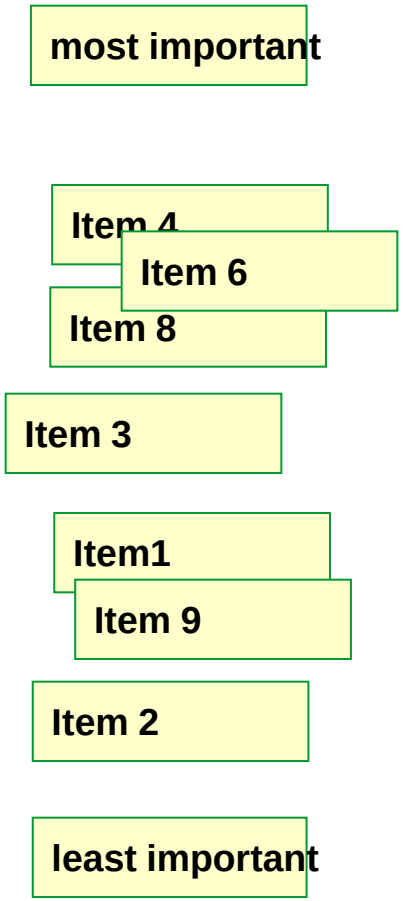
Prioritization Techniques – Direct comparison

Use a vertical list (e.g. use moderation cards)

- Select the most important item and put it on the top
- Select the least important item and put it at the bottom

- Now select one item at a time and find an adequate position between top and bottom and relative to the one's already placed

- Rearrange the distance between the items, if necessary



Prioritization Techniques – Wiegers* Prioritization Matrix

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Relative Weight	2	1			1		0,5		
	Benefit	**Penalty**	Total Value	Value %	**Cost**	Cost %	**Risk**	Risk %	**Priority**
Item A	2	4	8	5,2%	1	2,7%	1	3,0%	**1,22**
…	…	…	…	…	…	…	…	…	**…**
Item N	9	7	25	16,1%	5	13,5%	3	9,1%	**0,89**
Totals	53	49	155		37		33		

$$\text{priority} = \frac{\text{value \%}}{(\text{cost \%} * \text{cost weight}) + (\text{risk \%} * \text{risk weight})}$$

- Criteria are Benefit, Penalty, Cost, Risk
- Estimate criteria on a scale from 1…9 (= low…high)
- Adjust relative weights to suit your needs

* Source: Karl E. Wiegers, Software Requirements, 2nd Edition, 2003

Reality check

Ranking and prioritization is semi-quantitative

- Based on relative scales and weighting factors
- Gut feelings (of experts though)

Play around with ratings and weighting factors

- Discuss resulting effects

You may decide to deviate from ranking results

- Small differences may not be significant
- Place an emphasis on a release (the fairness principle of same rights for every part does not apply)
- Optimize workload for individuals/teams

Tips of the Trade

On people

- Make everybody understand the purpose of a prioritization effort
- Assign a balanced group of relevant stakeholders
- Counterbalance dominant individuals who bias the group
- Invite advocates for items, e.g. project lead, user, FSE, architect, product manager, usability engineer
- "Maybe later" is another message than "NO"

On process

- Agree on a prioritization technique up front
- Define a set of criteria that suits your project
- Calibrate weighting factors with empirical data

On pitfalls

- Use an appropriate level of abstraction
  e.g. features, use cases, system requirements
- Prioritize not more than several dozen items
- Be sure features and rationales are understood

Estimation and Prioritization

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Agenda

Prioritization

Effort Estimation

Summary

Why to do Estimations

Estimates are necessary for:

- Negotiations (e.g. requests for proposals, contract negotiations)
- Planning and project controlling, Change Management
- (Early) Decisions
- Test Architects are involved in test effort and duration estimations for testing activities,
  as well as effort, duration and cost estimations regarding the test environment

Underestimations

→ Often: Estimation based on budget rather than functionality

→ Results in budget and schedule overrun

Overestimation

→ Parkinson's law: "*Work expands so as to fill the time available for its completion*"

→ Gold-plating / over-engineering hampers business plan

→ Risk: Loss of contracts

Estimate Sanity Check

The following sanity check indicates how useful your current project estimate is likely to be in managing your project. For each Yes answer, give the estimate one point.

