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Adapting Integer Programming Techniques to Circuit Restructuring

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NOTE

ADAPTING INTEGER PROGRAMMING TECHNIQUES TO CIRCUIT RESTRUCTURING

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During the second half of the twentieth century, rapidly increasing federal caseloads sparked recurring debates about the geographic boundaries of the United States Courts of Appeals. Several studies, including a 1998 final report from the congressionally chartered Commission on Structural Alternatives for the federal Courts of Appeals, considered altering or splitting circuits to alleviate caseload congestion. Although the literature discusses criteria for ideal circuits, the resulting proposals have remained highly theoretical, geographically limited, or both.

In this Note, I apply mathematical programming techniques to construct a complete set of hypothetical circuit courts by using generally accepted criteria for an ideal circuit. I then consider how suggested relaxations of those ideal rules might alter the circuits' geographic arrangement.

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Introduction

For as long as the United States Courts of Appeals have been part of the federal judicial system, commentators, judges, and policymakers have disagreed over their geographic boundaries.[1] Indeed, these disagreements began even before Congress finalized the Evarts Act,[2] which initially created the courts.[3] These disagreements are closely intertwined with discussions about the courts' core characteristics, such as how many states they encompass, the workload of their judges, the number of judges on each court's bench, and whether a circuit may contain only part of a state.[4] The debates simmered through the early twentieth century and boiled over in the latter half of that century[5] when the federal docket expanded rapidly, prompting at least a dozen major studies and a rush of proposed solutions.[6]

As commentators struggled with these issues, their analyses were either highly theoretical, limited to a geographically compact subset of the country, or both.[7] Simultaneously juggling every circuit's boundaries is a daunting task. However, grasping the implications of each proposal for large-scale structural reform is difficult without de-

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1 *See, e.g.*, Comm'n on Revision of the Fed. Court Appellate Sys., The Geographical Boundaries of the Several Judicial Circuits: Recommendations for Change 3–5 (1973), *reprinted in* 62 F.R.D. 223, 229–30 (1973) [hereinafter Hruska Report] (recommending splitting the Fifth and Ninth Circuits); Comm'n on Structural Alts. for the Fed. Courts of Appeals, Final Report, at ix–x (1998) [hereinafter White Report] (recommending against splitting the Ninth Circuit).

2 26 Stat. 826 (1891).

3 *See* John M. Roll, *The 115 Year-Old Ninth Circuit—Why a Split Is Necessary and Inevitable*, 7 Wyo. L. Rev. 109, 112 (2007) (discussing the argument that California should be in a separate circuit from the Pacific Northwest, which Senator Joseph N. Dolph (R-OR) raised during debate on the Evarts Act in 1890).

4 *See, e.g.*, White Report, *supra* note 1, at ix–xi (outlining key aspects of the debate on splitting the Ninth Circuit).

5 *See* Roll, *supra* note 3, at 111–14 (providing a brief history of the debate on whether to split the Ninth Circuit).

6 *See generally* Thomas E. Baker, *A Generation Spent Studying the United States Courts of Appeals: A Chronology*, 34 U.C. Davis L. Rev. 395 (2000) (summarizing each study and its recommendations).

7 *See, e.g.*, Fed. Courts Study Comm., Report of the Federal Courts Study Committee 116–24 (1990), *reprinted in* 22 Conn. L. Rev. 733, 856–64 (1990) [hereinafter Weis Report] (examining several ideas for systemic structural reform at a highly theoretical level); White Report, *supra* note 1, at 33–57, 59–60 (discussing several specific proposals to reform the Ninth Circuit and theoretical proposals for structural reform of the entire federal appellate system); *see also* Baker, *supra* note 6.

pictions of how the circuits would look if the proposals were followed. Fortunately, computers now permit such depictions.

In this Note, I apply a mathematical programming technique called integer programming to create different models of the United States Courts of Appeals based on the most commonly accepted criteria for ideal circuit courts. I then consider the effects of proposed relaxations of these established criteria.

I
BACKGROUND

A. The Current Situation

1. *Structuring the Federal Courts*

The modern United States Courts of Appeals originated with the Evarts Act of 1891.[8] Congress passed the Act, which dramatically reshaped the contours of the federal courts, to address the burgeoning caseload of the federal judicial system.[9] In the decades preceding the Act, increases in the country's size, economic base, and population, as well as a significant expansion of federal jurisdiction, led to a massive increase in the federal docket.[10] For political reasons, Congress failed to address the problem until the federal appellate process almost completely broke down.[11] Fortunately, the reforms worked, and caseloads became manageable again.[12]

Since the passage of the Evarts Act, the federal courts have experienced significant changes. These changes have been incremental and functional rather than revolutionary,[13] but Congress did make some structural changes to the federal courts as a result of this evolution. In 1911, Congress merged the old, redundant circuit courts into the district courts.[14] Over the next seventy years, Congress created four additional courts of appeals: three regional courts and the Court of Appeals for the Federal Circuit, whose jurisdiction is based on subject matter.[15] Additionally, procedural and administrative changes implemented during the past few decades have radically altered the appellate experience.[16]

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8 *See* WHITE REPORT, *supra* note 1, at 11.

9 *See* THOMAS E. BAKER, RATIONING JUSTICE ON APPEAL: THE PROBLEMS OF THE U.S. COURTS OF APPEALS 9 (1994).

10 *See id.* at 7.

11 *See id.* at 7–9; WHITE REPORT, *supra* note 1, at 7–8, 10–11.

12 *See* BAKER, *supra* note 9, at 10.

13 *See* WHITE REPORT, *supra* note 1, at 12.

14 Act of Mar. 3, 1911, Pub. L. No. 61-475, 36 Stat. 1087.

15 *See infra* Part I.B; *see also* WHITE REPORT, *supra* note 1, at 21.

16 *See* Thomas E. Baker, *Applied Freakonomics: Explaining the "Crisis of Volume,"* 8 J. APP. PRAC. & PROCESS 101, 111–12 (2006).

2. *The Problem*

In the latter half of the twentieth century, the caseload of the federal appellate courts dramatically increased again. Furthermore, factors strikingly similar to those that drove the courts to disaster in the latter half of the nineteenth century caused this increase: economic development, increasing population, and an increase in federal jurisdiction.[17] Furthermore, caseload increases disproportionately burdened courts in the southern and western United States.[18] Although Congress authorized additional appellate judgeships during this time, those increases did not keep pace with the number of appeals.[19]

B. Past Attempts to Deal with the Problem

The debate over how to address the increase in appellate court workload is long running and energetic. A great deal of the discussion of these issues has focused on how to deal with the problems facing specific circuit courts. The debate surrounding the decision to split the former Fifth Circuit into the current Fifth and Eleventh Circuits was considerable.[20] In addition, the debate over how to alter the Ninth Circuit has always been lively.[21] Even as the specific focus of the debate wanders, it retains several common themes, which I consider below.[22]

1. *An Introduction to Past Studies*

Over the past fifty years, thirteen prominent studies have considered how to solve the federal appellate courts' caseload problem.[23]

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17 *Compare* Scott Bales, *The Ninth Circuit: Should It Stay or Should It Go?*, 34 U.C. DAVIS L. REV. 379, 387 (2000) (elaborating that rapid population and economic growth in the Southwest helped fuel the caseload crisis facing the Ninth Circuit), *and* WEIS REPORT, *supra* note 7, at 4–5, *reprinted in* 22 CONN. L. REV. 733, 744, *with* BAKER, *supra* note 9, at 7.

