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Decision Tree Analysis: A Means of Reducing Litigation Uncertainty and Facilitating Good Settlements

Marc B. Victor

DECISION TREE ANALYSIS: A MEANS OF REDUCING LITIGATION UNCERTAINTY AND FACILITATING GOOD SETTLEMENTS

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When most attorneys think about litigation uncertainty and how it impacts settling cases, they think mostly about two types of uncertainty: first, the uncertainty regarding what evidence will be available to present at trial; and second, the uncertainty regarding how the judge and jury will react to that evidence and the witnesses—both fact and expert—that present it. And while both of these play an important role in an attorney's and client's willingness to settle, there is also a third type of uncertainty that has a tremendous impact on their willingness—and ability—to settle cases: the uncertainty regarding *whether they have valued their case appropriately*.

In the face of this last uncertainty, lawyers are nervous about making specific settlement recommendations to their clients. And even in those instances when they feel they have valued their cases appropriately, most lawyers are unable to explain their reasoning convincingly to their clients, mediators, or ultimately their opponents, dragging out the time to achieve acceptable settlements.

Why are lawyers uncertain about whether they have valued their case appropriately? There are two potential reasons: a fear of garbage-in and a fear of garbage-out.

"Fear of garbage-in" is the concern that one might not have thought about all the important procedural and substantive issues—related to both liability and damages—that the judge and

jury will consider.[1] It is also the concern that one might fail to appreciate all of the arguments and evidence the trier will give weight to in deciding those issues, and that counsel's assessments of the chance of prevailing on at least some of those issues might not be realistic.[2]

"Fear of garbage-out" is the concern that the settlement value counsel is arriving at might not be truly consistent with the issues counsel has identified and the odds counsel has assessed on each issue.[3] In other words, even if counsel has avoided garbage-in, are they reaching the right conclusion from their analysis of each litigation uncertainty?

The focus of this article is on avoiding garbage-out—reducing the uncertainty surrounding the quality of the settlement values attorneys assign to lawsuits.[4]

I. THE NEED FOR DECISION TRESS ANALYSIS IN VALUING CASES

A simple hypothetical will illustrate how difficult it is to avoid the uncertainty of garbage-out if cases are valued without the help of decision tree analysis—and thus how difficult it is to convince

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1. Marc B. Victor, *Risk Analysis is a Valid, Valuable Tool for Litigators*, LAW360.COM (Mar. 3, 2014, 1:43 PM), http://www.law360.com/articles/514697/risk-analysis-is-a-valid-valuable-tool-for-litigators. "If the party, lawyer, or mediator constructing the tree has not thought carefully about the possible twists in the litigation process, if they have not researched and analyzed the case and the factual evidence, and considered whether damages assertions can be proven, the resulting tree will be of no value." Majorie Corman Aaron, *Finding Settlement with Numbers, Maps, and Trees*, in THE HANDBOOK OF DISPUTE RESOLUTION 13-17–18 (Michael L. Moffitt & Robert C. Bordone, Eds., 2005), *available at* http://www.law.uc.edu/sites/default/files/Aaron,%20Finding%20Settlement%20with%20Numbers,%20 Maps%20&%20Trees.pdf.

2. A probability assessment is realistic if it reflects what would happen if the issue in question were decided multiple times by multiple judges or juries. Marc B. Victor, *Resolving a Dispute by Getting a Neutral to Provide Probability Assessments*, 31 ALTERNATIVES TO THE HIGH COST LITIG. 36, 36 (2013). Thus a sixty-five percent chance of winning a motion would be a realistic assessment if, when 100 similar motions were argued to 100 similar judges, sixty-five of the judges ended up granting the motion, but thirty-five ended up denying it. *See id.*

3. Victor, *supra* note 1.

4. This is not to say that it is always easy to avoid garbage-in. But previous articles by this author have discussed ways of doing so: creation of a Dependency Diagram, development of Lists of Reasons, and use of a Probability Wheel. Craig B. Glidden, Clyde W. Lea, & Marc B. Victor, *Evaluating Legal Risks and Costs with Decision Tree Analysis*, in SUCCESSFUL PARTNERING OF INSIDE AND OUTSIDE COUNSEL § 12.1, 12.1–12.32 (Robert L. Haig ed., 2013).

yourself, your client, your mediator, and ultimately your opponent, so the case can be settled on reasonable terms. The article will then explain how the use of this tool in the evaluation of litigation eliminates garbage-out, thus facilitating earlier—and better—settlements. Consider the facts below:

> The lawsuit is for breach of contract: Defendant was to supply a component necessary for Plaintiff's launch of a new product line. Plaintiff claims Defendant's component did not meet the contract specifications, causing Plaintiff to incur losses arising from (i) the need to replace the component and (ii) the delays that Defendant's breach caused in the launch of Plaintiff's new product line. Defendant counters that its component did meet the contract specs, and further that the contract does not allow for delay damages, and even if the judge rules that it does, any delays were due solely to Plaintiff's own mismanagement of the new product launch and were completely unaffected by the time it took to swap out Defendant's component.

Now, after reviewing the evidence and witnesses, the law, your experience with judges, juries and verdicts in this venue, and your opinion of opposing counsel, you conclude as follows:

- Plaintiff has a *sixty percent* chance of convincing the jury that the component did *not* meet the contract specifications, though Defendant has a *forty percent* chance of convincing the jury otherwise and walking away with a defense verdict.
- There is a *seventy-five percent* chance the judge will interpret the contract as *excluding* delay damages, but Plaintiff has a *twenty-five percent* chance of a ruling in its favor on this issue.
- *If* the judge rules that delay damages are permitted, there is an *eighty percent* chance the jury will find that the need to replace the component caused *at least some* of the delays, but there is a *twenty*

> *percent* chance the jury will find the delays were *solely* due to Plaintiff's missteps.

- If the jury is awarding *both* delay damages and component replacement costs, there is a *fifty percent* chance it will award $13 million in total, a *twenty-five percent* chance it will award just $10 million, but a *twenty-five percent* chance it will award the full $20 million being sought by Plaintiff for all its losses. On the other hand, if the jury is awarding *only* the component replacement costs, it is undisputed these were $4 million.

In light of these trial risks, and initially ignoring the costs of litigation that could be avoided by settling, what would be an appropriate settlement amount for this case? Once you have decided on, and written down a value, ask yourself these questions: How certain are you? Are you certain enough to convince your colleagues, your client, or your mediator? Or are you so uncertain that you would be uncomfortable trying to explain how you picked your number, or why it should not be ten percent or even twenty percent different?