1. Was a standardized procedure used to create the estimate? ☐
2. Was the estimation process free from pressure that would bias the results? ☐
3. If the estimate was negotiated, were only the inputs to the estimate negotiated, not the outputs or the estimation process itself? ☐
4. Is the estimate expressed with precision that matches its accuracy? (For example, is the estimate expressed as a range or coarse number if it's early in the project?) ☐
5. Was the estimate created using multiple techniques that converged to similar results? ☐
6. Is the productivity assumption underlying the estimate comparable to productivity actually experienced on past projects of similar sizes? ☐
7. Is the estimated schedule at least 2.0 x StaffMonths $^{1/3}$? (That is, is the estimate outside of the Impossible Zone?) ☐

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Estimation method classification

- Analogy / Expert estimation methods
  Estimations based on experience with similar products or technologies

- Engineering estimation methods
  Estimation based on a detailed examination of product components and process flows; e.g. estimation of labor cost based on calculated time standards and labor cost per hour + part costs + material and energy costs + …

- Algorithmic estimation methods
  Estimation based on equations with variables and parameters, usually using historic (experience) data and statistical methods (e.g. function point analysis, %-method)

Effort Estimation Methods used at Siemens

	by Analogy Method	%-Method	Multiple Expert Estimation, (4 Eyes)	Estimation Meeting	Expert Estimation Delphi Method (e.g. Planning Poker)
based on	experience from similar projects	known effort distribution via Lifecycle	distict interviews of several experts (2 for 4-Eyes)	group interview, not anonymous	structured group interview
data source	history data (efforts, project type attributes)	history data (efforts, percentage distribution)	experts from different organizations		
useful ...	in early project phases	after first phase	for medium projects	for large projects and for highly innovative projects	
effort	medium	medium to high	medium	high to very high	
accuracy	not always good (depends on history data & comparability)		good		

(SW) estimation methods used at Siemens

How did/do you estimate software development effort for the current projects of your business unit ? (multiple answers allowed)

- Expert Estimation: 77%
- Estimation by Analogy: 50%
- Estimation workshop: 40%
- 4-eyes-principle: 24%
- Process-oriented Estimation: 11%
- Not at all: 2%
- Other: 25%

Example for "Other":
Feature-Phase-Matrix Method, Min-Max, Bottom-Up-Approach, SLIM, Delphi Method

Source: Effort Estimation Survey Results, Siemens AG, CT SE, MR, 02.06.2004

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7. Is the estimated schedule at least 2.0 x StaffMonths $^{1/3}$? (That is, is the estimate outside of the Impossible Zone?) ☐
8. Were the people who are going to do the work involved in

Mind setting

- Please discuss first, whether you have to provide an estimate or whether you are in a negotiation about targets and/or commitments.
- Best Practice:
  Avoid off-the-cuff estimates.

The following sanity check indicates how useful your current project estimate is likely to be in managing your project. For each Yes answer, give the estimate one point.

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7. Is the estimated schedule at least 2.0 x StaffMonths $^{1/3}$? (That is, is the estimate outside of the Impossible Zone?) ☐
8. Were the people who are going to do the work involved in creating the estimate? ☐
9. Has the estimate been reviewed by an expert estimator? ☐

Influence of size estimation in SW development

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Does size measurement have an influence on the estimation accuracy?

Accuracy	No sizing	Sizing used
0-10%:	23%	53%
11-20%:	51%	33%
21-50%:	18%	8%
more than 50%:	1%	1%
no answer:	6%	5%

There is a positive influence on the estimation accuracy when using size measures as a basis for effort estimation.

Source: Effort Estimation Survey Results, Siemens AG, CT SE, MR, 02.06.2004

Size estimation

Why? Size estimation

- enhances estimation accuracy
- allows progress monitoring
- allows use of external experience data
- simplifies collection and use of historic data

It is less important which size measure to take but more important to consistently apply the defined counting principles.

When? Not every work package needs or can use size estimation:

Development:

Component → Work Package → Size → Effort → Cost

Management / Support (e.g. Project Management, Quality Assurance)

Work Package → Effort → Cost

Size estimation methods used at Siemens

How do you measure the size of the software product (e.g. Lines of Code) or any other deliverables ? (multiple answers allowed)

- Lines of Code: 22%
- Function Points: 17%
- Number of test cases: 18%
- Number of use cases: 6%
- Number of pages: 12%
- Number of requirements: 21%
- Other: 15%

Example for Other: # Interfaces; # Problem Reports; # classes, methods, screens;
module code size (RAM/ROM/EEPROM); # changed requirements; # CAN-signals

Source: Effort Estimation Survey Results, Siemens AG, CT SE, MR, 02.06.2004

bias the results?