18 *See* Bales, *supra* note 17, at 386–88 (noting population growth in the Southwest).

19 *See* WHITE REPORT, *supra* note 1, at 13–14.

20 *See* BAKER, *supra* note 9, at 52–68; Crystal Marchesoni, Comment, *"United We Stand, Divided We Fall"?: The Controversy Surrounding a Possible Division of the United States Court of Appeals for the Ninth Circuit*, 37 TEX. TECH L. REV. 1263, 1269–71 (2005).

21 *See* Symposium, *Managing the Federal Courts; Will the Ninth Circuit Be a Model for Change?*, 34 U.C. DAVIS L. REV. 315 (2000) (discussing the significance and wisdom of the White Commission's report); *see also* WEIS REPORT, *supra* note 7, at 123, *reprinted in* 22 CONN. L. REV. 733, 863 (not taking a position on whether to split the Ninth Circuit); WHITE REPORT, *supra* note 1, at 40–47 (arguing for a divisional model that would split the Ninth Circuit into small units but preserve the Ninth Circuit as an administrative unit); Roll, *supra* note 3, at 111 (arguing in favor of splitting the Ninth Circuit).

22 *See generally* Baker, *supra* note 6 (summarizing past studies).

23 *See generally* Federal Courts Study Committee Implementation Act of 1990, Pub. L. No. 101-650, § 302(c), 104 Stat. 5104, 5104 (1990) (chartering a study of circuit splits and structural alternatives for the Courts of Appeals); AM. BAR FOUND., ACCOMMODATING THE WORKLOAD OF THE UNITED STATES COURTS OF APPEALS (1968) (focusing specifically on the caseload problem); AM. LAW INST., STUDY OF THE DIVISION OF JURISDICTION BETWEEN STATE

They include three congressionally chartered commissions: the Hruska Commission in the 1970s, the Federal Courts Study Committee in 1990, and the White Commission, which filed its Final Report in 1998.[24]

A few common trends appear in all thirteen studies.[25] All of the studies rely on highly competent experts from various disciplines. Each study also concludes that the caseload crisis is real and that reform is necessary. All of the studies suggest that internal procedural or administrative reforms could help solve the problem. However, the 1968 American Law Institute report was the last to support the proposition that adding judges alone could solve the caseload crisis.[26]

Despite their commonalities, the studies' recommendations differ, and Congress rarely implemented the recommendations. For example, the Justice Department studies led to the creation of the Court of Appeals for the Federal Circuit,[27] and Congress followed the Hruska Commission's recommendation to split the former Fifth Circuit.[28] However, policymakers ignored the recommendations of many other commissions, and later studies would contradict those recom-

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AND FEDERAL COURTS (1969) (presenting the results of the American Law Institute's (ALI) eight-year study); COMM'N ON REVISION OF THE FED. COURT APPELLATE SYS. STRUCTURE AND INTERNAL PROCEDURES: RECOMMENDATIONS FOR CHANGE, *reprinted in* 67 F.R.D. 195 (1975) [hereinafter HRUSKA FINAL REPORT] (proposing various reform measures, including a National Court of Appeals); DEP'T OF JUSTICE COMM. ON REVISION OF THE FED. JUDICIAL SYS., THE NEEDS OF THE FEDERAL COURTS (1977) (making recommendations for reform of the federal court system); FED. JUDICIAL CTR., REPORT OF THE STUDY GROUP ON THE CASELOAD OF THE SUPREME COURT (1972), *reprinted in* 57 F.R.D. 573 (presenting the Freund Committee's examination of various strategies of judicial system reform); HRUSKA REPORT, *supra* note 1, *reprinted in* 62 F.R.D. 223 (1973) (recommending splitting the Fifth and Ninth Circuits); JUDICIAL CONFERENCE OF THE U.S., LONG RANGE PLAN FOR THE FEDERAL COURTS (1995) (analyzing proposed reform of several facets of the federal court system); SAMUEL ESTREICHER & JOHN SEXTON, REDEFINING THE SUPREME COURT'S ROLE (1986) (proposing a managerial model for the Supreme Court and discussing the proposal for an Intercircuit Tribunal that would sit below the Supreme Court and above the Courts of Appeals); WEIS REPORT, *supra* note 7, *reprinted in* 22 CONN. L. REV. 733 (1990) (providing an assessment of the federal court system and describing various proposals for reform); Baker, *supra* note 6, at 396, 402 (highlighting the role of the Advisory Council on Appellate Justice); Seth Hufstedler & Paul Nejelski, *A.B.A. Action Commission Challenges Litigation Cost and Delay*, 66 A.B.A. J. 965 (1980) (discussing the American Bar Association's Action Commission to Reduce Court Costs and Delay); Daniel J. Meador, *The Federal Judiciary—Inflation, Malfunction, and a Proposed Course of Action*, 1981 BYU L. REV. 617, 628 (discussing the overlooked Advisory Council on Appellate Justice).

24 These studies are commonly known as the Hruska Commission, Weis Committee, and White Commission. *See* HRUSKA REPORT, *supra* note 1, *reprinted in* 62 F.R.D. 223 (1973); HRUSKA FINAL REPORT, *supra* note 23, *reprinted in* 67 F.R.D. 195 (1975); WEIS REPORT, *supra* note 7, *reprinted in* 22 CONN. L. REV. 733 (1990); WHITE REPORT, *supra* note 1.

25 *See generally* Baker, *supra* note 6 (summarizing each study's recommendations and identifying common themes).

26 *See id.* at 397–98; *cf.* WHITE REPORT, *supra* note 1, at 17 (describing reconfiguration of the Ninth Circuit as a possible alternative to increasing the number of judgeships).

27 *See* Baker, *supra* note 6, at 404.