In fact, try giving the same fact pattern with the same set of probabilities and verdicts to a number of your colleagues, and ask them to value the case. Do not be surprised if their valuations are pretty evenly distributed from $2 million to $8 million. So, even if you at first felt comfortable with your valuation, how sure are you now? Which of your colleagues have misvalued the case by millions? Is it you? How does the client know whose opinion should be relied on? The wrong choice and the client might be vastly overpaying if defendant or leaving millions on the table if plaintiff. Or, the client might be rejecting what is in reality a good deal and heading into court having misjudged the true risks of litigating. And in light of this experiment, the next time you and your opponent come up with different case values, is it necessarily because you have different views of the chances of success on each issue or is it just as likely

that your disagreement over an appropriate settlement value is due instead to the garbage-out problem?[5]

Decision tree analysis offers a sound solution to the problem of garbage-out, thus eliminating one of the major sources of litigation uncertainty and one of the major impediments to settling cases, especially in the early stages. Here is our hypothetical lawsuit in the form of a decision tree:
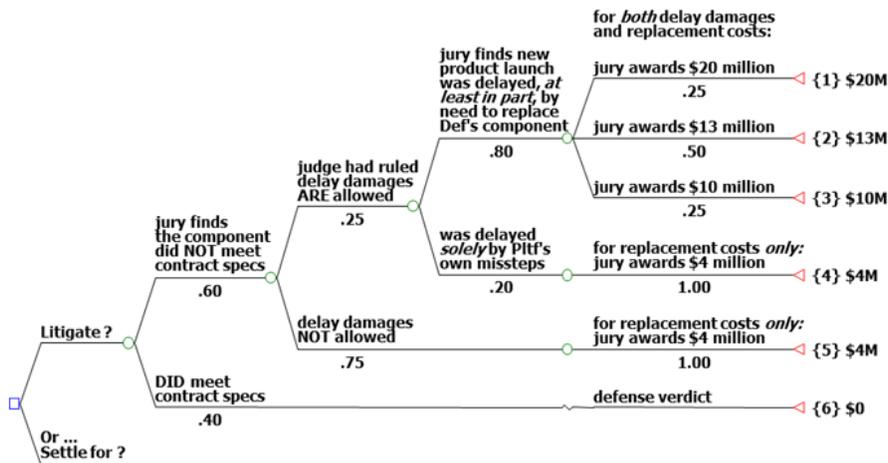

FIGURE 1

Decision tree analysis is the analytical discipline universally used to make better decisions in the face of uncertainty and complexity. In

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5. The likelihood of garbage-out increases tremendously if each uncertainty is described *qualitatively* rather than *quantitatively*. How would you even attempt to value the above lawsuit if you limited your opinions to the following, highly ambiguous, terms:

- Plaintiff has a *good chance* of convincing the jury that the component did *not* meet the contract specifications, though Defendant has a *reasonable shot* at convincing the jury otherwise and walking away with a defense verdict.
- The judge is *quite likely* to interpret the contract as *excluding* delay damages, but Plaintiff has a *fighting chance* of a ruling in its favor on this issue.
- *If* the judge rules that delay damages are permitted, the jury is *very likely* to find that the need to replace the component caused *at least some* of the delays—that the delays were not *solely* due to Plaintiff's missteps—but it is *not a sure thing*.
- If the jury is awarding *both* delay damages and component replacement costs, it will *probably* award $13 million in total, but it *might* award just $10 million, though it *certainly could* award the full $20 million being sought by Plaintiff for all its losses. On the other hand, if the jury is awarding *only* the component replacement costs, it is undisputed these were $4 million.

And how could you ever hope to explain persuasively to your client how you arrived at your settlement number?

addition to being taught for decades in business and engineering schools, it has been taught for years in medical schools to enable doctors to make better life-and-death decisions.[6]

Decision tree analysis is relied on because it has been repeatedly shown that even very smart and very intuitive people are not good at juggling multiple uncertainties in their heads to reach sound conclusions—conclusions that are fully consistent with their analysis of the important underlying issues.

This is especially the case when getting a good overall result for a problem—be it a new business venture, a medical procedure, or a lawsuit—requires (1) success on more than one uncertain factor (especially when these factors might be interrelated); (2) success on any one of several alternative but uncertain paths (especially when these alternative paths might be somewhat interrelated); or (3) doubly so when both of these prior conditions exist. For example, imagine how tricky it is to determine your overall chance of success in a lawsuit where:

> Plaintiffs can prevail (a) if they succeed on *either* their contract or their tort cause of action—though failure on one may have some influence on the chance of success on the other—*but* (b) where success on each cause of action requires success on *both* of two or more underlying elements—though success on one element may have some influence on the chance of success on the other(s).

Without employing the tools of decision tree analysis in such situations, one is far too likely to reach the wrong conclusions and make bad decisions.

There are two primary steps in performing a decision tree analysis of a piece of litigation: (1) creation of a decision tree and (2) use of basic probability arithmetic.

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6. *See* Marc B. Victor & Nelson Tavares, *Enabling Early Case Resolution to Drive Down Litigation Cost*, LITIG. MGMT., Spring 2014, at 33, 34. Typing *medical decision analysis* into Google results in over 13 million hits.

II. CREATING A GOOD DECISION TREE

A. Ordering the Issues

In a good litigation decision tree, the issues the judge and jury are likely to decide are laid out, from left to right, usually in the order in which counsel feels they will be decided. This is typically guided by the law, prior appellate decisions, standard jury instructions, the likely verdict form, and so on. But it should also reflect the experience of counsel, since jurors and even judges do not necessarily decide issues in the order they "should"—and putting issues in the wrong order can sometimes have a major effect on counsel's probability assessments. To illustrate, consider a securities fraud case in which the two major items in dispute are whether the information that was not disclosed was "material," and whether the company had the requisite "scienter" when it decided not to make the disclosure. Case law and jury instructions would typically talk first about the materiality element of the cause of action and later about the scienter element. And defense counsel might feel good about the chance of the jury finding "not material" *so long as the jury focused on that issue first.* But if the jury thought first about the scienter element and found the defendant had intentionally failed to disclose the information, then defense counsel might feel very differently about the probability of the jury finding the non-disclosed information was "not material."[7]

One twist on the "in chronological order" rule is that if the judge's ruling on a particular issue will affect *only* a related jury issue and not earlier, unrelated jury issues, then that judge issue can be placed immediately in front of the related jury issue rather than at the outset of the tree, as was done in Figure 1. But if, for example, the probabilities of the jury finding Defendant's component met or did not meet the specs were in some way influenced by whether they

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7. In one analysis in which the author was involved, two trees were created—one for each possible order of consideration of the two elements by the jury—and solved. *See* discussion *infra* Section III.A. The difference in case values was an indication of how important it was to develop a trial presentation that would encourage the jury to think first about the non-materiality of the information plaintiffs were claiming should have been disclosed. *See* discussion *infra* Section III.A.