3. If the estimate was negotiated, were only the inputs to the estimate negotiated, not the outputs or the estimation process itself?
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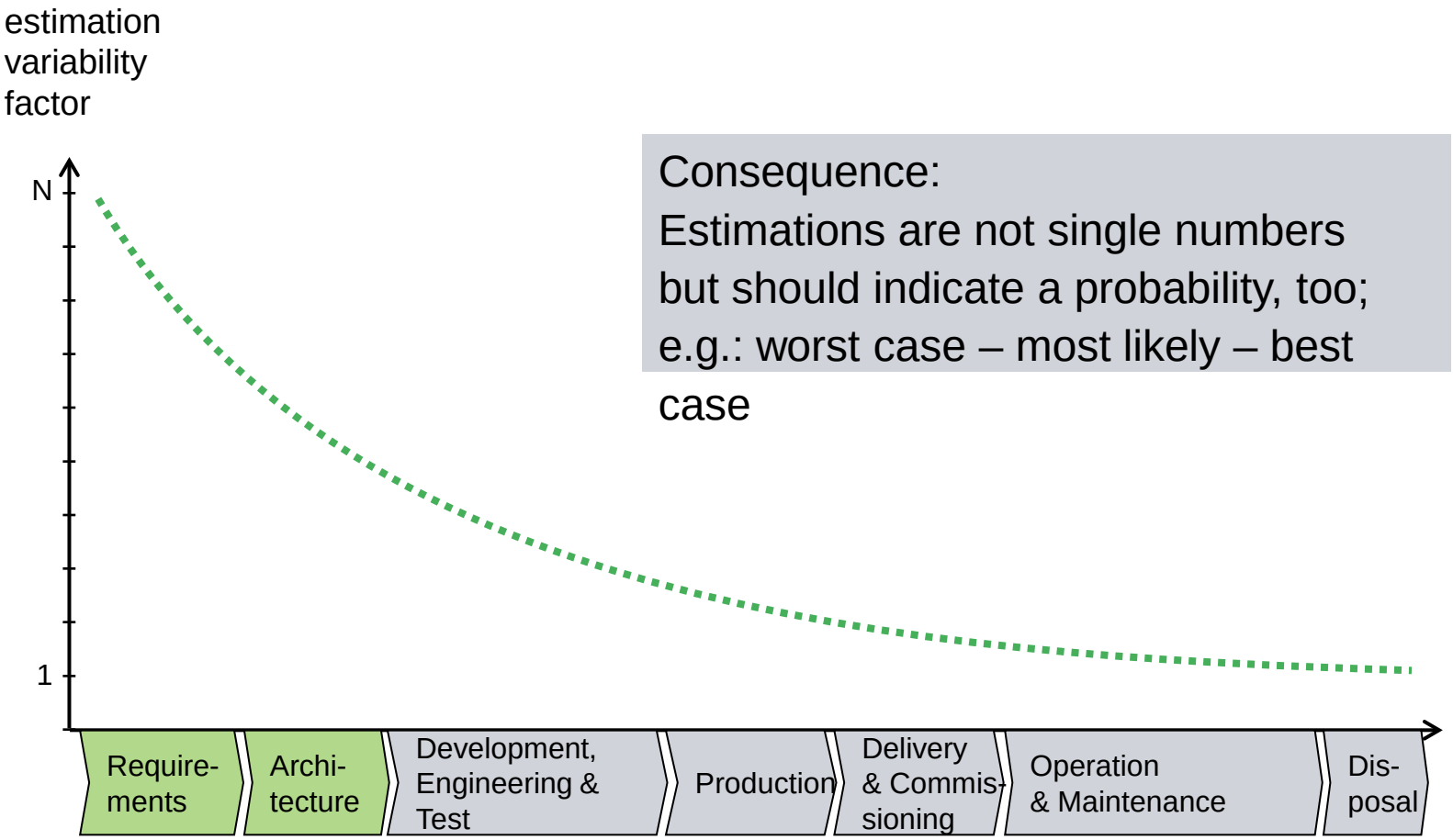
8. Were the people who are going to do the work involved in creating the estimate?
9. Has the estimate been reviewed by an expert estimator?
10. Does the estimate include a nonzero allowance for the impact that project risks will have on effort and schedule?
11. Is the estimate part of a series of estimates that will become more accurate as the project moves into the narrow part of the cone of uncertainty?
12. Are *all* elements of the project included in the estimate, including creation of setup program, creation of data conversion utilities, cutover from old system to new system, etc.?