28 BAKER, *supra* note 9, at 64–68.

mendations. For example, Congress rejected the White Commission's recommendation to split the Ninth Circuit into semiautonomous administrative divisions.[29] Furthermore, despite the findings of these studies and the absence of any major studies after the White Commission, no real consensus exists regarding how to solve the problems associated with the current structural framework.[30]

2. *Generally Accepted Guidelines*

The previous studies indicate several traditionally accepted rules about what geographic criteria the circuit courts should meet:

1) Circuits in the continental United States should be geographically contiguous.[31]
2) Regional circuit courts should encompass at least three states.[32]
3) No state should be split between two or more circuits.[33]

Although the studies do not unanimously agree upon these rules,[34] they tend to treat deviations from them as exceptions to the current baseline.[35]

Greater debate exists over how many cases a court can effectively manage. This question includes two separate issues: (1) whether adding too many judges to an appellate court reduces its effectiveness and (2) how many cases each judge can reasonably manage.

The debate over the Ninth Circuit illustrates the first of these issues. Some commentators believe the current number of judges on the Ninth Circuit, twenty-eight, is appropriate. Other commentators and the White Commission believe that it already has too many

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29 *See* WHITE REPORT, *supra* note 1, at ix–xi; Roll, *supra* note 3, at 118–19 (summarizing the White Commission's proposal platforms and Congress's subsequent rejection of them).

30 *See generally* Stefanie A. Lindquist, *Bureaucratization and Balkanization: The Origins and Effects of Decision-Making Norms in the Federal Appellate Courts*, 41 U. RICH. L. REV. 659 (2007) (using data analysis to look at decision-making norms of federal courts in finding a solution to the judicial-caseload quandary); Roll, *supra* note 3 (advocating for a split in the Ninth Circuit); Symposium, *supra* note 21 (discussing the significance and wisdom of the White Commission report); Carl Tobias, *An Update on the Ninth Circuit Debate*, 3 J. APP. PRAC. & PROCESS 661 (2001) (providing a general overview of the complexities of various approaches and possible future outcomes).

31 *See, e.g.*, HRUSKA REPORT, *supra* note 1, at 7, *reprinted in* 62 F.R.D. 223, 232 (1973).

32 *See, e.g.*, WHITE REPORT, *supra* note 1, at 52–53. *But see* HRUSKA REPORT, *supra* note 1, at 7, *reprinted in* 62 F.R.D. at 231–32 (arguing that two-state circuits might be acceptable in some circumstances).

33 *Cf.* WHITE REPORT, *supra* note 1, at 57 ("[W]e are persuaded that it is better to have the State of California subject to different divisions within the same circuit than to split it between circuits.").

34 *See, e.g.*, HRUSKA REPORT, *supra* note 1, at 16–20, *reprinted in* 62 F.R.D. at 238–40 (discussing and rejecting several arguments against splitting California between two courts of appeals).

35 *See, e.g.*, *id.* at 16, *reprinted in* 62 F.R.D. at 238 ("The division of a state between two circuits would be an innovation in the history of the federal judicial system.").

judges.[36] After polling the federal judiciary, the White Commission concluded that "the maximum number of judges for an effective appellate court . . . is somewhere between eleven and seventeen."[37] Seventy-four percent of the judges who responded to the Commission's survey shared this opinion, while twenty-two percent of the judges believed that either the limit was higher or that circuit courts can operate effectively with an unlimited number of judges.[38]

For comparison, the judges of the former Fifth Circuit voted to split when that circuit reached twenty-six judges.[39] Indeed, one notable difference between the current Ninth Circuit and the former Fifth Circuit is that the current Ninth Circuit judges still oppose a split, while the Fifth Circuit judges eventually concluded that the split was necessary.[40]

Commentators also disagree over the appropriate caseload for a federal circuit in both absolute terms and on a per judge or per panel basis. Currently, the Judicial Conference of the United States uses a measure called *adjusted case filings* to evaluate circuit court caseloads.[41] When computing this figure, the Judicial Conference ignores reinstated cases and discounts pro se cases by two-thirds.[42] When deciding whether to recommend that Congress appoint new judges, the Conference uses five hundred adjusted case filings per three-judge panel per year as its baseline.[43] It does not, however, rely solely on this measure; it also depends on subjective data including the circuit judges' recommendation on whether to expand its bench. Unsurprisingly, this procedure results in a wide range of caseload profiles across circuits. The Eleventh Circuit is a particularly interesting case. In their

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36 WHITE REPORT, *supra* note 1, at iii; *see also* Edward R. Becker, *Contemplating the Future of the Federal Courts of Appeals*, 34 U.C. DAVIS L. REV. 343, 343–44 (2000) ("I cannot imagine judges in a circuit as large as the Ninth, with its staggering volume of opinions, being able to do what the judges in [a smaller circuit] do to master circuit law."); Procter Hug, Jr., *Potential Effects of the White Commission's Recommendations on the Operation of the Ninth Circuit*, 34 U.C. DAVIS L. REV. 325 *passim* (2000) (arguing strongly against splitting or dividing the Ninth Circuit). At the time these articles were written, the authors were the Chief Judges of the Third and Ninth Circuits, respectively.

37 WHITE REPORT, *supra* note 1, at 29.

38 *See id.* at 29 n.72.

39 *See* BAKER, *supra* note 9, at 62–65; WHITE REPORT, *supra* note 1, at 21.

40 *Compare* BAKER, *supra* note 9, at 62–65 (noting that the judges on the former Fifth Circuit eventually agreed that a split was necessary), *with* WHITE REPORT, *supra* note 1, at 37–39 (noting that a majority of polled Ninth Circuit judges opposed a split).

41 U.S. GOV'T ACCOUNTABILITY OFFICE, GAO-09-1050T, FEDERAL JUDGESHIPS: THE GENERAL ACCURACY OF DISTRICT AND APPELLATE JUDGESHIP CASE-RELATED WORKLOAD MEASURES 7 (2009) [hereinafter GAO 2009].

42 *See id.* at 8.

43 *See id.* at 7; *see also* Arthur D. Hellman, *Assessing Judgeship Needs in the Federal Courts of Appeals: Policy Choices and Process Concerns*, 5 J. APP. PRAC. & PROCESS 239, 242–43 (2003) (analyzing and critiquing the Judicial Conference's approach to determining whether to recommend additional judgeships).

quest to maintain the size of their bench, a majority of the judges recommended against adding judges despite nearly seventy-five hundred adjusted case filings for the circuit.[44] This decision, however, has come with tradeoffs.[45]

Adjusted case filings does not perfectly measure appellate court workload: "Unlike the case weights used to measure district judge case-related workload, adjusted case filings are not based on any empirical data regarding the time that different types of cases required of courts of appeals judges."[46] The General Accounting Office (later the Government Accountability Office) raised this issue in a 2003 report and reiterated it in 2009.[47] In both cases, the Office called on the Judicial Conference to develop a more empirically grounded measure of appellate caseload.[48] Furthermore, even when a circuit's caseload suggests that the Judicial Conference should recommend that Congress add seats to the bench, the Conference consistently refuses to do so unless a majority of the active judges in that circuit also vote for the increase.[49] Although the Judicial Conference has considered some alternative caseload measures, it has not yet been able to agree on a replacement for the problematic adjusted-case-filings formula.[50]

3. *Suggestions for Reforms*

The suggestions for reform fall into two general categories: functional and structural. The functional reforms are a grab bag of administrative and procedural reforms intended to allow appellate judges to work more efficiently. They include increasing the role of law clerks and support staff, aggressively screening and tracking appeals, reducing the number of oral arguments, and reducing the number of formal opinions.[51] Not only do these reforms increase the number of cases that each judge could resolve, but they also completely reshape the appellate process.[52]

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44 *See* Hellman, *supra* note 43, at 253–54.

