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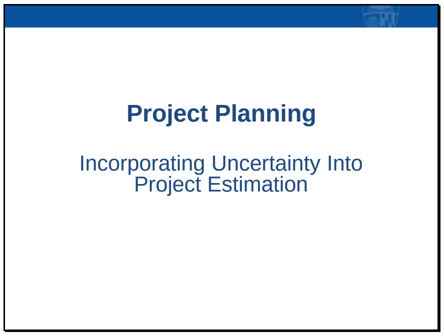

In this lecture we'll discuss some ways to incorporate risk into project estimation.

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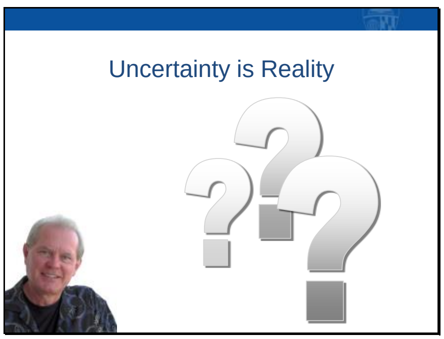

In an earlier lecture we said that an estimate is an approximation of something…such as effort, cost, or schedule. So…in its very definition an estimate connotes inherent uncertainty. If an estimate was a certainty we wouldn't call it an estimate in the first place.

For example, if we were certain how long a task will take or when we will complete it, then we would be able to make very precise statements like

- It will take me 12 hours and 3 minutes to complete that task
- We will complete the project on September 2 at 1:13pm

But…the reality is we can't be anywhere near that precise.

In practice, it is very common to present estimates that give a false sense of precision, because the estimates are presented as point estimates…single numbers. Presenting point estimates will cause people to treat them as "concrete" values.

So…how might uncertainty be incorporated into project estimates? There are two common ways endorsed by the Project Management Institute: present a range of values for estimates, and quote probabilities associated with estimates.

But…how can we come up with ranges that make sense? And how can we come up with probabilities?

In this lecture, I'll discuss a technique that can be used to state a range of values for project estimates. In the next lecture, I'll discuss how this same technique can be extended to present estimates and associated probabilities.

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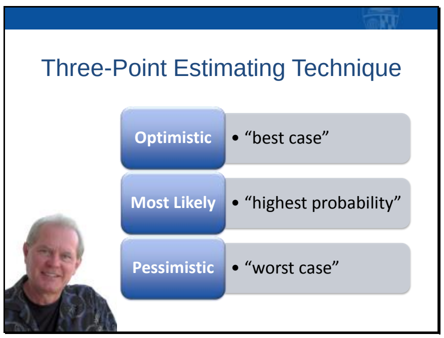

The technique that I want to share with you is called the three-point estimating technique. As its name implies, it involves making three estimates of something. It can be used to make estimates of things like effort, cost, size, or schedule and incorporate the degree of uncertainty.

The three estimates are an optimistic estimate, a most likely estimate, and a pessimistic estimate.

The optimistic estimate is associated with the absolute "best case" scenario that could happen. For example, if estimating effort or schedule, the best scenario might involve assigning the most experienced staff to do the work or timely customer approvals. The chance that the actual value could be less than the best case estimate should be very low.

At the other extreme is a pessimistic estimate. The pessimistic estimate is associated with the absolute worst case scenario that could happen. The chance that the actual value could be greater than the pessimistic estimate should be very low.

Somewhere in between the optimistic and pessimistic estimates is the most likely estimate. It should be the one that we feel is most likely to occur.

Now, in practice, it is very important to document all the assumptions that are associated with each of these estimates…because if the assumptions turn out to be untrue or do not occur, then the estimate may be invalid as a result.

Let’s take an example.

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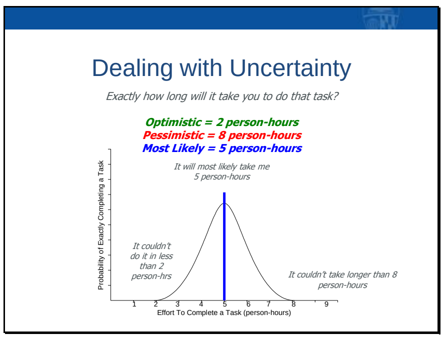


Let’s apply the three-point technique to the estimation of a single project task. Suppose we need to estimate the effort associated with the task…in other words, how many person-hours the task will require.

Maybe we think that under the best possible conditions the task could possibly be completed in two person-hours…and that it is virtually impossible to be completed with any less effort. So, two person-hours is our optimistic effort.

And, let’s assume that we think that under the worst case conditions the task might require eight person-hours. Realistically, we don’t think it could take longer than that. So, eight person-hours is our pessimistic estimate.