Development's ‘Cone of Uncertainty’



Consequence:
Estimations are not single numbers but should indicate a probability, too; e.g.: worst case – most likely – best case

bias the results? ☐

3. If the estimate was negotiated, were only the inputs to the estimate negotiated, not the outputs or the estimation process itself? ☐
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itself? ☐

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Σ: _____

Estimate the schedule (using the Basic Schedule Equation)

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$$ScheduleInMonths = n * StaffMonth^{\frac{1}{3}}$$

< 2: impossible

2..4: realistic

Staff Months	Min (n=2)	Avg (n=3)	Relaxed (n=4)
6	4	5	7
10	4	6	9
20	5	8	11
30	6	9	12
40	7	10	14
50	7	11	15
60	8	12	16
70	8	12	16
80	9	13	17
90	9	13	18
100	9	14	19
500	16	24	32
1000	20	30	40

Basic Schedule Equation: Source: McConnell, 2008

accuracy? (For example, is the estimate expressed as a range or coarse number if it's early in the project?) ☐

5. Was the estimate created using multiple techniques that converged to similar results? ☐
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12. Are *all* elements of the project included in the estimate, including creation of setup program, creation of data conversion utilities, cutover from old system to new system, etc.? ☐

Σ: _____

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Σ:

converged to similar results? ☐

6. Is the productivity assumption underlying the estimate comparable to productivity actually experienced on past projects of similar sizes? ☐
7. Is the estimated schedule at least 2.0 x StaffMonths $^{1/3}$? (That is, is the estimate outside of the Impossible Zone?) ☐
8. Were the people who are going to do the work involved in creating the estimate? ☐
9. Has the estimate been reviewed by an expert estimator? ☐
10. Does the estimate include a nonzero allowance for the impact that project risks will have on effort and schedule? ☐
11. Is the estimate part of a series of estimates that will become more accurate as the project moves into the narrow part of the cone of uncertainty? ☐
12. Are *all* elements of the project included in the estimate, including creation of setup program, creation of data conversion utilities, cutover from old system to new system, etc.? ☐

Σ:

(That is, is the estimate outside of the Impossible Zone?) ☐

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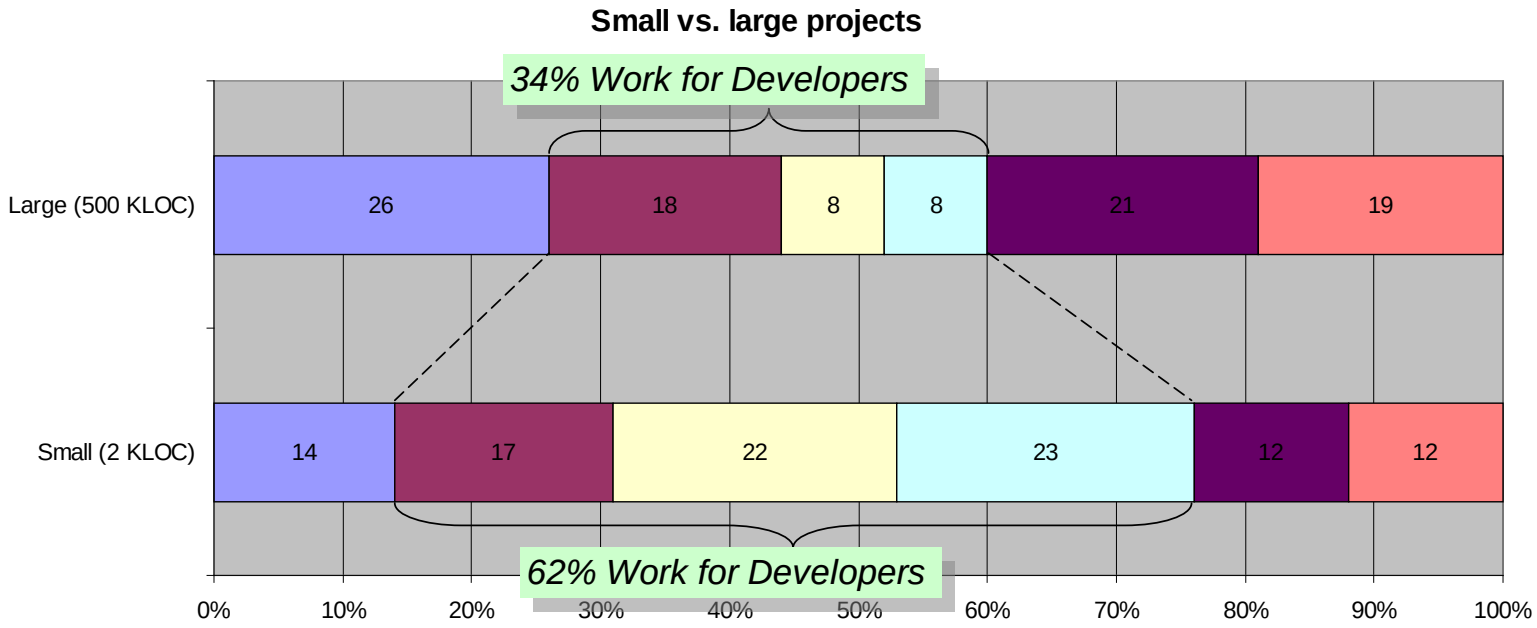
Σ: _____