45 *But see id.* at 253–58 (highlighting possible problems caused by the large caseloads of both the Fifth and Eleventh Circuits).

46 GAO 2009, *supra* note 41, at 4, 7.

47 U.S. GOV'T ACCOUNTABILITY OFFICE, GAO-03-788R, FEDERAL JUDGESHIPS: THE GENERAL ACCURACY OF THE CASE-RELATED WORKLOAD MEASURES USED TO ASSESS THE NEED FOR ADDITIONAL DISTRICT COURT AND COURTS OF APPEALS JUDGESHIPS 3 (2003) [hereinafter GAO 2003]; GAO 2009, *supra* note 41, at 4, 7, 10.

48 *See* GAO 2003, *supra* note 47, at 12; GAO 2009, *supra* note 41, at 7, 10.

49 *See* Hellman, *supra* note 43, at 254–58.

50 *See* GAO 2009, *supra* note 41, at 4.

51 *See* WHITE REPORT, *supra* note 1, at 21–25.

52 Commentators' views on this result differ greatly. Some condemn the result as an abandonment of the basic principles of appellate justice. *See* BAKER, *supra* note 9, at 48–50, 106–07 (discussing procedural, administrative, and "intramural" appellate reforms in response to the "crisis of volume"). Others accept it as the cost of justice in the modern

Additionally, commentators have proposed several major structural reforms. Many of these reforms are highly theoretical, particularly those that propose changing the entire court of appeals system at once.[53] Other reforms are highly specific, recommending changes that address a particular geographical subset of the country—typically, the Ninth Circuit.[54] The studies do not, however, offer specific descriptions of the dimensions of the circuit courts under the proposed systemic reforms.

C. A Brief Introduction to Integer Programming

Integer programming is one of many mathematic techniques for optimally allocating scarce resources.[55] It is particularly useful because of its flexibility.[56] Technically speaking, an integer program maximizes (or minimizes) a linear objective function subject to one or more linear constraints. In addition, one or more variables in the integer program may not assume noninteger values.[57] This definition undoubtedly makes as little sense to most lawyers as constitutional law does to most mathematicians. Fortunately, it can be broken down into more easily understood terms.

Integer programs contain four key elements: data, variables, constraints, and an objective function. Data are simply numbers that the program may not change. Variables, on the other hand, are symbols whose values the program may change. Constraints are rules that the program must follow in determining what values to assign to each vari-

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world. *See* Baker, *supra* note 16, at 113–14. However, while the functional reforms are quite interesting, further discussion of them is beyond the scope of this Note.

53 *See, e.g.*, WEIS REPORT, *supra* note 7, at 116–24, *reprinted in* 22 CONN. L. REV. 733, 856–65 (1990) (discussing systematic reforms for the entire federal appeals system in theoretical terms).

54 *See, e.g.*, BAKER, *supra* note 9, at 59–60 (discussing proposals for structural reform of the Fifth Circuit); WHITE REPORT, *supra* note 1, at 33–57 (discussing several specific proposals to reform the Ninth Circuit).

55 For a more complete introduction to linear programming, see VAŠEK CHVÁTAL, LINEAR PROGRAMMING 5–7 (1983).

56 *See generally* ROBERT FOURER ET AL., AMPL: A MODELING LANGUAGE FOR MATHEMATICAL PROGRAMMING 403, 437–38 (2d ed. 2003) (comparing nonlinear programming to linear programming and discussing the particular benefits of integer programming as compared to linear programming).

57 This final characteristic differentiates integer programs from the broader category of linear programs. *See id.* A simple example demonstrates the significance of this feature. Suppose an airline wants to use an integer program to assign planes to its routes. On a particular day, the airline has one unassigned plane and two destinations. The airline obviously cannot send half of the plane to Pittsburgh and the other half of the same plane to New York City. A linear program that is not an integer program, however, might suggest this impractical solution. An integer program would allow the airline to avoid the problem by assigning the complete plane to either destination. *See id.* Of course, linear programming might be able to solve this problem; some linear programs naturally assign values of 0 or 1 to their variables. This ideal situation, however, only arises in a small subset of the field called network linear programming. *See* CHVÁTAL, *supra* note 55, at 326–27.

able. A program's objective function defines its ultimate goal, frequently by assigning rewards and penalties to different outcomes or approaches.[58] Finally, the constraints and objective function must all be linear; although variables may be multiplied by nonvariables, no variable may be multiplied by itself or another variable, and the constraints must take the form of mathematical equalities or inequalities.[59]

For example, imagine a program to allocate emergency-response vehicles to base stations in a community. The user would enter data such as emergency call rates and travel times. Variables would represent the number of vehicles assigned to each possible site. In computing results, the program would work under constraints representing defined minimum response times. The objective function could then minimize average response time while applying a penalty for each extra vehicle added to the system.[60]

II
MODELING STRUCTURAL REFORM

A. Introduction

To study possible structural reform of the federal appellate courts using integer programming, I wrote computer models using commercial modeling software and ran the models on a desktop computer.[61] I started by modeling the generally accepted rules regarding circuit court assignments. On subsequent models, I relaxed requirements.

The first model uses several constraints:

1) Circuits in the continental United States must be geographically contiguous.
2) No single state may be split between two or more circuits.
3) Regional circuits must contain at least three states.
4) Each circuit must have enough judges to insure that adjusted case filings per three-judge panel do not exceed five hundred.
5) Each circuit should seat between seven and seventeen judges.[62]

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58 *See generally* CHVÁTAL, *supra* note 55, at 5–7 (introducing linear programming).

59 Although this linearity requirement may appear overly restrictive, models that follow it may be solved much more quickly and easily than those that do not. *See generally* FOURER ET AL., *supra* note 56, at 129–34, 391, 410, 437–38 (discussing the comparison between linear programming and nonlinear programming).

60 *See generally* Luce Brotcorne et al., *Ambulance Location and Relocation Models*, 147 EUR. J. OPERATIONAL RES. 451 (2003) (reviewing several ambulance location problems).