were hearing expert testimony on delay damages or not, then the strict chronological order must be adhered to, with the judge's ruling on the issue of whether or not the contract allows for consequential damages placed first in the tree, as shown in Figure 2.[8]
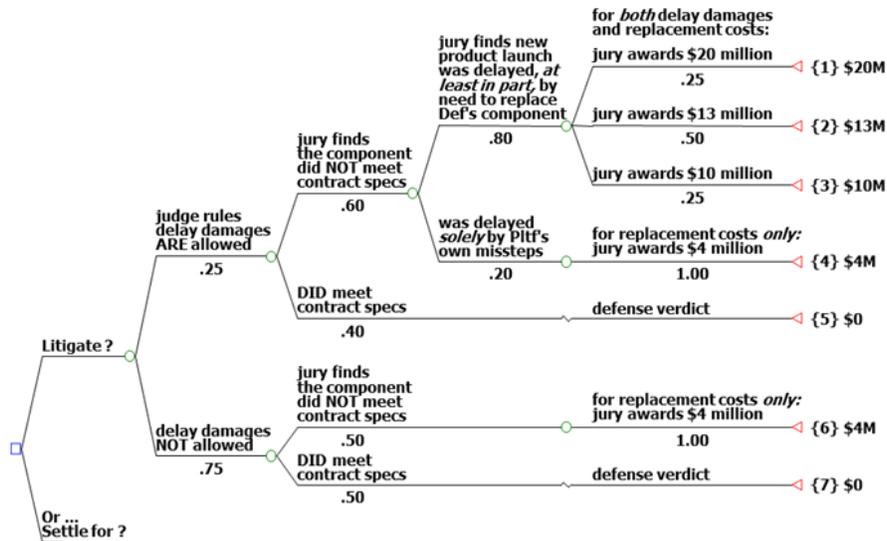

FIGURE 2

B. *Disaggregating Versus Aggregating the Issues*

In a good litigation decision tree, the "depth" to which the issues are drawn should also be guided by how counsel anticipates the judge or jury will approach them. *In other words, the most realistic assessment of case value comes from creating a decision tree that mirrors the way in which the judge and jury will analyze the case.* If the judge or jury will separately consider each of two or more sub-issues—even though they might be interrelated—then these two or

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8. To illustrate this point, note that the probability of the jury finding a breach of contract has been lowered to .50 in the path where the judge has ruled Plaintiff will *not* be allowed to discuss delay damages. This could reflect counsel's view that a jury that never hears such testimony will not be as mad at Defendant and will thus be less likely to want to find for Plaintiff on the issue of breach. Note also that the very exercise of thinking about what is the best decision tree for a particular set of arguments and facts—illustrated in both this paragraph and the previous one—can reduce the risk of garbage-in.

more sub-issues should be broken out separately in the decision tree and be assessed separately. On the other hand, if the judge or jury will combine two or more sub-issues and only decide the overall question—even though in doing so they will give some thought to each of the sub-issues—then only the overall issue should be assessed in the decision tree—albeit with notes indicating the multiple sub-points the judge or jury will be weighing in reaching their single overall conclusion.

Consider for example a fraud claim, with its several elements: Was there a misrepresentation? Was it material? Was it intentionally, or perhaps recklessly, made? Was it reasonably relied on? Did it cause damage? Do you think the jury will *disaggregate* the cause of action into *each* of these elements and vote separately on each, or do you think the jury will *aggregate* the elements and simply vote on the *one* ultimate question of whether fraud was committed or not? Or perhaps the jury will do something *in between* such as: Did the defendant lie to or try to deceive the plaintiff about something important? (Capturing the first three elements of the cause of action in one compound question.) If so, did plaintiff reasonably suffer some injury as a result? (Combining the last two elements of the claim.) Note that any of these three approaches would be consistent with the judge instructing the jury on each of the many elements of a fraud cause of action, and with the jury discussing the evidence presented on each element. But only one will be best when it comes time for you to assess probabilities—the one that best reflects which questions the jury will answer in order to reach its conclusions. This is the approach that should be captured in the way you draw your tree.

C. *Some Basic Building Blocks for Litigation Trees*

As noted at the end of Part I, a finding of liability can sometimes require that a plaintiff succeed on *more than one* uncertain factor. For example, if a plaintiff must prevail on two sub-issues, the liability portion of the tree might look as follows:

PLAINTIFF MUST WIN <u>BOTH</u> OF TWO SUB-ISSUES

Judge/Jury finds for plaintiff on 1st sub-issue (e.g., negligence)

Judge/Jury finds for plaintiff on 2nd sub-issue (e.g., causation) — **Defendant IS Liable**

Judge/Jury finds for defendant on 2nd sub-issue (e.g., causation) — **Defendant NOT Liable**

Judge/Jury finds for defendant on 1st sub-issue (e.g., negligence) — **Defendant NOT Liable**

FIGURE 3

In other instances, liability might result if the plaintiff succeeds on any *one of several* alternative, but uncertain, claims. The liability portion of the tree in this situation, assuming two claims, might look as follows:

PLAINTIFF NEED ONLY WIN <u>EITHER</u> OF TWO THEORIES

Judge/Jury finds for plaintiff on 1st theory (e.g., breach of contract § A) — **Defendant IS Liable**

Judge/Jury finds for defendant on 1st theory (e.g., breach of contract § A)

Judge/Jury finds for plaintiff on 2nd theory (e.g., breach of § B) — **Defendant IS Liable**

Judge/Jury finds for defendant on 2nd theory (e.g., breach of § B) — **Defendant NOT Liable**

FIGURE 4

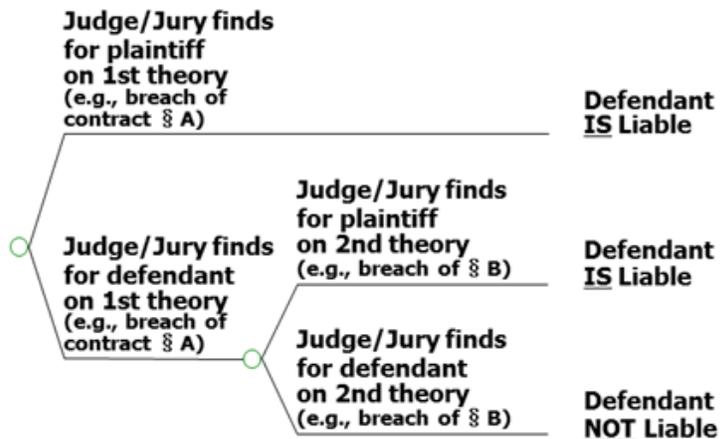If the damages that might be awarded for plaintiff's two claims are different, or if the jury would increase its award should plaintiff prevail on *both* claims—rather than just one claim—then the liability portion of the tree should be expanded, as shown in Figure 5.