Considerations on project size



	Small (2 KLOC)	Large (500 KLOC)
System Testing	12	19
Integration	12	21
Unit Testing	23	8
Coding & Debugging	22	8
Detailed Design	17	18
Architecture	14	26

Source: McConnell, Steve, 2002, *The Business Case for Better Software Practices*

creating the estimate?

9. Has the estimate been reviewed by an expert estimator? ☐
10. Does the estimate include a nonzero allowance for the impact that project risks will have on effort and schedule? ☐
11. Is the estimate part of a series of estimates that will become more accurate as the project moves into the narrow part of the cone of uncertainty? ☐
12. Are *all* elements of the project included in the estimate, including creation of setup program, creation of data conversion utilities, cutover from old system to new system, etc.? ☐

Σ: _____

Scores of 10–12 indicate estimates that should be highly accurate.
Scores of 7–9 indicate estimates that are good enough to provide project guidance but that are probably optimistic.
Scores of 6 or below indicate estimates that are subject to significant bias, optimism, or both, and are not accurate enough to provide meaningful guidance to managing a project.

Backup material (Estimation)

How to deal with estimation uncertainty

2 point estimation

assumes
Normal distribution

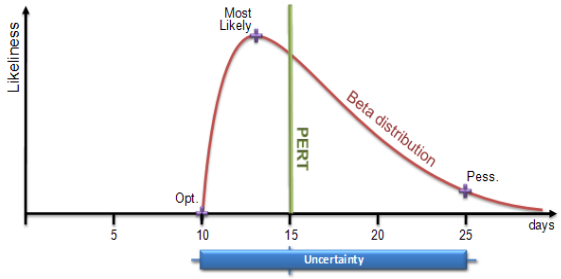
$$\frac{\text{Best Case + Worst Case}}{2}$$