61 I wrote the model in AMPL 10.1, a programming language developed by Bell Laboratories for mathematical modeling. I solved the models using AMPL's implementation of ILOG's CPLEX solver, a computer program designed to solve a variety of optimization problems. I ran each model on a 2.40 GHz desktop computer with 2 GB of RAM.

62 Taken together, the limits in Rules 4 and 5 enforce a caseload limit of 2,833 adjusted case filings per circuit. Each circuit can contain at most $17 + 3 = 5\ ^{2}/_{3}$ three-judge

6) Where possible, states and districts should remain in their current circuit.[63]

Rules 1–5 are the baseline rules and possible alternatives that the White and Hruska Commissions presented.[64] Rule 6 is a common sense rule that the Hruska Commission considered.[65] I structured Rules 1–5 as absolute commands and Rule 6 as a weight in the objective function. In situations where the Rules were irreconcilable, I broke Rules, starting at the bottom of the list, until I found a solution. For the first model, I implemented all of the rules. For the other three models, I allowed two-state circuits, split states between two circuits, or both.

Rule 5 is likely the most controversial.[66] I ultimately decided to use this range because even if the White Commission was overly conservative in identifying acceptable size ranges, a judge cap of seventeen is still useful as a way of building excess capacity into the system. Historically, very long periods passed between major overhauls of the federal appellate system.[67] Thus, planning for such excess capacity would help newly reformed appellate courts remain healthy for a longer period of time.

This approach also has the effect of transforming caseload-per-judge limits into judges-per-circuit limits. Altering the model to fix the number of judges or directly impose caseload-per-circuit limits would be simple. Therefore, depending on which variable the user wants to optimize and what data is available, the programmer can switch variables for constants and vice versa.

B. Gathering Caseload Data

For the integer program to meaningfully alter circuit boundaries in response to caseload pressures, the user must input the caseloads originating from each state or district from which the circuit court hears appeals. As I discussed previously, the Judicial Conference measures circuit courts' caseloads by calculating their adjusted case filings per three-judge panel. However, the Judicial Conference does not

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panels. $5\ ^{2}/_{3}$ three-judge panels × 500 adjusted case filings per three-judge panel = 2,833 adjusted case filings.

63 *See* HRUSKA REPORT, *supra* note 1, at 7, *reprinted in* 62 F.R.D. 223, 232 (1973).

64 *See supra* notes 32–33 and accompanying text.

65 *Cf.* HRUSKA REPORT, *supra* note 1, at 7, *reprinted in* 62 F.R.D. at 232 ("Fourth is the principle of marginal interference: excessive interference with present patterns is undesirable . . . .").

66 Although the explicit decision to resort to circuit rearrangement as a solution of first resort is also controversial, the focus of this Note is to demonstrate how integer programming may be used to develop and evaluate proposals for structural change. Further integer programming could test the proposals on either side of these debates.

67 *See* Martha J. Dragich, *Once a Century: Time for a Structural Overhaul of the Federal Courts*, 1996 WIS. L. REV. 11, 12.

publish these figures. Fortunately, I was able to use information in Judicial Business of the United States Courts, a compilation published by the Administrative Office of the United States Courts, to approximate these values.[68] For this Note, I used figures from the twelve-month period preceding September 30, 2008. However, running the model with figures for different time periods would be as simple as substituting in a new data table.

Two primary difficulties arise in using information from Judicial Business to approximate adjusted case filings. First, although Judicial Business tracks how many appellate cases originated from each district court, it tracks bankruptcy appeals, agency appeals, pro se cases, and original proceedings by court of appeals rather than district of origin. Judicial Business tracks these cases by court of appeals because they often do not originate at the district court level and because knowing where each case originated is unnecessary to measure appellate caseload per judge. For purposes of the integer programming model, however, allocating these cases among each circuit's districts is absolutely critical. Otherwise, the model could not consider such cases when evaluating alternative circuit arrangements. To approximate district-by-district figures, I assumed that each district generated a portion of the circuit's total cases in each category equal to its portion of circuit-wide direct appeals from district courts. If district-by-district data became publicly available in the future, swapping that data into the program would be simple.

Second, Judicial Business stopped tracking reinstated cases in 2007. Instead, it now tracks a broader category: reopened cases. Fortunately, reopened cases only constitute a small portion of appellate cases.[69] In addition, a cursory analysis of reinstated and reopened case figures from the past several years reveals that they make up roughly the same percentage of total cases. Accordingly, I used reopened cases as a proxy for reinstated cases. This assumption may have undercounted the adjusted case filings generated by some states and districts, with the most drastically affected states and districts being those currently in circuits that hear the most reopened cases—

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68 *See generally* ADMIN. OFFICE OF THE U.S. COURTS, JUDICIAL BUSINESS OF THE UNITED STATES COURTS: 2008 ANNUAL REPORT OF THE DIRECTOR [hereinafter JUDICIAL BUSINESS] (providing caseload data for the Courts of Appeals).

69 *Cf.* GAO 2003, *supra* note 47, at 9 n.9 (noting that reinstated cases constitute a small portion of appellate cases). In the twelve-month period considered here, the ratio is determinable by examining reopened cases as a percentage of all cases. Specifically, reopened cases comprised 0.43% of all cases in the First Circuit, 7.44% in the Second Circuit, 1.18% in the Third Circuit, 0.52% in the Fourth Circuit, 5.75% in the Fifth Circuit, 1.67% in the Sixth Circuit, 1.84% in the Seventh Circuit, 0.96% in the Eighth Circuit, 2.86% in the Ninth Circuit, 0.99% in the Tenth Circuit, and 4.54% in the Eleventh Circuit. I calculated these figures using data available in JUDICIAL BUSINESS, *supra* note 68, at 84 tbl.B-1.

