

Top 10 Things You (Probably) Did Not Know About Estimation

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Quick Introduction

- Estimation is a problem at almost every IT and Software Development company
 - The Denver airport baggage handling system required an additional 50% of the original budget - nearly \$200m
 - Taurus, the automated transaction settlement system for the LSE was canceled after 5 years of failed development. Losses are estimated at £75m for the project and £450m to customers
 - Virtual Case File (FBI) – scrapped after \$170 million
- Proper estimation practice = science of the estimation methodology (i.e. math and statistics) + co-operation between business and technical teams
- This presentation is more about co-operation and understanding ...



Agenda



- Are we good at estimating in general?
- Estimates, Targets, Commitments: are they all the same?
- “Cone of Uncertainty” – What is it?
- How do we set ourselves up for failure even before the start of the project?
- Accuracy vs. Precision vs. Reliability: what is the difference?
- Effort and Duration: how to understand them?
- How do we improve our estimation efforts?
- Three Degrees of Project Freedom
- Five Degrees of Project Freedom
- Is there a place for negotiations?



You Are Not An American, Are You?



- In 1942 the Red Army suffered several disastrous defeats at the hands of Germans and lost close to 5 million soldiers
- Around that time Soviet dictator Joseph Stalin summoned one of country's leading military airplane designers and his personal senior weapons adviser general Alexander Yakovlev to his office in Kremlin:
 - **Stalin:** *“Your assignment is to come up with a design of a new airplane and put it in full production. Of course, it has to be the best fighter plane in the world. You have three months ...”*
 - **Yakovlev:** *“Designing a new fighter plane is a very complicated project. For example, it takes the Americans on average two to three years to put a new plane in full production ...”*



General A. Yakovlev

You Are Not An American, Are You?



- **Stalin:** *"But you are not an American, are you, comrade Yakovlev?"*
- **Yakovlev:** *"No, comrade Stalin, I'm definitely not an American"*
- **Stalin:** *"In that case, three months should be sufficient"*
- Yak-3 was indeed designed and put in full production in three months. It became one of the most feared Soviet airplanes in World War II



You Are Not An American, Are You?



- However, in his memoirs Yakovlev remembers a very difficult moment almost three years later when he was again summoned to Stalin's office in Kremlin
- The dictator proceeded to tell him that there were some serious problems with the airplane design, including bad quality paint, overlooked during the initial development
- Stalin accused the general of being a saboteur and promised to prosecute him to the fullest extent of the law, which basically meant a one-way ticket to a prison camp in Siberia
- According to Yakovlev's memoirs, it took them another several weeks of 24/7 work to somehow address the issue and avoid prison



You Are Not An American, Are You?



- The reason I like to tell this story is because it illustrates perfectly what exactly happens when we ignore common sense and impose unrealistic estimates on our project team members
- No matter how much pressure you apply on your people, no matter how afraid they are, if it takes two to three years to deliver a quality product, it is practically impossible to do it in three months



Quiz: Are We Good at Estimating?



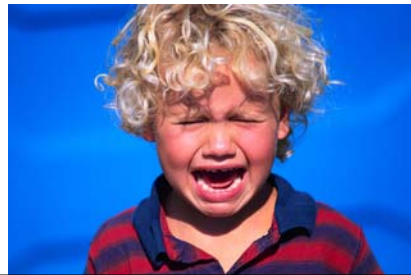
- Provide me with estimates (min and max) for:
 - Distance between New York and Paris (km or miles)
 - Area of Australia (km² or mi²)
 - The year of Alexander the Great's birth
 - Weight of the largest elephant on record (kg or lb)
 - Surface temperature of the Sun (C or F)
- Note: I need a 90% confidence; you have to provide ranges



Quiz Results



- The results are:
 - We are not very good at estimating!
 - “90% confident” translates into “20-40% confident”
 - Why do you think you “missed” with your estimates?
 - Was there an internal pressure to make ranges narrower? Why?



What is an Estimate?



- “An assessment of the likely quantitative result. Usually applied to project costs and durations and **should always include some indication of accuracy (+/- x percent).**”
 - A Guide to the Project Management Body of Knowledge (PMBOK), Project Management Institute.