PLAINTIFF NEED ONLY WIN <u>EITHER</u> OF TWO THEORIES — *BUT* (i) THE DAMAGES ARE DIFFERENT UNDER EACH AND/OR (ii) LOSING BOTH MIGHT LEAD TO GREATER DAMAGES THAN JUST LOSING ONE OR THE OTHER

Judge/Jury finds for plaintiff on 1st theory (e.g., breach of contract § A)

Judge/Jury finds for plaintiff on 2nd theory (e.g., breach of § B) → **Defendant IS Liable** *for A & B*

Judge/Jury finds for defendant on 2nd theory (e.g., breach of § B) → **Defendant IS Liable** *for A only*

Judge/Jury finds for defendant on 1st theory (e.g., breach of contract § A)

Judge/Jury finds for plaintiff on 2nd theory (e.g., breach of § B) → **Defendant IS Liable** *for B only*

Judge/Jury finds for defendant on 2nd theory (e.g., breach of § B) → **Defendant NOT Liable** *for either*
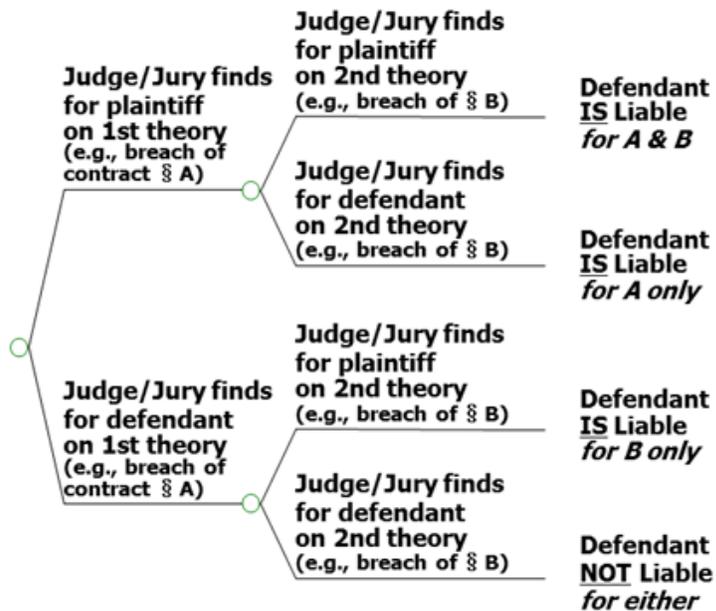
FIGURE 5

In most lawsuits, the jury's answers to the questions on the verdict form will depend to a significant degree on the outcome of one or more "influencing" uncertainties. Influencing uncertainties can include the existence or non-existence of certain evidence or testimony—fact or expert; admission or exclusion of evidence by the judge; whether the judge will give plaintiff's or defendant's desired instruction on an issue; and so on. Inclusion of these influencing

uncertainties results in that portion of the tree being symmetrical, as shown in Figure 6.[9]
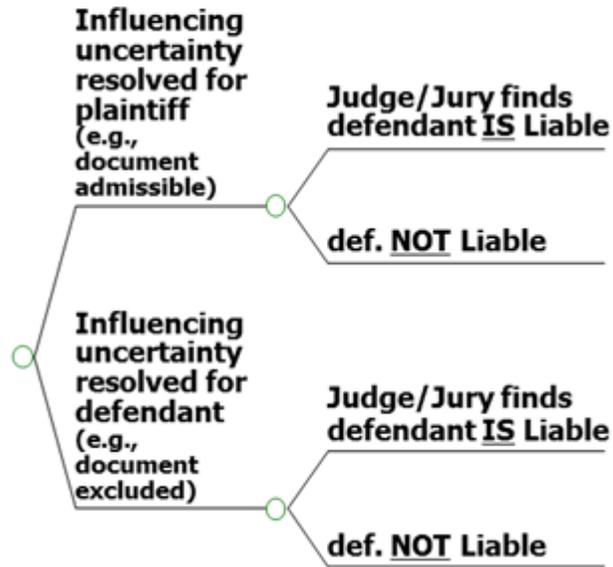
LIABILITY <u>DEPENDS ON</u> SOMETHING

Influencing uncertainty resolved for plaintiff (e.g., document admissible)

Judge/Jury finds defendant <u>IS</u> Liable

def. <u>NOT</u> Liable

Influencing uncertainty resolved for defendant (e.g., document excluded)

Judge/Jury finds defendant <u>IS</u> Liable

def. <u>NOT</u> Liable

FIGURE 6[10]

The subject of disaggregating or aggregating issues also arises very often in the context of analyzing *damages*.[11] The hypothetical in Figure 1 *aggregated* delay damages and replacement costs in the portion of the tree where the jury is allowed and—after finding a causal connection—decides to award the former as well as the latter. Contrast that portion of the tree—with just a single set of three branches to capture the range of the jury's *total* award—with the one

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9. Although symmetrical, the probabilities assessed on the "influenced" issue will ultimately be very different, depending on which branch of the "influencing" uncertainty one follows. *See* discussion *infra* Part III.A.

10. The *damages* portions of a litigation tree can also contain influencing uncertainties, and their inclusion will help counsel more realistically assess how much might be awarded following a finding of liability.

11. *See supra* Part II.B (discussing disaggregating or aggregating issues in the context of liability).

in Figure 7 where the issue of damages has been explicitly *disaggregated* into its two components.[12]

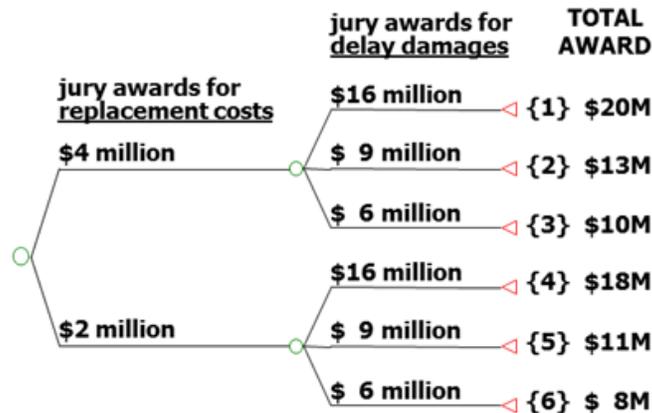## PLAINTIFF WILL BE AWARDED TWO TYPES OF DAMAGES

FIGURE 7[13]

Not surprisingly, all but the least complex of cases will result in litigation trees that combine most, if not all, of the building blocks described in this section.

III. USING BASIC PROBABILITY ARITHMETIC TO SOLVE FOR CASE VALUE

Lawyers have *always* valued cases based on the strength of their liability arguments or defenses and the magnitude of damages realistically at stake. For example, the stronger the plaintiff's case and the larger the likely verdict, the more money plaintiff would require to settle, and the more the defendant would be prepared to pay. Or, the stronger the defenses and the smaller the expected

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12. The replacement costs, for the purpose of better illustrating the concept in Figure 7, were also assumed to be uncertain rather than an undisputed $4 million.

13. *See supra* Part II.A (discussing how to decide whether the uncertainty regarding the amount awarded for replacement costs should come before or after the uncertainty regarding the amount awarded for delay damages).

verdict in the unlikely event the plaintiff were to prevail, the less the defendant would offer to settle, and the less the plaintiff would seek.

Thus, lawyers have always made use of probability arithmetic in valuing lawsuits even though the calculations were rarely explicitly or carefully done. As demonstrated by the initial hypothetical in Part I, trying to do the arithmetic in one's head can easily result in substantially misvaluing a case. So, what do the explicit calculations actually look like? They consist of two types: calculating "compound probabilities" and calculating "probability-weighted average values"—also known as "expected values."

A. *Compound Probabilities*

Probability theory teaches that "[t]he joint probability that both events A and B will occur equals the probability of A times the conditional probability of B, given A."[14] This joint probability is also referred to as a compound probability.