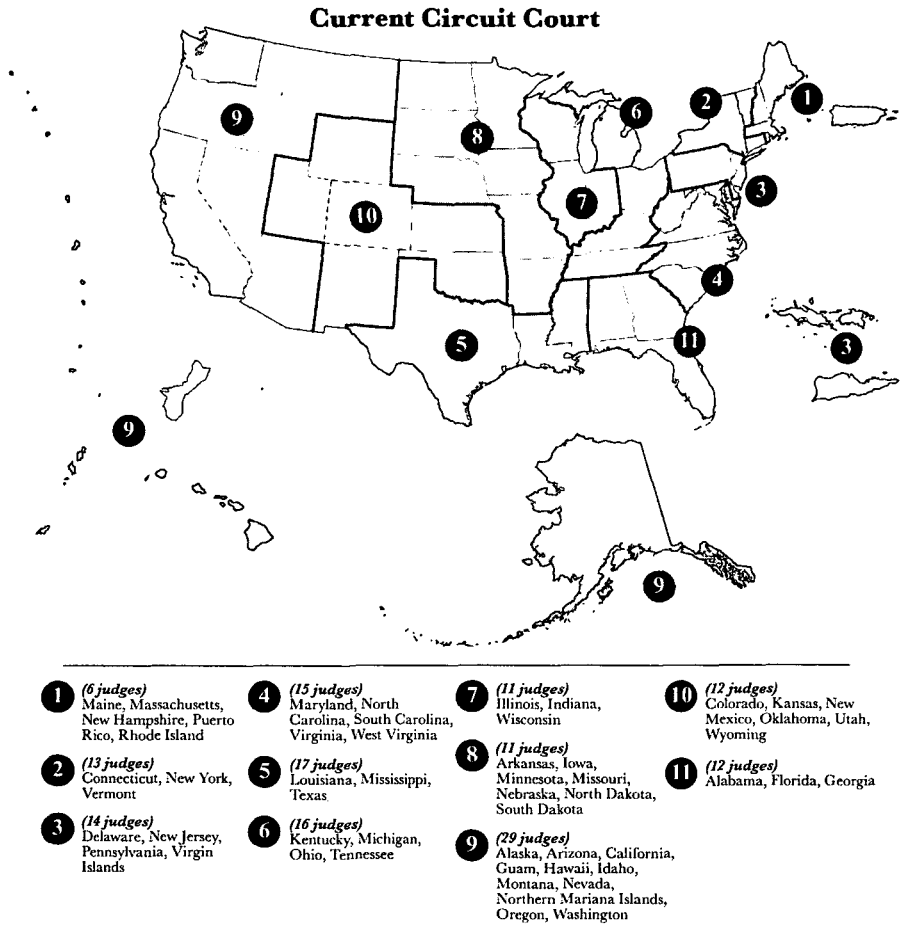
specifically those states in the current Second, Fifth, and Eleventh Circuits.[70]

ESTIMATED CASELOAD BY DISTRICT & STATE[71]

State/District	Current Circuit	ACF
Alabama	11	608
Middle District	11	159
Northern District	11	273
Southern District	11	176
Alaska	9	144
Arizona	9	915
Arkansas	8	376
Eastern District	8	295
Western District	8	82
California	9	5290
Central District	9	2501
Eastern District	9	1133
Northern District	9	1014
Southern District	9	645
Colorado	10	335
Connecticut	2	447
Delaware	3	168
Florida	11	2520
Middle District	11	1111
Northern District	11	349
Southern District	11	1061
Georgia	11	1312
Middle District	11	193
Northern District	11	873
Southern District	11	248
Guam	9	17
Hawaii	9	210
Idaho	9	184
Illinois	7	1245
Central District	7	244
Northern District	7	845
Southern District	7	157
Indiana	7	475
Northern District	7	213
Southern District	7	262
Iowa	8	328
Northern District	8	159
Southern District	8	170
Kansas	10	266
Kentucky	6	459
Eastern District	6	281
Western District	6	178
Louisiana	5	904
Eastern District	5	400
Middle District	5	151
Western District	5	354
Maine	1	116
Maryland	4	388
Massachusetts	1	535
Michigan	6	1174
Eastern District	6	819
Western District	6	355
Minnesota	8	299
Mississippi	5	408
Northern District	5	119
Southern District	5	289
Missouri	8	762
Eastern District	8	348
Western District	8	415
Montana	9	352
Nebraska	8	177
Nevada	9	646
New Hampshire	1	115
New Jersey	3	613
New Mexico	10	217
New York	2	4463
Eastern District	2	1239
Northern District	2	624
Southern District	2	2191
Western District	2	411
North Carolina	4	723
Eastern District	4	277
Middle District	4	159
Western District	4	288
North Dakota	8	53
Northern Mariana Islands	9	17
Ohio	6	935
Northern District	6	523
Southern District	6	413
Oklahoma	10	424
Eastern District	10	95
Northern District	10	132
Western District	10	198
Oregon	9	464
Pennsylvania	3	1871
Eastern District	3	922
Middle District	3	518
Western District	3	432
Puerto Rico	1	383
Rhode Island	1	95
South Carolina	4	657
South Dakota	8	84
Tennessee	6	672
Eastern District	6	232
Middle District	6	195
Western District	6	245
Texas	5	3573
Eastern District	5	437
Northern District	5	913
Southern District	5	1211
Western District	5	1013
Utah	10	194
Vermont	2	92
Virgin Islands	3	108
Virginia	4	968
Eastern District	4	716
Western District	4	253
Eastern District	9	206
Western District	9	549
West Virginia	4	335
Northern District	4	213
Southern District	4	123
Wyoming	10	71

70 *See* JUDICIAL BUSINESS, *supra* note 68, at 84 tbl.B-1.

71 I calculated these figures using the data provided in JUDICIAL BUSINESS, *supra* note 68, at 83 tbl.B, 84 tbl.B-1, 102 tbl.B-3A, 129 tbl.B-9.



C. Initial Observations and Assumptions

When designing the model, I made a few basic assumptions. First, I assumed that the District of Hawaii would remain in the same circuit as the District of the Northern Mariana Islands and the District of Guam. This assumption should not be controversial; they are all already in the current Ninth Circuit, and the White Commission followed this convention when examining proposals to split that circuit.[72] Second, I followed the White Commission in treating the Courts of Appeals for the District of Columbia Circuit and the Federal Circuit as special cases because of their unique caseloads, and therefore, I did not allow the model to alter their jurisdictions.[73] Third, I did not count Guam, the Northern Mariana Islands, the Virgin Islands, or Puerto Rico as states for purposes of Rule 3, which requires at least three states per circuit.

72 *See* WHITE REPORT, *supra* note 1, at 42.

73 *See id.* at 53 n.112.

Several results were immediately apparent from my initial work. Most significantly, California, New York, and Texas each generate enough cases that even if they were in circuits by themselves, those circuits still could not comply with both the caseload limit and judge maximum.[74] Additionally, although Florida is not large enough to single-handedly break both rules, constructing a three-state contiguous circuit containing Florida that complies with both the caseload and judge restrictions is impossible.[75] In response to these problems, I forced the program to assign these states to circuits with as few judges as possible without violating other restrictions in the program. In addition, six of the current circuit courts have larger caseloads than can be accommodated within the caseload and judge limits imposed by the traditional rules.[76] Because the program is designed to aggressively force compliance with those rules, it will undoubtedly split those circuits.