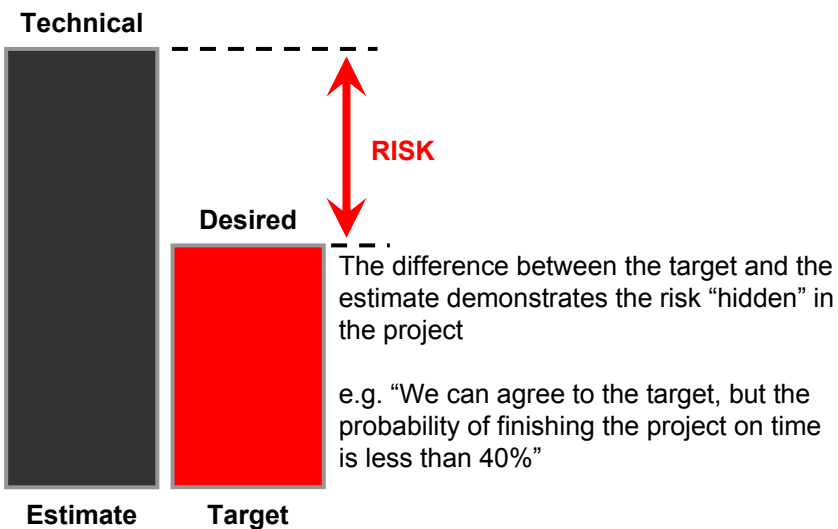
Bad vs. Good Estimates



- Your customer just asked you to do a project. He has a target in mind and wants to know if you can do it ... You can:
 1. Agree to whatever your customer demands OR
 2. Come up with a pure guesstimate, double it, then double it again just in case
- Why are these approaches bad?
 1. Target may be completely unrealistic (it usually is)
 2. Inefficiency and Parkinson's Law
- According to Standish Group typical IT/SD project statistics are:
 - 54% of projects are late
 - 18% fail outright

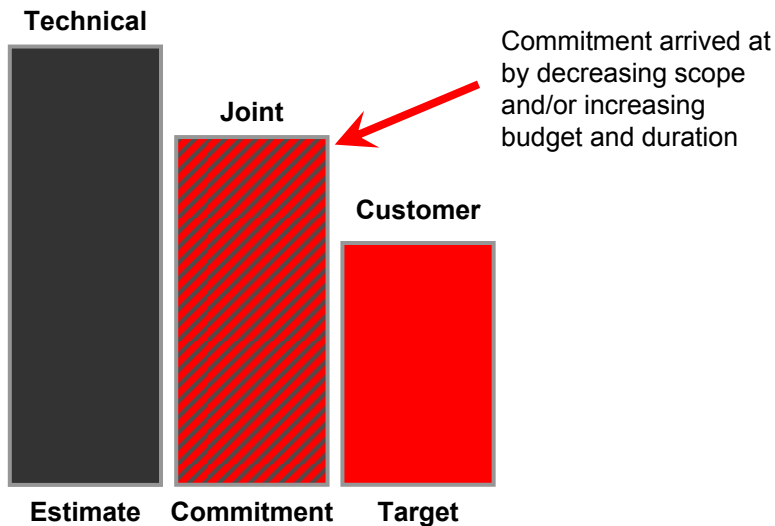
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Estimates, Targets, Commitments



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Estimates, Targets, Commitments

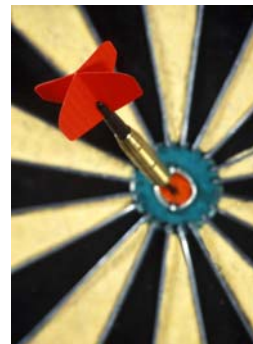


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Estimates, Targets, Commitments



- When you are **estimating** you are answering questions like:
 - How much will it cost us to do Task A?
 - How long will it take?
- When you are **targeting** you are answering questions like:
 - Can we do Project Y in 12 months for \$650,000?
 - Can we build these features by 12-Nov-2008?
- When you are **committing** you are making statements like:
 - We will deliver the project for \$500,000 and by 05-Apr-2007