To understand the power and simplicity of compound probabilities, let's reconsider the building block examples of Part II.C. Figure 8 below is identical to Figure 3, but with probabilities assessed on each of the two sub-issues.
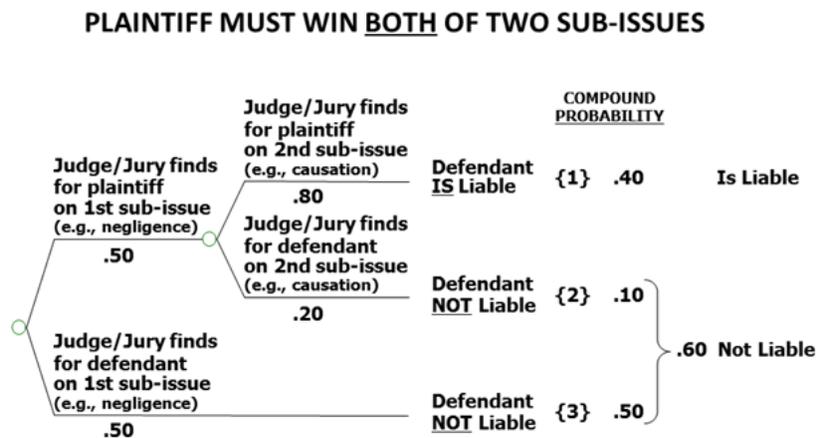
PLAINTIFF MUST WIN <u>BOTH</u> OF TWO SUB-ISSUES

FIGURE 8

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14. Victor, *supra* note 1.

Where success requires prevailing on *both* of two points (A *and* B), the overall probability of success will equal the probability of "win A" times the probability of "win B" *given* "won A." Note that if A and B are in all respects independent of each other, then this last modifier—given "won A"—is not needed. Thus, we all know that the probability of getting two heads when flipping two fair coins is .50 × .50 = .25. But if "win B" in some way "depends on" or "is influenced by" the outcome of A, then it is essential that the probability of "win B" be assessed *on the assumption of* "won A." For example, if the probability of the jury finding "negligent conduct" equals .50 and the probability of the jury *then* finding "causation" equals .80—high, perhaps in part, because a jury that has found negligent conduct may be mad enough not to want to "let the defendant off" on its causation defense—then the probability of "liable" is correctly calculated as .50 × .80 = .40,[15] as shown on Figure 8.

Figure 9 below is identical to Figure 4, but with probabilities assessed on each of plaintiff's two alternative theories.
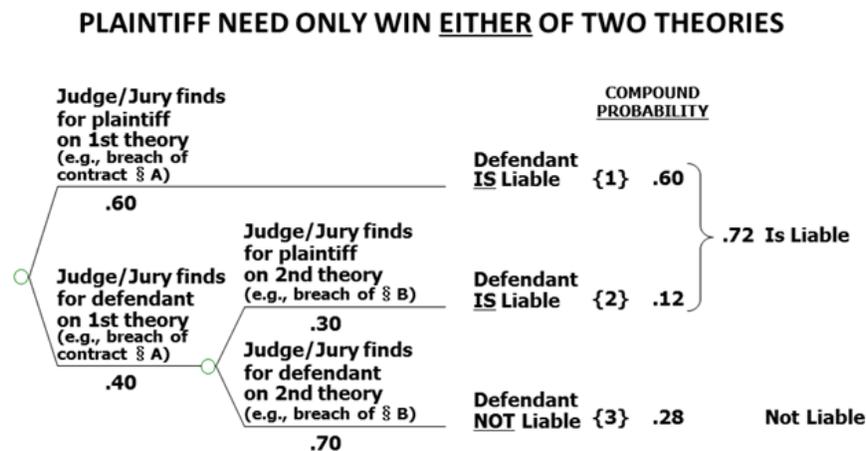
PLAINTIFF NEED ONLY WIN EITHER OF TWO THEORIES

FIGURE 9

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15. Note that this arithmetic conclusion also makes sense. If fifty percent of juries would find negligent conduct and most, but not quite all, of those—eighty percent *of those fifty percent*—would go on to find causation, then the percentage of juries finding *both* negligence and causation should be somewhat less than fifty percent—more specifically, in this example, twenty percent less than fifty percent, which equals forty percent.

Where success can be attained by prevailing on *either* of two points—A *or* B—the overall probability of success equals (1) the probability of "win A" *plus* (2) the probability of "lost A" times the probability of "win B" *given* "lost A." As noted in Part II.C, this calculation is relevant when the consequence of plaintiff winning A is identical to that of winning B—where counsel's assessment of the damage award if plaintiff wins either of two claims in a lawsuit is identical—and where the consequence is no different even if plaintiff were to win both A and B.

Thus, for a contract with two provisions that were allegedly breached—where causation is not in dispute—and where counsel would in fact make the same assessment of the damage award whether the finding is "breached A" or "breached B" or "breached both A and B," if the probability of the jury finding "breached A" is .60 and the probability of the jury finding "breached B" *in the event they did not believe* "breached A" is .30, then the overall probability of "liable" = .60 + (.40 × .30) = .72. In other words, one cannot simply add .60 ("breached A") and .30 ("breached B"), which is abundantly clear if one were also to imagine a .20 chance of yet a third contract provision being breached, since the overall chance of breach clearly cannot be .60 + .30 + .20 = 1.10. Instead, "win B" is only of incremental significance—given the assumptions of this particular hypothetical—*in the event plaintiff has not already prevailed on A*, which in this example has a probability of 1.00 minus .60, or .40. So if sixty percent of juries would find A was breached, and thirty percent *of the forty percent of juries who did not find A was breached*—twelve more juries—would nonetheless find B was breached, then 60 + 12 juries out of 100 would find *either* A or B had been breached,[16] as shown on Figure 9.

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16. Note that these calculations are really just a variation of the Figure 8 calculations, since the ones in Figure 9 could be restated as follows: success can be had by *not losing both* A *and* B. Using the same percentage chances as just above but the arithmetic from Figure 8, the overall chance of *losing both* A *and* B would be .40 × .70 = .28. Thus, the chance of *winning at least one* point—A *or* B *or* both—is 1.00 minus .28 = .72.

Figure 10 below is identical to Figure 5, but again with probabilities assessed on each of plaintiff's two alternative theories.

