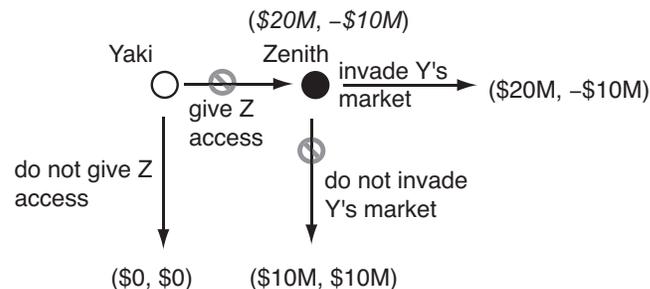


# Chapter 4 Material

The single problem from Chapter 4 is solved.

**4.1** (a) The extensive-form game played by Yaki and Zenith is depicted in Figure S4.1. Backward induction has been applied, and it tells us that, notwithstanding its promise, Zenith would be likely to invade Yaki's territory, so that Yaki cannot afford to make this agreement. This is the trust game pure and simple, with the scale of one unit of utility equals \$1 million.



*Figure S4.1. Problem 4.1(a): Yaki vs. Zenith.* Yaki must decide whether to make its technology available to Zenith and, if it does, Zenith must decide whether to abide by its promise not to invade Yaki's market. Zenith's payoffs are listed first, in this figure and in those that follow; payoffs are in millions of dollars. Backward induction indicates that, once Zenith has the technology, it would invade Yaki's market—Zenith's promise not to do so is not credible—and so Yaki cannot agree to this deal. (In this figure and those to follow, we indicate the results of backward induction by (a) putting the computed "values" on top of nodes—for instance, the  $(\$20M, -\$10M)$  on top of Zenith's node indicates the results of backward induction at that node—and (b) by using the "circle with a slash" symbol to indicate options that, per backward induction, will not be chosen.)

(b) The possibility of a court-enforceable agreement changes the game from that depicted in Figure S4.1 to the game in Figure S4.2. Yaki must decide whether to sign the contract. Zenith must decide whether to breach or honor the contract. If Zenith breaches it, Yaki must decide whether to go to court. Apply backward induction and you see that, since the damage award more than covers Yaki's court costs, Yaki would go to court if Zenith breached.

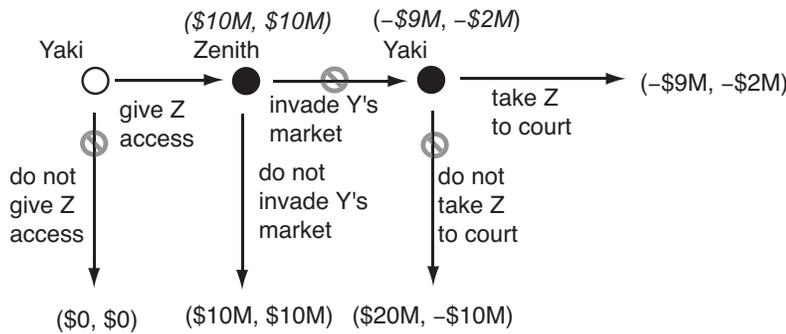


Figure S4.2. Problem 4.1(b): Yaki vs. Zenith. If we add the possibility that Yaki can take Zenith to court if Zenith breaches an agreement and Yaki stands to gain more than it loses (in court costs) if it goes to court, then the contract lends credibility to Zenith's promise and Yaki can sign the deal.

This then makes breach an unattractive option for Zenith. And thus Yaki can sign the agreement.

Note: If it comes to a court case, Yaki's final net position is a loss of \$2 million. Yaki would be worse off than if it had not signed the contract. But the loss of \$2 million is to be compared with a loss of \$10 million if Yaki did not take Zenith to court. Yaki would take Zenith to court. And that keeps Zenith from breaching. Which means that Yaki can sign the contract.

(c) If there is only a 0.3 chance that, in the event of breach, the courts would find in Yaki's favor, then the court-enforced contract fails on two grounds. If Zenith breached, Yaki would not take Zenith to court, and even if Yaki did sue, the expected penalty imposed on Zenith is insufficient to keep Zenith from breaching. The deal is in trouble again.

For the analysis that supports this, see Figure S4.3.

To explain the application of backward induction through the final node, this node represents the chance that the Yaki would win or lose its suit. This is not a choice by one player or the other, but instead a chance node and, under the assumption of risk neutrality, we compute the expected payoffs (monetary values) of the two parties if this position is reached. Zenith, for instance, would lose a net \$9 million if Yaki won the suit, but it would be ahead \$11 million (its \$20 million less \$9 million in court costs) if it won the suit, so its EMV is  $0.3 \times (-9) + 0.7 \times 11 = \$5$  million.