3 point estimation

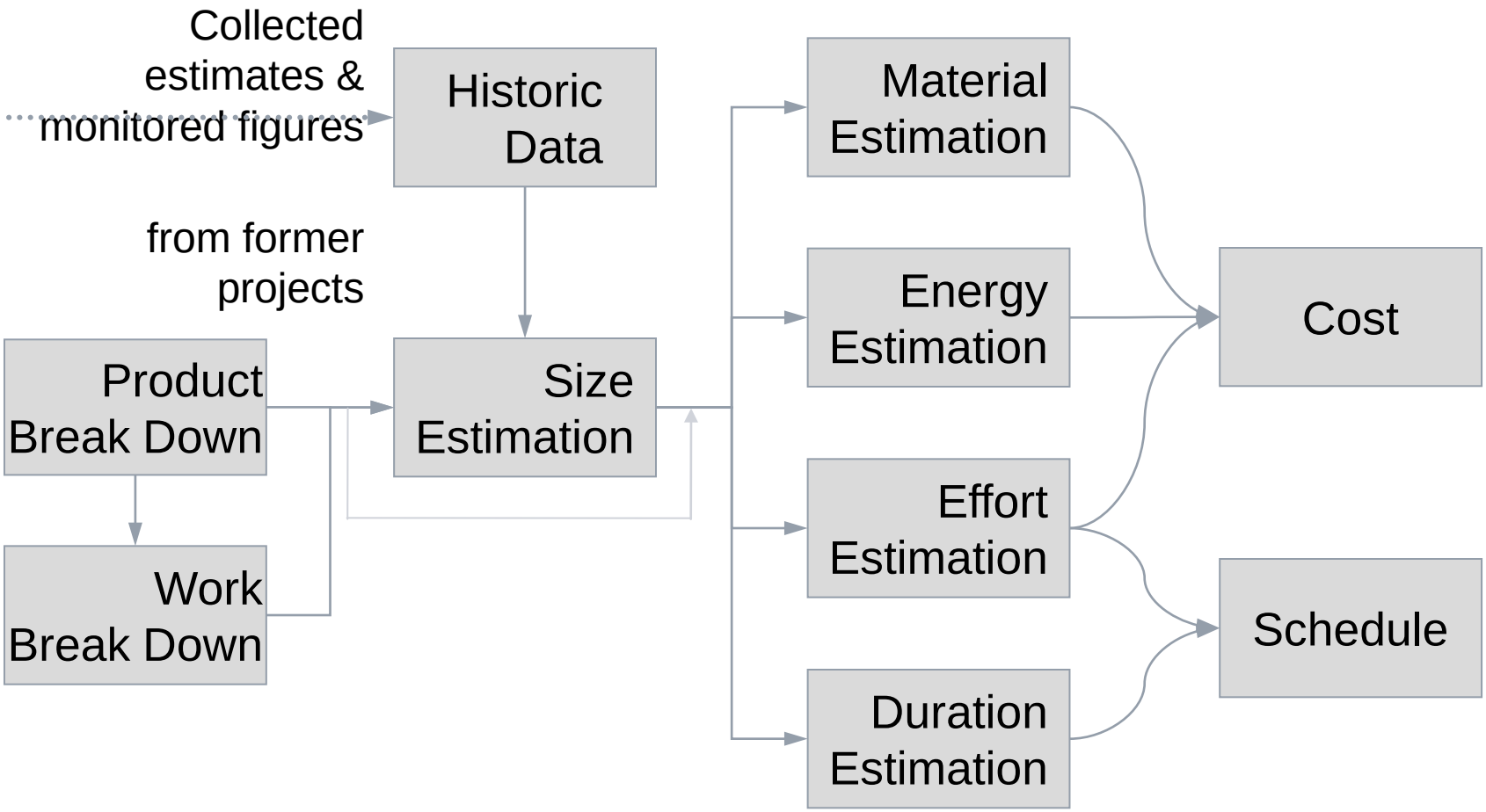
assumes
Beta distribution

$$\frac{\text{Best Case + n * (most) Likely Case + Worst Case}}{n + 2}$$

a DoD-NASA Pert-Cost Guide recommended
n=4,
which is mostly used for this kind of
estimation



Estimation data flow



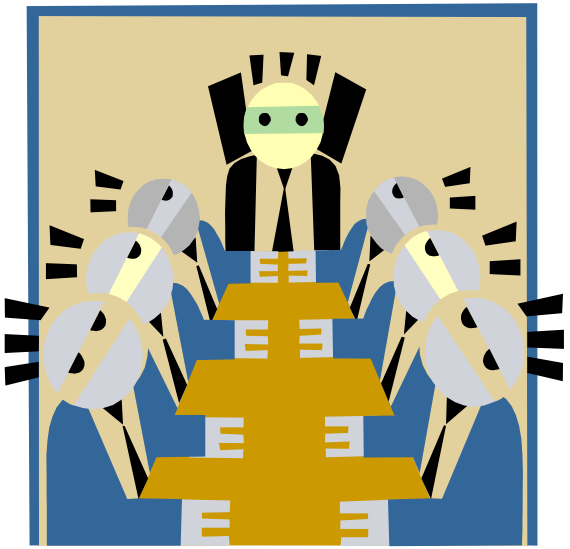
Expert estimation workshop

Agree upon method and scope

- Estimation attitude: Optimistic / pessimistic / most likely, or any combination
- Project phases to be considered
- Deliverable being estimated (e.g. including test automation)
- Assumptions (e.g. make-or-buy decisions)
- Top-down or bottom-up approach
- Estimation based on:
  - Feature set or
  - Architectural decomposition