PLAINTIFF NEED ONLY WIN <u>EITHER</u> OF TWO THEORIES — *BUT* (i) THE DAMAGES ARE DIFFERENT UNDER EACH AND/OR (ii) LOSING BOTH MIGHT LEAD TO GREATER DAMAGES THAN JUST LOSING ONE OR THE OTHER

COMPOUND PROBABILITY

Judge/Jury finds for plaintiff on 1st theory (e.g., breach of contract § A) .60

Judge/Jury finds for plaintiff on 2nd theory (e.g., breach of § B) .30 → Defendant **IS** Liable *for A & B* {1} .18

Judge/Jury finds for defendant on 2nd theory (e.g., breach of § B) .70 → Defendant **IS** Liable *for A only* {2} .42

.72 Is Liable

Judge/Jury finds for defendant on 1st theory (e.g., breach of contract § A) .40

Judge/Jury finds for plaintiff on 2nd theory (e.g., breach of § B) .30 → Defendant **IS** Liable *for B only* {3} .12

Judge/Jury finds for defendant on 2nd theory (e.g., breach of § B) .70 → Defendant **NOT** Liable *for either* {4} .28 Not Liable
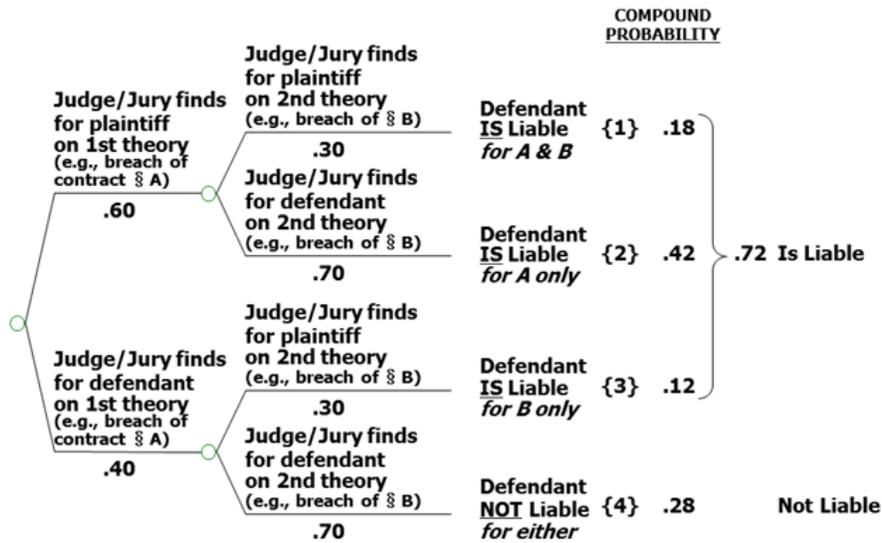
FIGURE 10

Notice that even where the amount of damages that is likely to be awarded is *different* for theories A and B, or where prevailing on both theories would lead to greater damages than prevailing on just one or the other, Figure 10 shows that it remains true that the overall probability of *some* liability is the same for the expanded tree as it was for the simpler one drawn in Figure 9. In these situations, however, this fuller tree *must* be drawn in order to calculate the proper case value because only this construction will allow for different damages to be assessed at the end of paths 1, 2, and 3.[17]

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17. *See supra* note 8 (reiterating the fuller tree should force counsel to question whether a different probability should be assessed for winning B if A is won than if A is lost).

Figure 11 below is identical to Figure 6, but with probabilities assessed on both the influencing uncertainty and the ultimate liability issues.
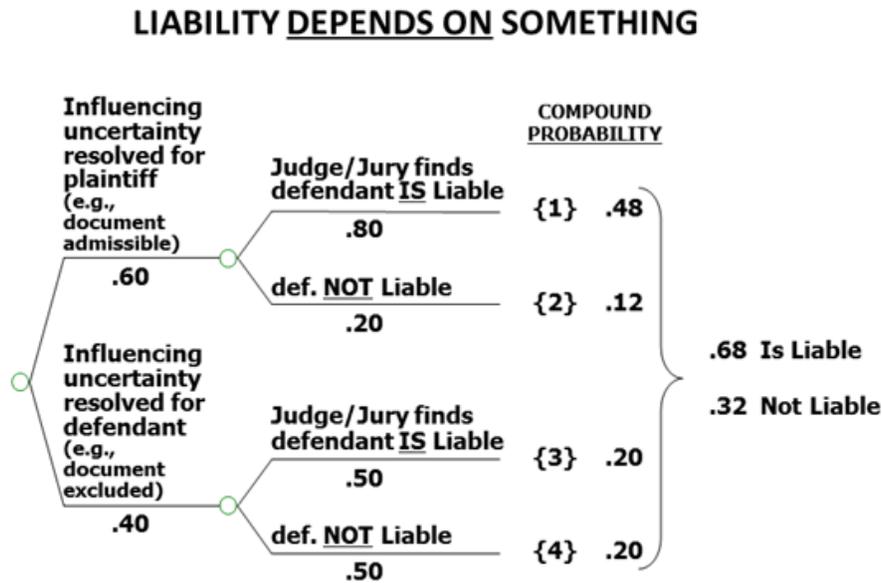
LIABILITY DEPENDS ON SOMETHING

FIGURE 11

Where success on an issue (X) depends on the outcome of some issue (Y)—such as the admissibility of a document—the *overall* probability of "win *X*" is equal to (1) the probability of "win *X*" *given* "win *Y*" multiplied by the probability of "win *Y*" *plus* (2) the probability of "win *X*" *given* "lose *Y*" multiplied by the probability of "lose *Y*." As illustrated in Figure 11, imagine you assess a .80 chance the defendant will be found liable if an important document *is* admissible but only a .50 chance if it *is not*. Clearly, your overall chance of "defendant liable" must be somewhere between .80 and .50, and should depend on your assessment of the chance of getting the document admitted. For example, the higher the chance of "admissible," the closer the overall chance of liability should be to .80. The lower the chance of "admissible," the closer the overall chance liability should be to .50. Imagine also that you feel the odds are .60 "admissible" and .40 "not admissible." With these odds, your

overall chance of "defendant liable" would be $(.60 \times .80) + (.40 \times .50) = .68$. *In other words, when there are two or more identical outcomes on a decision tree, their overall chance of occurring will be the sum of the compound probabilities resulting in that outcome.*[18]

Not only do compound probabilities allow conclusions to be drawn about the overall chance of *liability* in a case, they are also the first step in calculating the probability-weighted average *value of an entire lawsuit.* Specifically, the first step in determining the amount for which a client should reasonably be willing to settle is to calculate the compound probability of each scenario of the litigation tree. This is illustrated in the column at the far right of Figure 12.

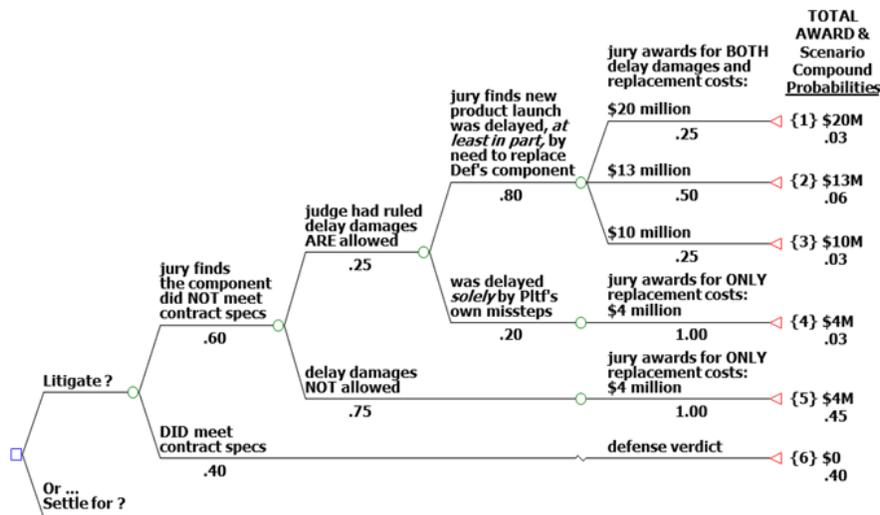## COMPOUND PROBABILITIES ARE THE FIRST STEP IN SOLVING A DECISION TREE FOR THE CASE VALUE

FIGURE 12

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18. Once again, the arithmetic should make sense: With the odds of "admissible" just a little better than those of "not admissible," the overall probability of "liable" should be just a little closer to the .80, when the document *is* admissible, than to the .50, when it *is not* admissible. *If* "admissible" and "not admissible" had been equally likely—exactly .50/.50—the probability arithmetic would have led to an overall result of .65, exactly mid-way between .80 and .50. However, with "admissible" assessed as slightly more likely (at .60) than "not admissible" (at .40), the arithmetic leads to .68, a result that is just slightly greater than .65.