III
MODEL RESULTS

A. Model 1

For my first implementation, I asked the program to reform circuit boundaries subject to all six rules. Ultimately, it adjusted the boundaries of every circuit except the Third and Seventh and created two new circuits. These changes appear driven by the program's need to shrink or split the circuits where caseloads are already very large.[77] In particular, the program created the new Twelfth Circuit because it needed to place California in a circuit consisting of itself and the two other smallest states that comply with the geographic-contiguity rule. It also created the new Thirteenth Circuit to absorb excess states from the oversized former Fourth, Sixth, and Eleventh Circuits. The pro-

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74 California, New York, and Texas respectively generate approximately 5,290 adjusted case filings, 4,463 adjusted case filings, and 3,573 adjusted case filings. I calculated adjusted caseload using the data in JUDICIAL BUSINESS, *supra* note 68, at 102 tbl.B-3A. However, to comply with the traditional rules regarding caseload and judgeships, a circuit may have no more than 2,833 adjusted case filings. *See supra* note 62; *see also* Bales, *supra* note 17, at 385–86 (discussing this "big state" problem in the context of California's disproportionate influence in the current Court of Appeals for the Ninth Circuit).

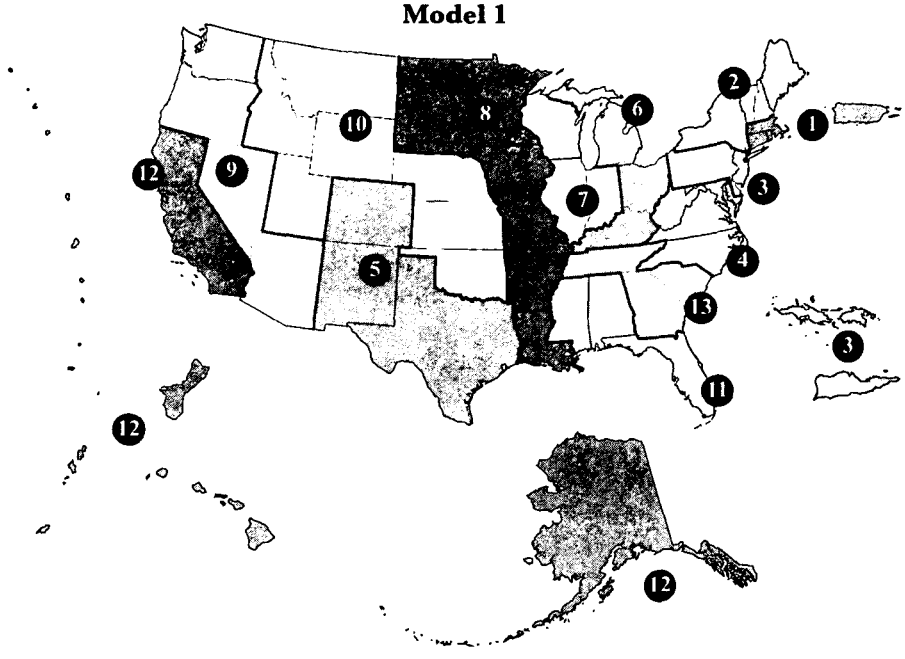
75 Any circuit containing Florida must contain at least two other states, one of which must be either Alabama or Georgia due to the geographical continuity rule. Although Alabama generates fewer cases than Georgia (608 cases compared to 1,312 cases), a circuit containing only Florida and Alabama would still generate approximately 3,128 adjusted case filings, which already exceeds the 2,833 adjusted-case-filing limit. *See supra* tbl.1.

76 These appellate courts are the Second Circuit, with approximately 5,000 adjusted case filings; the Fourth Circuit, with approximately 3,069 adjusted case filings; the Fifth Circuit, with approximately 4,883 adjusted case filings; the Sixth Circuit, with approximately 3,238 adjusted case filings; the Ninth Circuit, with approximately 8,988 adjusted case filings; and the Eleventh Circuit, with approximately 4,439 adjusted case filings.

77 *See supra* note 62 and accompanying text.

gram's decision to split the Fifth Circuit among three different circuits appears to result from its need to make the circuits containing Florida and Texas require as few judges above the Rule 5 limit as possible.

Model 1



1 *(9 judges)* Connecticut, Massachusetts, Puerto Rico, Rhode Island

2 *(29 judges)* Maine, New Hampshire, New York, Vermont

3 *(17 judges)* Delaware, New Jersey, Pennsylvania, Virgin Islands

4 *(15 judges)* Maryland, North Carolina, Virginia, West Virginia

5 *(25 judges)* Colorado, New Mexico, Texas

6 *(16 judges)* Kentucky, Michigan, Ohio

7 *(13 judges)* Illinois, Indiana, Wisconsin

8 *(17 judges)* Arkansas, Iowa, Louisiana, Minnesta, Missouri, North Dakota, South Dakota

9 *(17 judges)* Arizona, Nevada, Oregon, Washington

10 *(11 judges)* Idaho, Kansas, Montana, Nebraska, Oklahoma, Utah, Wyoming

11 *(22 judges)* Alabama, Florida, Mississippi

12 *(35 judges)* Alaska, California, Guam, Hawaii, Northern Mariana Islands

13 *(16 judges)* Georgia, South Carolina, Tennessee

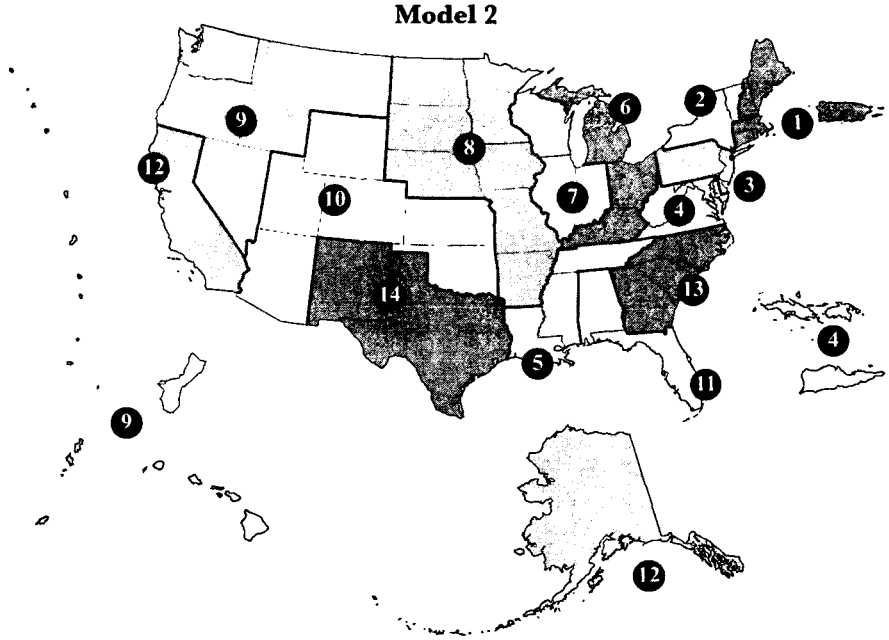
B. Model 2

In the second model, I allowed two-state circuits where necessary either to avoid violating the seventeen-judge limit or to mitigate unavoidable violations of the seventeen-judge limit. Unsurprisingly, when the program applied these conditions, it placed California, Florida, New York, and Texas in two-state circuits.[78] However, allowing two-state circuits did relatively little to decrease the size of some circuits, resulting in at best a three-judge reduction in the circuits' size. The four circuits containing California, Florida, New York, and Texas continued to require more than seventeen judges each. These two-state

78 *See supra* notes 74–75 and accompanying text.

circuits aside, this model's results closely resemble those of the first model.