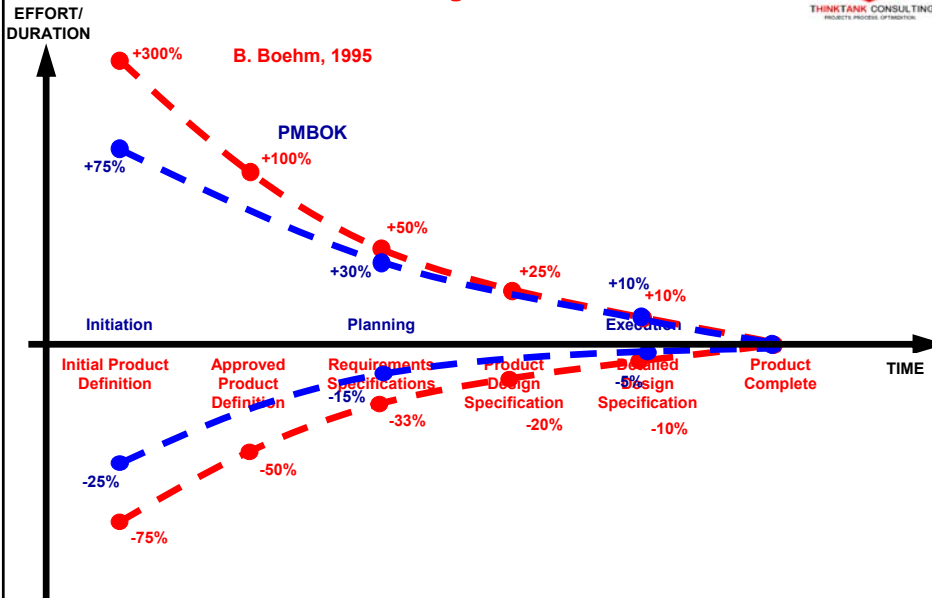


Uncertainty in Estimation

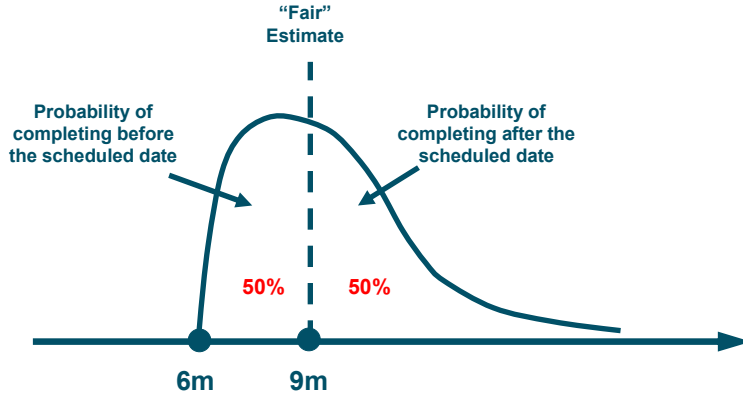
- Will the customer want Feature X?
- Will the customer want the “Honda Civic” or “Ferrari” version of Feature X?
- If you implement the “Honda Civic” version of Feature X, will the customer later change his mind and demand the “Ferrari” version after all?
- How will Feature X be designed?
- How long will it take to debug and correct mistakes made in implementing Feature X?