The compound probability of each scenario is simply the product of the probabilities that comprise each scenario. Thus, for our hypothetical lawsuit: (1) = $.60 \times .25 \times .80 \times .25$ = .03; (2) = $.60 \times .25 \times .80 \times .50$ = .06; (3) = $.60 \times .25 \times .80 \times .25$ = .03; (4) = $.60 \times .25 \times .20 \times 1.00$ = .03; (5) = $.60 \times .75 \times 1.00$ = .45; and (6) = .40.[19] Many attorneys find that just seeing the compound probabilities next to the "Total Award" for each scenario makes it easier to value the case, and they are right to think so. In my experience, the degree to which attorneys misvalue cases is reduced once confronted with carefully calculated probabilities of arriving at each potential end result. To see this, review what you wrote down in Part I as the appropriate settlement amount for our hypothetical lawsuit. Now looking at the same case—this time portrayed in the Figure 12 decision tree form with the compound probabilities noted for each scenario—would you alter your initial valuation? Many would, moving it closer to the soon-to-be-revealed answer that is most consistent with the issue-by-issue assessments of probabilities and damages.

B. *"Probability-Weighted Average Value" or "Expected Value"*

Because the value of a lawsuit depends on both a finding of liability and the magnitude of the award if liability is found, one common measure—or at least, starting point—for valuing a suit is the probability of finding liability times the amount of the award. This is easy to understand where the amount of the award is undisputed and only liability is uncertain. For example, if the overall probability of liability is .60 and the award will be $10 million, the case is said to have an "Expected Value" of $6 million.[20] Note that the term "Expected Value" is a purely technical one. It does *not* mean

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19. As with earlier examples in this Part, these scenario probabilities should make sense. Scenario 2 (at .06) is twice as likely as Scenario 1 (at .03) because the $13 million award for both delay damages and replacement costs was assessed (at .50) as twice as likely as the $20 million award (at .25). Scenarios 1–3—with a combined compound probability of .12—are four times as likely as Scenario 4 (at .03) because the jury finding some causation (at .80) was four times as likely as finding no causation (at .20).

20. *See infra* Figure 13.

the single result that is most expected. Rather, it is a probability-weighted average value. [21]

GOOD DECISION MAKING RELATES SETTLEMENT VALUE TO THE "PROBABILITY-WEIGHTED AVERAGE VALUE" — I.E., THE "EXPECTED VALUE" — OF LITIGATING
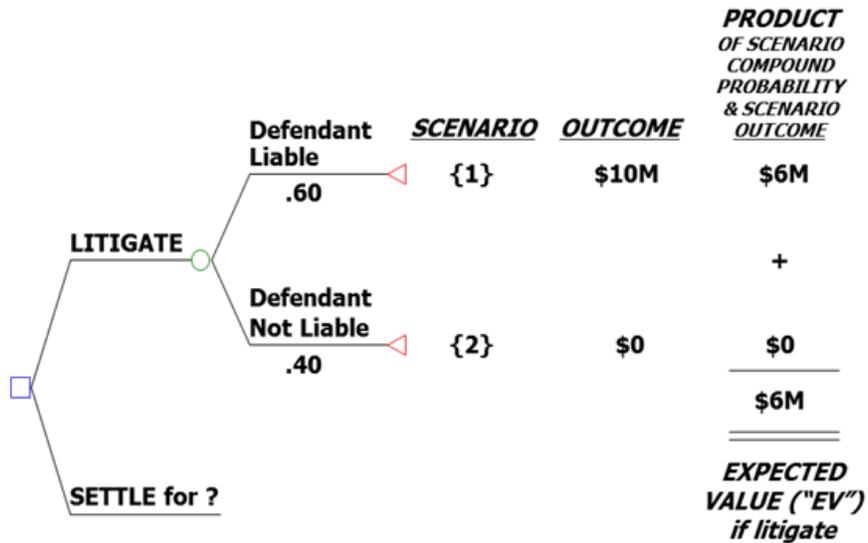
FIGURE 13

It was proven centuries ago that making decisions consistent with the expected value maximizes wealth or minimizes losses over time. Thus, "expected value decision making" is well accepted across all disciplines.[22]

In the litigation arena, "expected value decision making" means that a defendant would settle for anything less than its expected value

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21. Some may find the concept of the expected value easiest to understand by thinking about probabilities as the number of juries out of 100 who would reach a particular result. Thus, in the example of Figure 13, imagine that sixty juries had found liability and written an award of $10 million on the verdict form, and that forty juries had found no liability. For the sixty liability verdicts the defendant would pay out a total of $600 million; for the forty defense verdicts the defendant would pay out a total of $0. Thus across all 100 cases the defendant would pay out a total of $600 million. This results in an *average* of $6 million per case.

22. *See, e.g.*, CHARLES P. BONINI & WILLIAM A. SPURR, STATISTICAL ANALYSIS FOR BUSINESS DECISIONS 169 (1968) ("If the decision maker follows the criterion of maximizing expected monetary value in each [situation], he will be better off, on the average, than using any other decision criterion.").

of litigating, while a plaintiff would settle for anything more than its expected value of litigating, prior to taking into account potential adjustment factors.[23]

For our hypothetical case in Figure 12,[24] the expected value would be calculated by (1) "weighting"—multiplying—the award in each scenario by its respective compound probability of occurring and (2) summing the products: ($20 million × .03 = $0.6 million) + ($13 million × .06 = $0.78 million) + ($10 million × .03 = $0.3 million) + ($4 million × .03 = $0.12 million) + ($4 million × .45 = $1.8 million) + (.40 × $0 = $0) = $0.6 million + $0.78 million + $0.3 million + $0.12 million + $1.8 million + $0 = $3.6 million.