(d) If there is a chance of triple punitive damages added to compensatory damages, Yaki would take Zenith to court and Zenith would be deterred by the prospect. Back in business (see Figure S4.4). Note that the expected

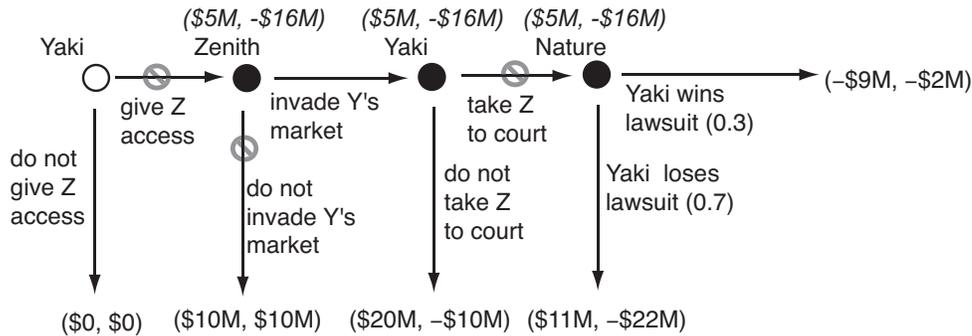


Figure S4.3. Problem 4.1(c): Yaki vs. Zenith, with an uncertain outcome in court. If the chance of Yaki winning its suit is too low, Yaki would have insufficient incentive to sue Zenith, and even if it did, the threat of a suit is insufficient to deter Zenith.

values are computed two nodes from the end, taking into account the three possible outcomes: Yaki loses the case, with probability 0.7. It wins and is awarded punitive damages, with probability  $0.3 \times \frac{2}{3} = 0.2$ . It wins but is not awarded punitive damages, with probability  $0.3 \times \frac{1}{3} = 0.1$ .

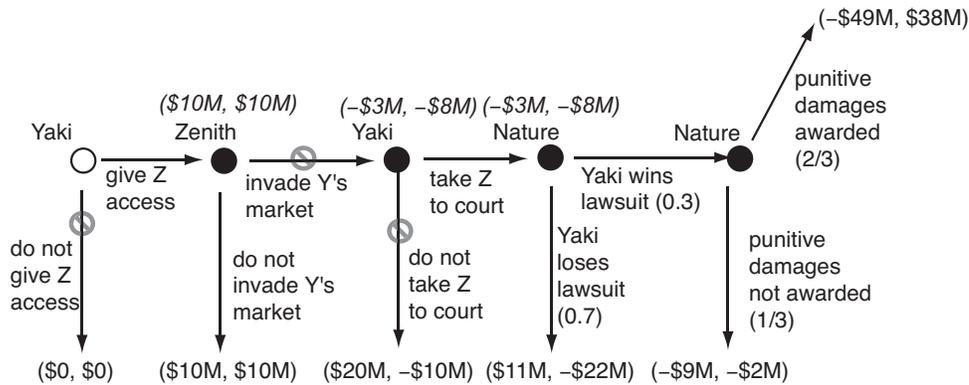


Figure S4.4. Problem 4.1(d): Yaki vs. Zenith, with an uncertain outcome in court and the chance of punitive damages. By adding in the chance of punitive damages, we both increase Yaki's motivation to go to court and Zenith's fears if it breaches the contract.

(e) If the punitive damages were not awarded to Yaki, while the prospect of a lawsuit would keep Zenith honest, Yaki has insufficient motivation to sue. The threat to sue Zenith, if it breaches, is not credible, so Zenith would breach. Therefore, Yaki cannot sign the agreement (see Figure S4.5).

(f) Reputation could help us out of the dilemma of part e in two ways. First, if Zenith cultivated a reputation for never breaching contracts of this sort and that reputation was worth (in terms of the future payoffs) more than \$20 million to Zenith, that would forestall Zenith from breaching in this

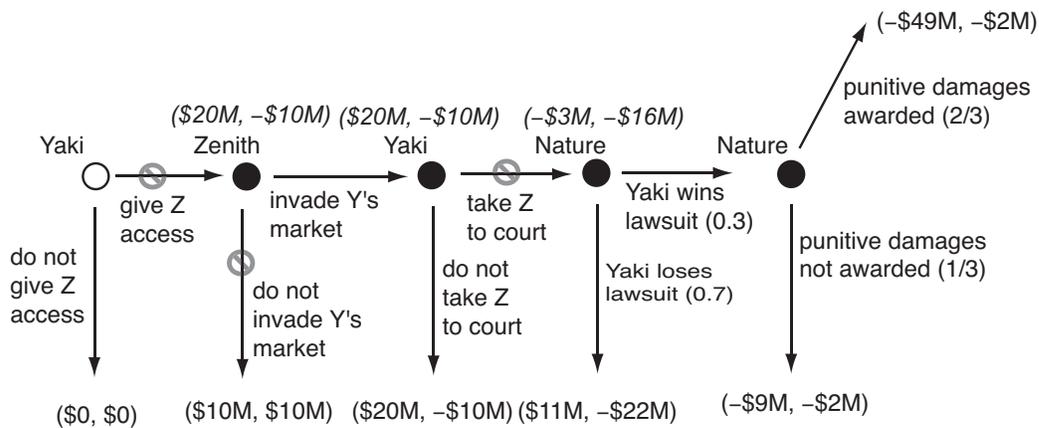


Figure S4.5. Problem 4.1(e): Yaki vs. Zenith, with an uncertain outcome in court and punitive damages that do not go to Yaki. Although the punitive damages would be sufficient to keep Zenith honest if it knew it would be sued, without them going to Yaki, Yaki has insufficient motivation to sue. Therefore, Zenith would breach. So, Yaki should not sign the agreement.

case. Second, if Yaki cultivated a reputation of taking contractual partners to court even if the prospect of net gains from the suit were negative and if that reputation was worth at least \$6 million to Yaki, a threat by it to take Zenith to court would become credible and Zenith would be forestalled from breach.

*Final note:* Although the problem did not mention this, in things like damages and punitive damage awards, another thing to worry about is whether punitive damages motivate plaintiffs to file nuisance suits or suits based on a small chance of winning even though the case is weak.