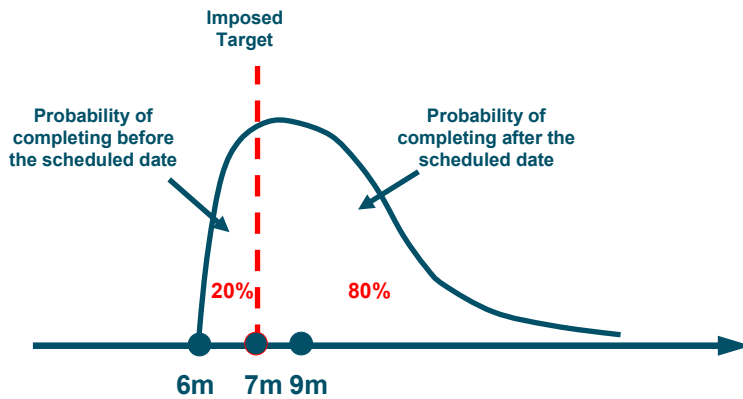
Cone of Uncertainty



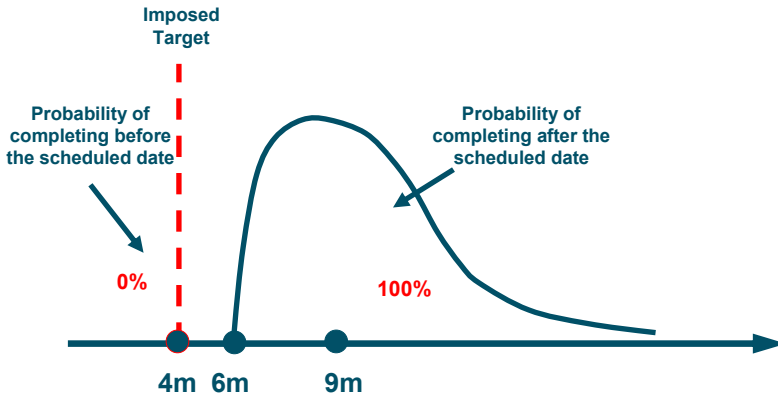
Estimates vs. Probabilities



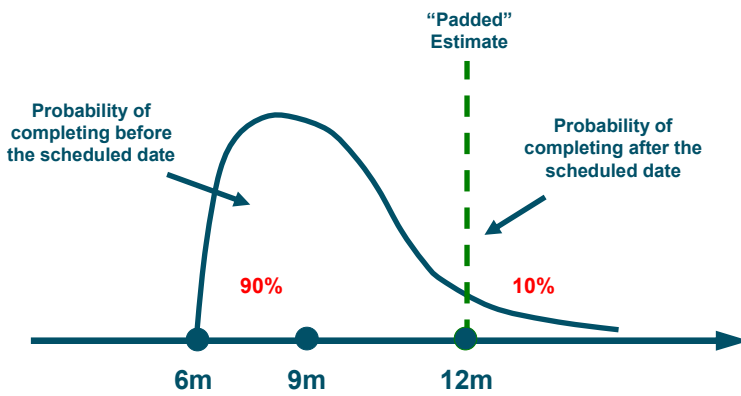
Estimates vs. Probabilities



Estimates vs. Probabilities



Estimates vs. Probabilities



Accuracy, Precision, Reliability



- An **accurate** estimate (no matter how “wide” it is) describes a range that includes the actual outcome
 - e.g. estimate range - 5-11 weeks
 - Actual duration - 7 weeks
- **Precision** of an estimate is the exactness of the numbers provided
 - e.g. total project effort = 1,275.49 hours
- **Reliability** of the estimate implies you are confident enough in it to make project commitments based on it
 - e.g. estimated duration – 9-14 months
 - “I’m 90% sure we can do it in 12 months”



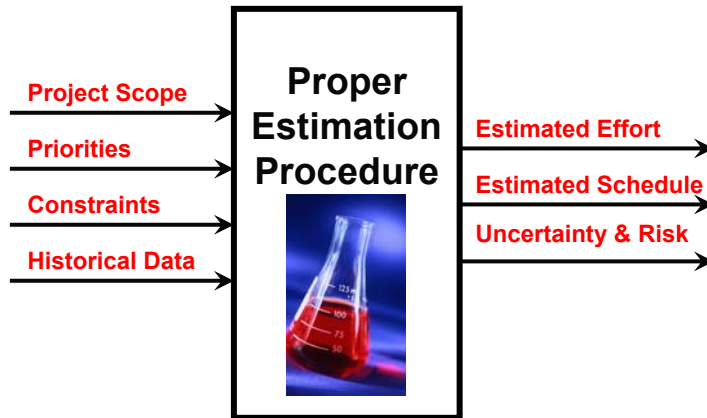
Effort and Duration



- Effort
 - Measured in man-hours, man-days, man-months, etc.
 - e.g. Project Effort – 8 man-months
 - Not to be confused with duration!
- Duration
 - Total length of the project from initiation to closure
 - e.g. Project Duration – 3 months
- Relationship between Effort and Duration:
 - Effort – 12 man-months
 - Project Team – 2 people
 - Project Duration – 6 months
 - Warning: if it takes 1 woman 9 months to deliver a baby, it does not mean 9 women can do the job in 1 month!