To help get comfortable with the reasonableness of the expected value as the best initial measure of the value of a lawsuit, many find it helpful to look at the issue-by-issue assessments in a slightly different way. Consider the following version of our decision tree:

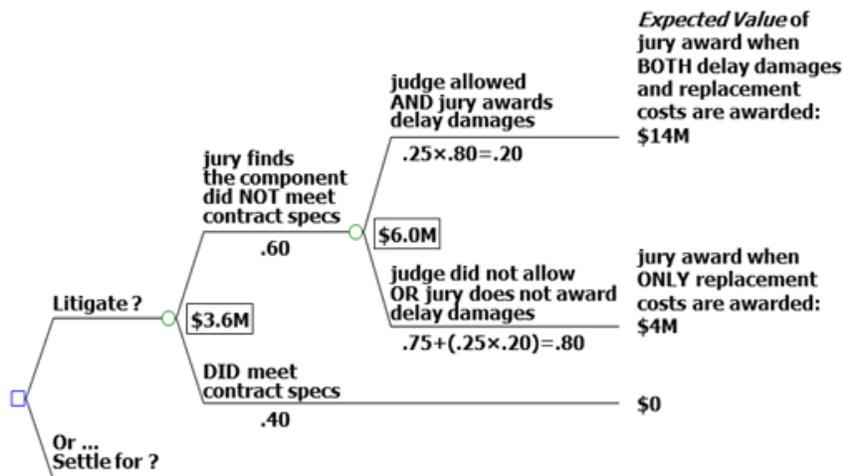# "ROLLING BACK" A DECISION TREE WILL PRODUCE THE SAME EXPECTED VALUE

FIGURE 14

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23. *See* discussion *infra* Part III.C.
24. *See supra* Figure 12.

Starting at the top far-right of the diagram, notice that the three branches previously used in Figure 12 to capture the uncertainty in the jury's award of delay damages plus replacement costs have been replaced by the *expected value* of the high-medium-low range that was assessed. That is, the range of dollars—$20 million, $13 million, and $10 million—along with their respective probabilities—.25, .50, and .25—has been summarized by its probability-weighted average value. Thus, with a .25 chance of a jury awarding $20 million, a .50 chance of $13 million, and a .25 chance of $10 million, the expected value of the award—assuming liability has been found and both types of damages are being awarded—is: (.25 × $20 million) + (.50 × $13 million) + (.25 × $10 million) = $5 million + $6.5 million + $2.5 million = $14 million.[25]

This version of the tree next calculates the compound probability of (1) the judge allowing and (2) the jury awarding delay damages. Because counsel assessed the chance of (1) at .25 and the chance of (2) at .80, the joint probability of both (1) and (2) occurring is .25 × .80 = .20. And the probability that either (1) or (2) will *not* happen must then be .80.

Look now at the middle of the tree in Figure 14, where the value of $6.0 million appears. This is the probability-weighted average value of the damage award once the jury finds breach. It is calculated by (1) multiplying the $14 million "Expected Value of the Jury Award" that results in the scenario where the jury is allowed to and does award both delay damages and replacement costs by the twenty percent chance of that occurring, (2) multiplying the $4 million Jury

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25. Yet again, the arithmetic should make sense: The high award of $20 million is further from the medium award of $13 million than is the low award of $10 million. Specifically, the high is $7 million above the medium, while the low is just $3 million below the medium. This asymmetrical range causes the average value not to be exactly at the medium value, but rather, in this example, somewhat higher. Again, this can be understood by thinking about probabilities as the number of juries out of 100 who would make a given award of delay damages plus replacement costs. Imagine that 100 juries had found breach and causation, and were allowed by the judge to award delay damages. If twenty-five juries were to award $20 million, the defendant would pay out $500 million for those twenty-five cases. If fifty juries were to award $13 million, the defendant would pay out another $650 million for those fifty cases. Finally, if the remaining twenty-five juries were to award $10 million, the defendant would pay out another $250 million for those last twenty-five cases. Therefore, across all 100 cases the defendant would pay out $500 million + $650 million + $250 million = $1.4 billion, which is an average of $14 million in each of the 100 cases.

Award that results in the scenario where the jury awards only replacement costs by the eighty percent chance of that occurring, and (3) summing the products: $(.20 \times \$14 \text{ million}) + (.80 \times \$4 \text{ million}) = \$6$ million. This arithmetic should, once again, have produced a result that makes sense. With such a high probability—.75—that the judge will have found that the contract excludes delay damages—plus some small chance that the jury will not award them even if permitted because it finds no causation—the Expected Value of the Award assuming a finding of breach should be much closer to $4 million than to $14 million.

Finally, the calculations can be "rolled-back" all the way to the start of the litigation tree. A .60 chance of the jury finding breach—which leads to a probability-weighted average award of $6 million—but a .40 chance of the jury not finding breach means—which leads to $0—results in an overall expected value of the case of $(.60 \times \$6 \text{ million}) + (.40 \times \$0) = \$3.6$ million. Of course, this is *exactly* the same result as when the *full* tree was solved earlier using the compound probabilities of all six scenarios.

How does the expected value of $3.6 million compare to the number you wrote down in Part I? How many of your colleagues overvalued the case by millions? How many undervalued it significantly?

C. *Typical Adjustments to the Expected Value*

As alluded to above, the expected value is often only a starting point for arriving at a—maximum if defendant or minimum if plaintiff—settlement value. The first common adjustment is for transaction costs. In our context, transaction costs are all of our client's future litigation costs, being careful to ignore "sunk costs".[26] The existence of remaining litigation costs that could be avoided or saved by settling would allow a plaintiff to demand somewhat *less,* and a defendant to offer somewhat *more,* than whatever expected value had been calculated based solely on the potential award.

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26. If at least some of the prevailing party's costs will be borne by the loser, these costs should be included in the decision tree as an additional award.

The second common adjustment is for risk aversion. Risk aversion is the client's inability or unwillingness to "play the averages" because "expected value decision making" assumes the client is risk neutral. This adjustment cuts in the same direction as any adjustment for avoidable litigation costs: plaintiffs would often prefer to settle for the certainty of an amount *below* the litigation expected value rather than gambling on the possibility of an even larger payday at trial and risking a complete loss or just a token win. Similarly, defendants would sometimes prefer to settle for the certainty of an amount somewhat *above* the expected value rather than gambling on the possibility of a defense verdict at trial and risking a big loss. Thus, the likelihood that at least one side will be risk averse, as well as the existence of avoidable transaction costs, typically creates a helpful gap between the minimum amount a plaintiff will take and the maximum amount a defendant will offer to settle a dispute.

CONCLUSION: DECISION TREE ANALYSIS AND GARBAGE-IN, GARBAGE-OUT

Attorneys using decision tree analysis find that the very process of creating a good decision tree, combined with a balanced discussion of the evidence and arguments the trier might consider in deciding each issue, greatly reduces the likelihood of garbage-in. The correct use of basic probability arithmetic, applied to a well-constructed decision tree, eliminates the likelihood of garbage-out. Counsel is now "less uncertain" about the risk of litigating, and the client is now better equipped to understand the basis of counsel's settlement recommendation—and thus act on it. Going further, sharing one's decision tree with a mediator, or even directly with one's opponent, can also reduce the uncertainty either of them might have about the reasonableness of the value you have put on the dispute.[27]

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27. *See* Victor, *supra* note 2, at 36–37.