Participants

- A moderator (user representative):
  - Explains the features
  - Answers any questions
- 7 ± 2 subject matter experts as estimators



Delphi Method: Planning Poker

FOR each estimation unit { // user story, customer requirement, …

Present feature to all players

FOREVER {

Players discuss topic for two minutes,
without mentioning estimation figures at all
(timer may be restarted by anybody)

All players expose their cards simultaneously

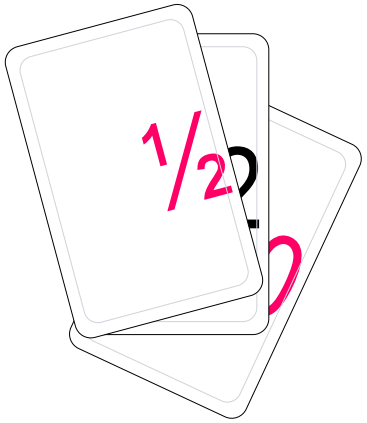
IF consensus reached

BREAK

Provide reasoning for outliers

}

}



0 ½ 1 2 3 5 8 13 20 40 100

Advantage: reduced influence of opinion leaders

(Grenning 2002)

Planning Poker construction kit

0	½	1	2	4	8
16	32	64	128	256	 Break

Delphi advantages

- Combines multiple expert opinions (cross-functional team)
- Aims at consensus
- Minimizes influence of opinion leaders
- Constrained set of values
  - Indicates uncertainty of estimates
  - Shortens discussion about estimates
- Easy to learn and easy to execute

Delphi Rules – 12 expert estimation principles

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1. Evaluate estimation accuracy, but avoid high evaluation pressure
2. Avoid conflicting estimation goals
3. Ask the estimators to justify and criticize their estimates
4. Avoid irrelevant and unreliable estimation information
5. Use documented data from previous development tasks
6. Find estimation experts with relevant domain background and good estimation records
7. Estimate top-down and bottom-up independently
8. Use estimation checklists
9. Combine estimates from different experts and estimation strategies
10. Assess the uncertainty of the estimate
11. Provide feedback on estimation accuracy and task relations
12. Provide estimation training opportunities

Source: Jørgensen, 2004

Estimation and Prioritization

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Agenda

Prioritization

Effort Estimation

Summary

Involvement of a Test Architect in effort estimation and prioritization

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Understand

- Purpose of effort estimations and consequences of over- or under-estimation
- Any estimation method is better than none
- Prioritization helps to select the (most) important items from a set

Analyze and assess

- Actively identify estimation cost factors across the whole lifecycle and their impact

Contribute and drive

- Support and conduct effort estimation repeatedly in a project
- Create your effort knowledge base as an asset for the future
- Establish effort estimation techniques in your change process
- Prioritize the items in large sets (e.g. requirements or test cases)

Strategic thinking?

A good decision is based on knowledge and not on numbers.

[Plato]

Further readings

Use the SSA Wiki :
https://wiki.ct.siemens.de/x/fReTBQ

and check the “Reading recommendations”
https://wiki.ct.siemens.de/x/-pRgBg

- Architect's Resources:
  - Competence related content
  - Technology related content
  - Design Essays
  - Collection of How-To articles
  - Tools and Templates
  - Reading recommendations
  - Job Profiles for architects
  - External Trainings
  - ... more resources

Backup material (Summary)

Why "Prioritization"

Prioritization is used to select

the (most) important items from a set.