Our most likely estimate should be somewhere the two extremes. Maybe we feel that the most likely effort will be five person-hours. This should be the estimate that we are most comfortable with…the one that would have the highest probability of occurring. So, in this case, five person-hours is our most likely estimate.

Now…let’s look at a visual interpretation of what we’ve just done. In this case, our most likely estimate was equidistant from the optimistic and pessimistic estimates, so there would be a bell-shaped probability distribution around our estimates. In practice, the most likely need not be equidistant.

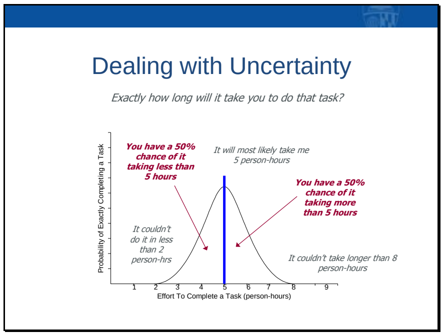
If our optimistic and pessimistic estimates are realistic, then the probability that we complete the task in 2-8 person hours should be 100 percent. If they are not realistic…meaning it could take less than 2 person hours or more than 8 person hours…then the probability will be less than 100 percent. If we feel that the probability is very close to 100 percent, then our optimistic and pessimistic estimates are good enough.

So…which estimates should we use in practice? Many people will quote the most likely. Management and stakeholders will likely choose the optimistic if they have the choice. And…no one will likely believe the pessimistic unless we have clearly documented the assumptions behind it.

One approach is to give all three estimates along with the associated assumptions. Another approach is to quote the pessimistic minus the optimistic. And a third approach is to quote a single estimate that we feel comfortable with.

I'll repeat the Project Management Institute advice to always quote a range or to associate a probability if we're quoting a point estimate. In practice, we are often pressured to use point estimates…particularly if we are making a fixed price bid. So, there may be no easy choice.

Let's explore the probability aspect of our example a bit more.

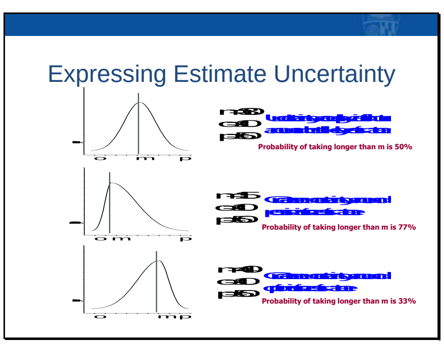
5 

If we look at the probability distribution around our estimates, the area under the curve should be very near to 100 percent. Since the distribution is symmetric about the most likely estimate, 50 percent of the area is to the left of the most likely and 50 percent is to the right.

This means that we have a 50 percent chance of the task taking less than 5 person-hours and a 50 percent chance of it taking more than 5 hours. So…if we quote the most likely estimate, there is a 50 percent chance that the actual effort will fall within 2-5 person-hours. Do we feel comfortable quoting 5 person-hours now that we know a bit more about probabilities? Different people will answer that question differently.

We can see from the illustration that the probability of completing the task within 6 person-hours is more than 50 percent…so we may be more comfortable quoting that as a point estimate. It's not obvious from the illustration what probability is associated with 6 person-hours, but it can, in fact, be calculated, if we apply the three-point technique with a bit more rigor. We'll see how that's done in the next lecture.

But for now, it's important to understand how this technique can be used to express estimating uncertainty.

6 

In the last example, our most likely estimate was equidistant from the optimistic and pessimistic estimates. This resulted in a symmetric probability distribution around the most likely estimate. In practice, the probability distribution can be skewed as illustrated here.

If the optimistic and most likely estimates are close to one another, the probability distribution would look like the one in the middle. It would correspond to greater uncertainty around the pessimistic estimate.

If the pessimistic and most likely estimates are close to one another, the probability distribution would look like the one at the bottom. It would correspond to greater uncertainty around the optimistic estimate.

I calculated the probabilities here for purposes of illustration. It’s not important at this point to understand how the computations are done.

Now…the example I used involved applying the three-point technique to a single work task. The same technique could be applied to all the tasks associated with a project. It could also be applied to estimating cost and schedule…and it can be applied at varying levels of detail.

For example, if expert judgment or a technique like the Delphi method is used in our estimating process, the three-point technique could be used there as well to express uncertainty. The three point technique is particularly useful when we have little historical data or for project types that have never been done before.

In my own work, I have used this technique very successfully, in combination with probability computations, to bid on fixed price software engineering projects.

In the next lecture, we’ll see how to extend the three-point technique to calculate probabilities.