Improving Estimation

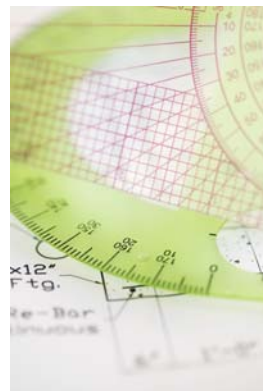


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Improving Estimation

■ What you know and what you are trying to find out leads to different estimation approaches:

- Top-Down
 - Analogy (Comparison of whole projects or tasks)
- Bottom-Up
 - Requirements-based (Bottom-Up, based on the Requirements Document)
 - Design/Architecture-based (Bottom-Up, based on the Detailed Design Document)
 - WBS (Bottom-Up, tasks from the Project Plan)



Historical Data



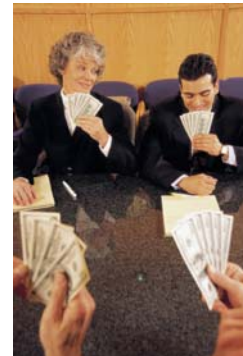
Product	LOC	Staff		Cost in 1994	
		Years	Year	Dollars	\$ / LOC
IBM Chief Programmer Team Project	83,000	9	1994	594,000 *	\$7 *
Lincoln Continental	83,000	35	1989	2,189,975	\$26
IBM Checkout Scanner	90,000	58	1989	3,649,959	\$41
WinWord 1.0	249,000	55	1989	3,406,628 *	\$14 *
NASA SEL Project	250,000	24	1994	1,584,000 *	\$6 *
Putnam & Myers Average Shrinkwrap Product	250,000	42	1994	2,772,000 *	\$11 *
Lotus 123 v. 3	400,000	263	1989	26,766,364	\$67
Citibank Teller Machine	780,000	150	1989	16,059,818	\$21
Putnam & Myers Average Systems Product	3,000,000	1880	1994	124,080,000 *	\$41 *
Windows NT 3.0	4,000,000	3000	1994	150,000,000	\$52
Space Shuttle	25,600,000	22,096	1989	1,459,983,483	\$57

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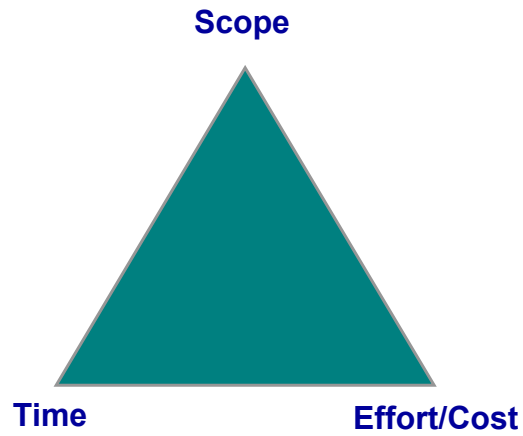
Are We Allowed To Negotiate?!



- Producing the estimate is just the beginning ...
- The first estimates rarely meet expectations of the customers
 - They don't match delivery dates
 - Can't be done with the available project staff
 - Can't be done within the available budget
- Negotiating is the next (**frequently omitted**) step that involves:
 - Comparing the estimate and the target
 - Examining budget and schedule risks
 - Analyzing "what if" scenarios
 - Making trade-off decisions

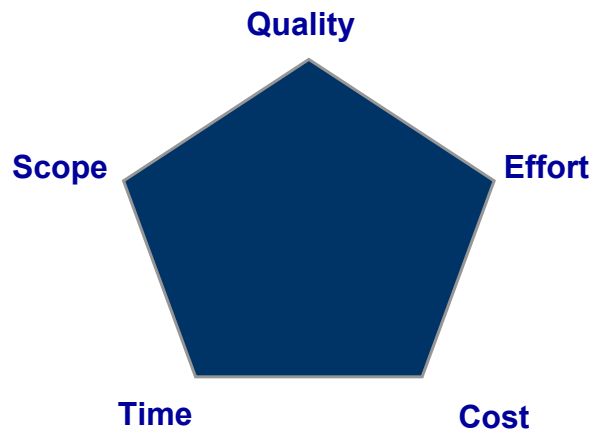


Three Degrees Of Project Freedom



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Five Degrees Of Project Freedom



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Are We Allowed To Negotiate?!



- Don't hate the customer!
- Agree to respect both targets & estimates (both of them are frequently legitimate positions)
 - e.g. "We have to finish NHL 200X for the E3 in July!"
- **However**, understand what the target represents, don't take it at face value
- Always drill down into all statements
- Question "why?" is your best friend



"How Bad Do You Want This?"