Typical sets in focus are

- Projects or Work Packages
- Requirements
- (solution, supplier, …) alternatives

Why "Estimation"

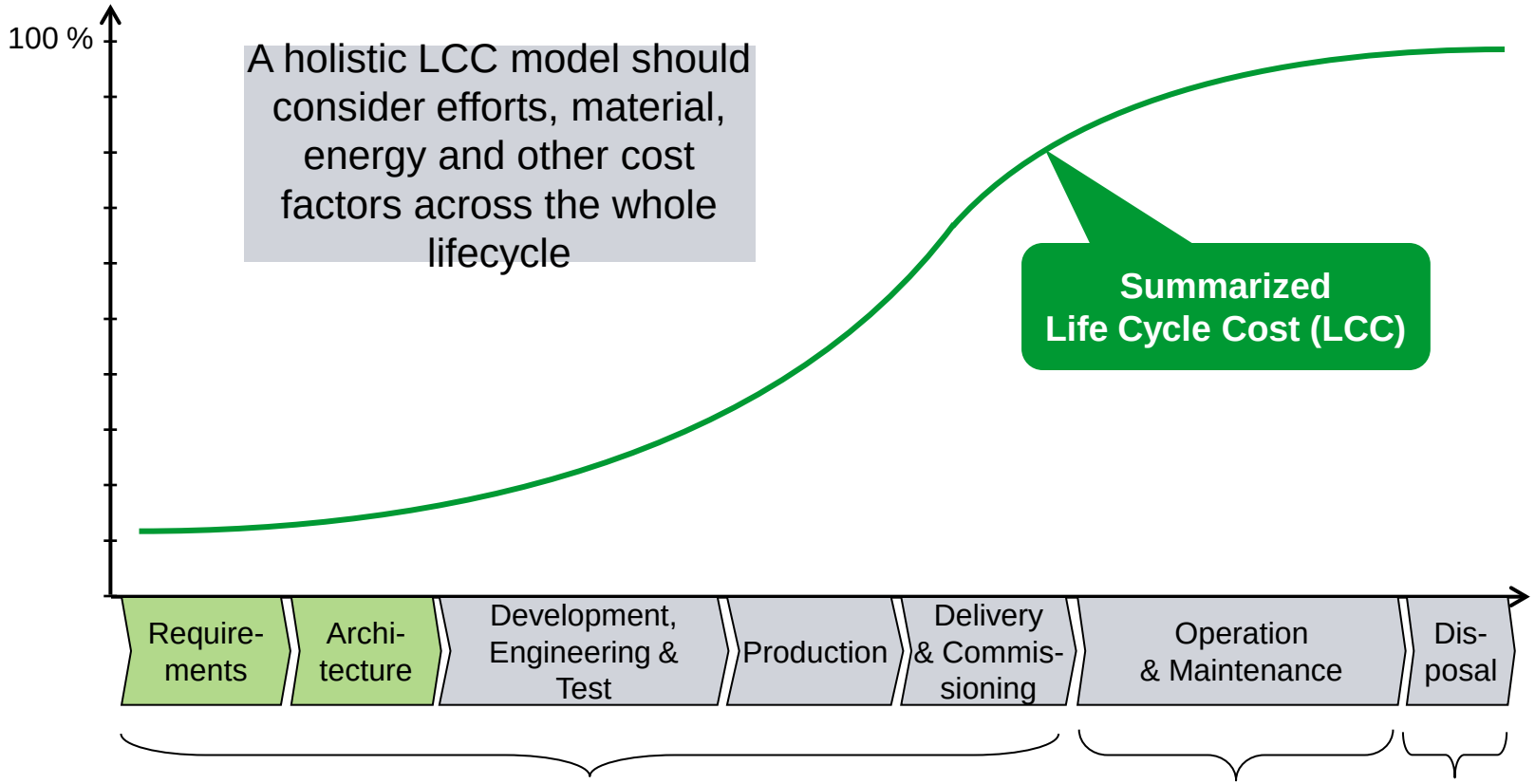
Estimation is used to get initial values for

prioritization or decision criteria

or engineering sizes,

for which real data are not yet available.

What is Lifecycle Cost (LCC)



$LCC = Cost_{disposal} + Cost_{acquisition} + Cost_{ownership}$

Examples for cost categories

- **staff / effort**
- **consulting**
- **energy**
- **material**
- **manuals**
- **trainings / hand overs**
- **transportation / shipping**
- **floor space**
- **storage**
- **tools**
- **supplies**
- **…**

- financing
- insurance
- public relations
- taxes
- customs
- public charges
- warranty
- supplements for risks
- penalties
- …

Lifecycle cost (LCC) accuracy

LCC analysis is not an exact science!

- It does not provide exact number
- It is (only) an estimate
- It depends on experience and assumptions
- Many parameters would be necessary, but only a few are known

LCC does provide insight to major cost factors and (at least) the magnitude of costs!

For increasing the accuracy involve the right experts!