

## Deeper 🚫

- On what “data” are our estimates based?  
*Requirements, specifications, and designs.*  
*Previous experience with this type of product.*  
*Previous experience with this team of people.*  
*Previous experience with these tools.*

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## Deeper 🚫

- What kind of “analysis” contributes to our estimates?  
*We develop requirements, specification, architecture and designs.*  
*We break down each component into tasks.*  
*We enumerate the difficulties that might be associated with each task.*  
*We estimate the size and difficulty of each task.*  
*We attempt to quantify the risks and develop plans to address them.*

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## Deeper 🚫

- What kinds of uncertainties prevent us from giving a single number for an estimate?  
*Exactly what work needs to be done.*  
*How difficult it will be, and how many problems will arise.*  
*What resources will be available, and what other commitments they may also have.*  
*How productive we will be in the predicted work and dealing with the problems.*

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## Deeper 🚫

- Why might different people give different estimates for the same task?  
*They have different expertise & experiences.*  
*They anticipate different problems.*
- What should we do if you get a wide range of estimates for the same task?  
*Understand why they differ.*  
*Perhaps one estimate is better than the other.*  
*Perhaps this task just has high uncertainty.*

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## Deeper 🚫

- Why would different techniques yield different estimates for the same task?  
*They are different models, based on different parameters.*
- What should we do if there are wide discrepancies between models?  
*Try to understand the differences.*  
*Perhaps one model is better suited to this problem.*  
*Perhaps this task just has high uncertainty.*

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## Deeper 🚫

- Why should a design enable us to produce better estimates than an architecture?  
*Because the design spells out, in greater detail what is to be done. We can analyze the work at a finer grain of detail, and better understand the potential difficulties that might arise in the process.*
- How well could you estimate the size of a component? A module? A routine?

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## Deeper

- Why aren't all estimates prepared at the finest level of detail?  
*It requires the components to be designed and the tasks to be enumerated at a finer level of detail. This is time consuming, and we may not yet be ready to get to that level of detail.*
- How can we deal with this problem?  
*Allocate enough time to do good estimates. Iteratively revise the estimates as the plans evolve.*

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## Deeper

- What could happen if we're way low?  
*We will set expectations we can't fulfill.*
- What could happen if we're way high?  
*Management will give up on the project.*
- What could happen if we can't justify it?  
*Management will simply say "then lower it". We will look like incompetent amateurs ... which is, in fact, how we are behaving.*

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## Deeper

- What should we do if management questions some of our assumptions?  
*(a) Seek better validation for our assumptions.  
(b) Prepare a schedule based on alternate assumptions (which is why automated tools are so critical).*

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## Deeper

- How might we go about narrowing a confidence band?  
*Do more research.  
Go find an expert in this particular area.  
Do the next level of design.  
Build prototypes of things about which we are unsure.*

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## Deeper

- Are any of these not predictable or inevitable?  
*Requirements analysis should show us weak spots in our requirements.  
Review should find problems with designs and estimates, and identify potentially difficult areas.  
Required tools/techniques follow from design, and prototyping can mine-sweep potential issues.  
A good plan should enumerate the external dependencies.*

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## Deeper

- How can we predict which problems might turn out to be "harder than expected"?  
*We should know, when we design a component, if it is simply a reapplication of well proven technology, or if it involves moving into new areas.  
When we realize that we are moving into a new area, we can do research (or ask other people) about the level of difficulty we are likely to encounter.  
If we don't have much information, it would be prudent to assume the worst, and perhaps to do some additional research and prototyping.*

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## Deeper ●

- What does “adequate commitment” to a schedule mean?

*Ideally, it means that everyone who is expected to work on this project understands what they have to do, and is confident they can do it.*

*Usually, it means that senior people in each group have made this assessment and commitment.*

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## Deeper ●

- What is an external dependency, and how would we know how reliable it was?

*An external dependency is anything we need, that we cannot create or control ourselves (e.g. tools, equipment, other code, services).*

*Do they already have the thing we need?*

*Have they done this kind of thing before?*

*How difficult is it, and how good is their team?*

*How committed are they to meeting our needs?*

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## Deeper ●

- What kinds of resource and schedule changes could we reasonably anticipate?

*We know that people will take vacations and get sick.*

*In a large (many people for a long time) project, we might reasonably anticipate there will be staff turn-over.*

*We can estimate and plan for both of these.*

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## Deeper ●

- How can we formulate reasonable expectations for productivity?