- Suggest **scope** degrees of freedom:
 - Can we move some of the desired functionality into version 2?
 - Can we deliver the product in stages?
 - Can we cut features altogether?
 - Can we polish some features less?
 - Can we relax the detailed requirements for each feature?



“How Bad Do You Want This?”



- Suggest **resource** degrees of freedom:
 - Can we add more developers?
 - Can we add more experienced developers?
 - Can we add more testers?
 - Can we add more administrative support?
 - Can we increase the degree of developer support?
 - Can we eliminate company red-tape?
 - Can we increase the level of end-user involvement?
 - Can we increase the level of executive involvement?



“How Bad Do You Want This?”



- Suggest **schedule** degrees of freedom:
 - Can we set a schedule goal but not an ultimate deadline?
 - Can we set a project goal of short schedule, and look for ways to reduce time during requirements, design, and implementation?
 - Can we use estimation ranges, and agree to refine them as the project progresses?
- **Note: You will be surprised how much freedom you can gain by asking the right questions!**



“How Bad Do You Want This?”



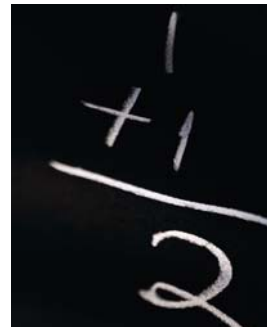
- Large international bank:
 - SVP: “We have to finish this regulatory project in 6 months”
 - PM: “Our estimates suggest 9 months ...”
 - SVP: *It HAS to happen!*
 - PM: “We don’t have any extra resources and we can’t outsource. However, our analysis suggests that assigning 2 finance managers from your department can speed up requirements and design phases ...”
 - SVP: “They are too busy working on other stuff ...”
 - PM: “What priority do you assign internally to this project?”
 - SVP: “It is the most important one in our portfolio ...”
 - PM: “Well?...”
- What do you think happened?

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Negotiating Tips



- Don’t negotiate the estimate itself
 - i.e. $2+2 = 5$
- Insist that the estimate be prepared by a qualified party
 - i.e. by project team members and not the customer or sales manager
- Insist on a rational estimation procedure
- Insist on real, not imaginary tradeoffs
 - e.g. adding one developer will not decrease the project duration by 70%
- Weather the storm!
 - It is much better to suffer a bit initially than to live through a “doomed” project for 6 months



Negotiating Tips



- “I take your being upset seriously”
- “I want to be sure I understand your interests”
- “Help me understand what you need to get out of this”
- “I’m sorry I’m not able to give you the answer you were hoping for”
- “I hear you saying X”
- “We both want the same thing, let’s focus on how to get that”
- “Let’s walk through how we created this estimate”



Negotiating Tips



- “Put on a CEO hat” by focusing on corporate goals and help make ‘difficult’ as opposed to ‘blind’ decisions
- Example:
 - Sales – “Customer can only pay \$100,000 for the project
 - IT – “Actual cost will be \$150,000”
 - Possible Solution:
 - Consider decreasing the project scope and/or
 - Accept the loss on the initial sale and try to “make some money” on subsequent sales and/or
 - Consider engaging the customer more actively in the project
- Success and positive track record will lead to your opinion being listened to, respected, and your concerns taken seriously



Presentation Of 'Quick' Estimates



- Plus-or-minus qualifiers
 - e.g. "6 months \pm 2 months"
- Ranges
 - e.g. "4 months to 8 months" (problem with this one)
- Cases
 - Best case – 4 months
 - Most likely – 6 months
 - Worst case – 8 months
- Coarse dates and time periods
 - e.g. "3 Quarters" instead of "270 days"
- Confidence factors
 - e.g. "We are 95% sure the project will be done in between 90 and 118 days"



Summary



- We are not very good at estimating
- Estimates, Targets, Commitments are not the same
- There are always +/- qualifiers associated with estimates
- Do not set yourself up for failure even before the start of the project
- Accuracy, Precision and Reliability
- Effort and Duration
- Historical data, knowledge of estimation methodology and co-operation – keys to estimation success
- Degrees of Project Freedom and what happens if you abuse them
- Principled Negotiations

Questions

