ESTIMATING PROJECTS

When it Comes to Estimating

- We can estimate things we know
- We can estimate things that are like/similar to things we know
- We can't estimate what we don't know

So How Do We get to Know?

- Ask an expert
- Break a complicated task into simple tasks we do know
  - A house is just a collection of bricks, pipes, tiles, wire and cement
- Use Rules of Thumb
  - In North America a house costs $100/sq. ft. It's not completely accurate, but it get's you started

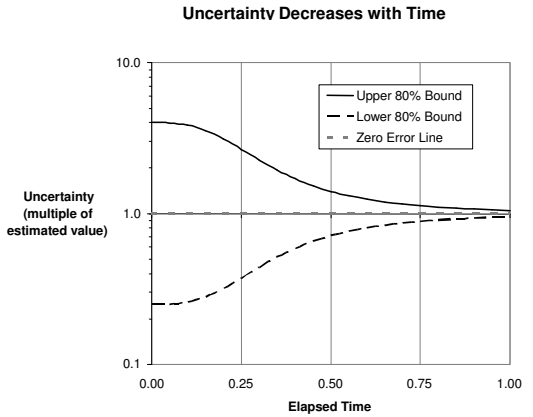
- Compare it to something we do know.
  - "We did a project like this last year…"
- Estimate in Project Phases
  - Will the client pay for the design and then use the design to estimate the implementation?

Problems and Challenges

- We tend to estimate low early in a project because:
  - People don't tell us everything
  - We think we know more than we do
  - Scope tends to grow rather than shrink
  - Requirements are volatile
  - People often think things are easier than they are
  - Some things are taken for granted and not counted/considered

Stages in Estimating

- Estimates get better as we go through a project…



Early Stage in Estimating

- Estimates get better as we go through a project…
  - Order of Magnitude Estimate- Final cost should be within 10 times of what is estimated. Usually a high level estimate to decide if a project is worth considering. Usually based on a off-the-cuff guess by one or two "experts."
    - How long will it take and how many people will it require?

Intermediate Stage

- COnstructive COst MOdel (COCOMO)- How many lines of code will be required?
  - Programs can be:
    - **Organic-** Small, simple to implement with experienced teams
    - **Semi-detached-** Teams with mixed experience will face some rigid requirements
    - **Embedded-** Projects must be developed within strict hardware, software and operational constraints

COCOMO Equation

$$P = \frac{a_b (KLOC)^{b_b}}{c_b E^{d_b}}$$

Effort in person-months = E

Development time in months

- KLOC is the estimated number of software lines of code (SLOC) for the project (in thousands)
- P is the number of people required
- a_b, b_b, c_b, and d_b are constants from the following table…

COCOMO Constants

Project:	a_b	b_b	c_b	d_b
Organic:	2.4	1.05	2.5	0.38
Semi-Detached:	3.0	1.12	2.5	0.35
Embedded:	3.6	1.20	2.5	0.32

Intermediate COCOMO

- The COCOMO formula can be enhanced to deal with quality issues, reliability, complexity, size of databases, team capabilities, memory constraints, turnaround time, use of CASE tools, etc.

Problems with COCOMO

- How many SLOC do we need?
  - We won't know until we finish our detailed design
- A better tool for older procedural programming environments (COBOL, FORTRAN, C, PERL)
  - Harder to count lines in event driven languages like Java, C++, VB
- All SLOC are not as easy to create

Function Point Analysis (FPA)

- From General Requirements, features are counted:
  - Screens
  - Reports
  - Functions
- Functions are broken into complexity and a metric assigned to each

FPA Matrix

Days of Effort	Easy	Medium	Hard
Screens	1 d	2 d	4 d
Reports	2 d	4 d	6 d
Procedures	2 d	5 d	7 d

FPA Calculation

- These numbers can then be plugged into a table:

	Easy	Medium	Hard	Total
FPA Count				
Screens	20	17	5	**42**
Reports	7	3	1	**11**
Procedures	12	8	4	**24**
Total Features	***39***	***28***	***10***	***77***
Estimated Effort (days)				
Screens	20	34	20	**74**
Reports	14	12	6	**32**
Procedures	24	40	28	**92**
Total Effort	***58***	***86***	***54***	***198***

Other FPA Notes

- FPA is useful for event driven projects: lots of screens, procedures, reports.
- Developed to estimate coding effort but can easily be used to estimate Testing effort as well. (How much Integration Testing is required?)

Top-Down Estimation

- Most accurate but is a lot of work
- Normally derived using a “Work Breakdown Structure” (WBS) from Microsoft Project or some other tool
- Start with a high level list of key tasks and decompose each until you have a handle on what’s involved for each task and how long it will take.

WBS

- Normally only done as part of the Project Plan (once the business is won); not usually used in a proposal stage (unless a Detailed Design is available)
- Needs to consider fixed costs (Hardware, software licensing, facilities) as well as labour costs and expenses

References

- Stutzke, R.D., “Improving the Accuracy of Early Software Estimates”. March 5, 2005. Available at: http://sw-estimation.com/papers.html
- http://en.wikipedia.org/wiki/COCOMO