*Start with previous data about how this team has performed, on similar projects, using similar tools and methodology.*

*Then apply adjustments to those numbers, based on apparent differences between this situation and those from which the data was taken.*

*If you don't have data, you are guessing.*

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## Deeper ●

- To what extent are requirements changes anticipatable?

*We cannot predict changes in the market, or the entry of new players (with new requirements), but should have a good sense of how solid the requirements we do have are.*

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## Deeper ●

- When can we create our first estimates?

*As soon as we have a product concept.*

- What would such estimates be based on?

*The first draft requirements, and initial concepts about how such a system could be built.*

- What use could safely be made of such a preliminary (inaccurate) estimate?

*Deciding whether or not it makes sense to further pursue the concept.*

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## Deeper

- When should we revise an estimate?  
*When there are significant changes in the data on which it is based.*  
*At regular intervals (e.g. before the start of each major activity)*
- Give examples of “changing data”?  
*More detailed plans enable better predictions.*  
*We have real productivity to extrapolate.*  
*We see what problems actually arise.*

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## Deeper

- What activities and problems should we consider for requirements development?  
*Activities: time to develop initial concept, elicitation sessions, review sessions, negotiation sessions, writing up reports.*  
*Problems: changing stake-holders, inconsistent requirements, disputes over requirements and priorities, conflicting requirements, inability to achieve consensus.*

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## Deeper

- Why activities and problems should we consider for architecture, design, specification?  
*Activities: several iterations of research, problem-solving, high level design and review, prototypes, writing up proposals and review results, architectural presentations, initial estimates, bringing in new designers as the project evolves.*  
*Problems: changing requirements, changing players, hard problems, false-starts, ...*

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## Deeper

- What activities and problems should we consider for coding and unit-testing?  
*Activities: design reviews, coding, code reviews, unit-test case development, test case execution, debugging, documentation, other check-in processes, status reporting, estimate revision, ...*  
*Problems: changing specifications, interface confusion, difficult implementations and debugging, poor code quality, performance issues, competing demands for staff.*

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## Deeper

- Why activities and problems should we consider for integration and system testing?  
*Activities: development and execution of new test cases, problem isolation, debugging, bug verification, manual exploratory and usability testing, and an unknown number of iterations.*  
*Problems: lots of integration problems, hard to isolate problems, finger pointing, platform testing combinatorics, late arriving changes, pressure to release.*

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## Deeper

- How can we estimate the complexity of a program?  
*Based on the architecture and the design.*  
*Based on previous experience with this type of software.*

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## Deeper 🟡

- How can we estimate programmer productivity?

*Based on the design and our assessment of the complexity of the code.*

*Based on previous experience with this team and this type of code.*

*Applying corrections for differences in the problem, team or tools (e.g. CoCoMo).*

*Realize some things change with program size (e.g. architecture, integration, system test).*

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## Deeper 🟡

- How can we estimate the number of required test cases?

*Formulae based on number of requirements, routines, parameters, function points, lines of code, etc.*

*Based on the complexity of the specifications.*

*Based on the design and our assessment of the size and complexity of the code.*

*Based on previous experience with this type of software.*

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## Deeper 🟡

- How can we estimate the number of bugs we expect to encounter?

*Based on our assessment of the size and complexity of the code.*

*Based on previous experience with this team and methodology.*

*Based on previous experience with this type of software.*

*Applying corrections for differences in this project.*

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## Deeper 🟢

- Do we have techniques to detect and prevent incomplete requirements?

*The requirements elicitation process is meant to gather real customer requirements.*

*The requirements validation process is meant to ensure that all requirements are real and properly understood, ensure they meet objective quality criteria.*

*We should have a good sense of how solid our requirements are.*

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## Deeper 🟢

- Can we assess our confidence in a schedule?

*We know where every number came from.*

*We know which ones are based on good analysis, which ones are based on solid data, and which ones are just guesses.*

*We also have a sense of how complete our planning is (are we sure we've included everything).*

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## Deeper 🟢

- How do we know what kind of experience we need, or what the team will have?

*When we specify the components, we should have a good sense of how complex each of them is likely to be, and what skills will be required to build it.*

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## Deeper ●

- Is there any way to predict problems with a new tool or technique?

*We should always anticipate a learning curve, and expect to have to find and work-around a few problems with any new tool or methodology.*

*A practice project can greatly reduce this uncertainty.*

## Deeper ●

- Is there any way to find out that our design can't be built?

*Show it to the people who we expect to build it and ask them how confident they are.*

- Is there any way to find out that our design won't work?

*Prototypes and design reviews.*