Model 2



1 *(11 judges)* Connecticut, Maine, Massachusetts, New Hampshire, Puerto Rico, Rhode Island

2 *(28 judges)* New York, Vermont

3 *(16 judges)* Delaware, New Jersey, Pennsylvania

4 *(11 judges)* Maryland, Virginia, Virgin Islands, West Virginia

5 *(12 judges)* Louisiana, Mississippi, Tennessee

6 *(16 judges)* Kentucky, Michigan, Ohio

7 *(13 judges)* Illinois, Indiana, Wisconsin

8 *(13 judges)* Arkansas, Iowa, Minnesota, Missouri, Nebraska, North Dakota, South Dakota

9 *(16 judges)* Guam, Hawaii, Idaho, Montana, Nevada, Northern Mariana Islands, Oregon, Washington

10 *(14 judges)* Arizona, Colorado, Kansas, Oklahoma, Utah, Wyoming

11 *(19 judges)* Alabama, Florida

12 *(33 judges)* Alaska, California

13 *(17 judges)* Georgia, North Carolina, South Carolina

14 *(23 judges)* New Mexico, Texas

C. Model 3

In the third model, I allowed states to be split between two circuits where necessary to avoid violating the seventeen-judge limit or to mitigate unavoidable violations of the seventeen-judge limit.[79] In no instance did I allow the model to split states between three or more circuits, and I treated these partial states as full states for purposes of Rule 3. Additionally, I imposed the rule that if a circuit contains multiple districts from the same state, those districts must be contiguous.

This model produced fewer overly large circuits than did Model 2. Attaining this result, however, required the model to split Califor-

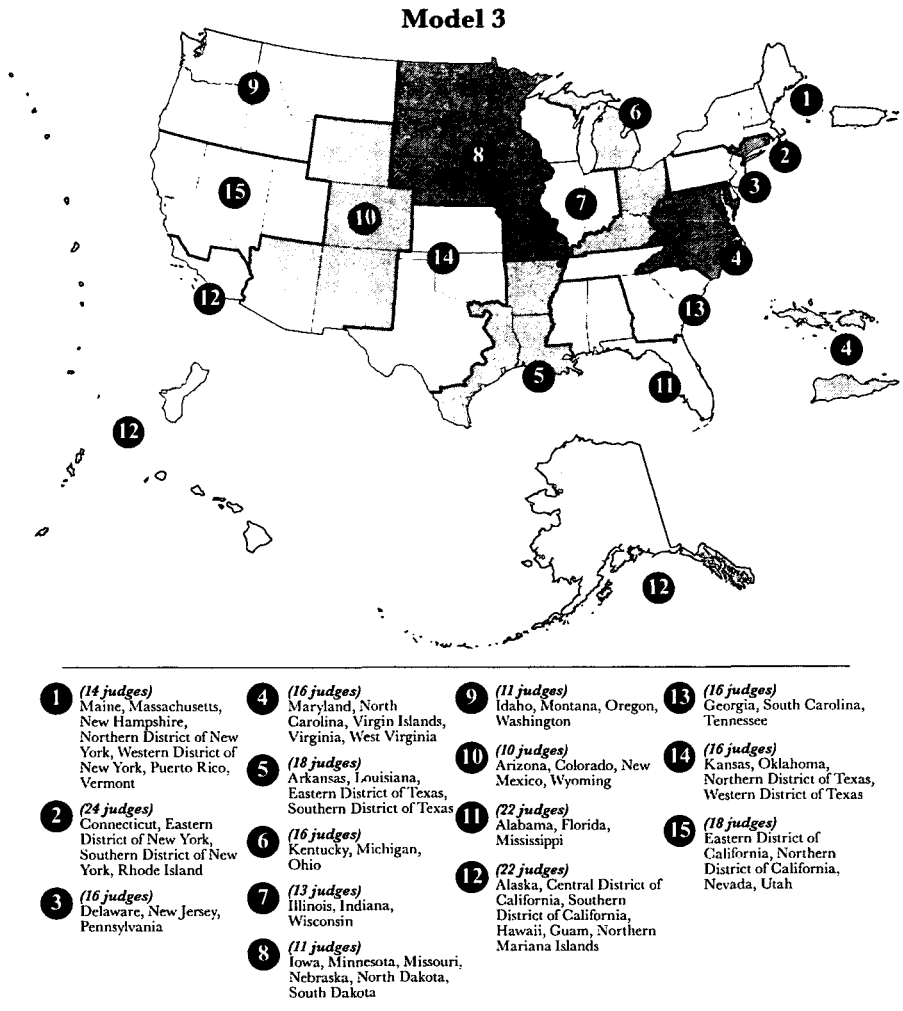
79 The Hruska Commission similarly suggested this technique when it confronted the otherwise unsolvable problem of how to equitably divide the Ninth Circuit. *See* HRUSKA REPORT, *supra* note 1, at 16–20, *reprinted in* 62 F.R.D. 223, 238–40 (1973).

nia, Texas, and New York between two circuits each and also required a total of four new circuits, one more than was needed for Model 2. This model finally manages to bring California's caseload under control. Indeed, California's split leaves the new Second Circuit, containing the Southern and Eastern Districts of New York, as the largest circuit. In addition, splitting Texas not only allows the model to drop the Fifth Circuit to eighteen judges, but it also allows it to avoid Model 2's potentially highly disruptive three-way split of the old Fifth Circuit. It also has the added, serendipitous advantage of avoiding an increase in the number of circuits on the Gulf Coast.[80] On the other hand, this model does split the West Coast between three circuits, two of which are dominated by parts of California.[81]

This model also makes larger and more significant alterations to circuit boundaries than Models 1 and 2. Those models generally shifted one or two state blocks, and the largest disruptions occurred in the South (where the models added an additional circuit) and around Texas (due to the models' efforts to reduce the number of judges in the circuit containing that state). Although those models split up the current Ninth Circuit, the new circuits generally occupy the same basic territory. By contrast, this model's new Fourteenth and Fifteenth Circuits dramatically cut into the territory of the current Tenth Circuit.

80 *Cf.* WHITE REPORT, *supra* note 1, at 52 (discussing the impact of circuit boundaries on federalism in the context of the West Coast).

81 *See id.*

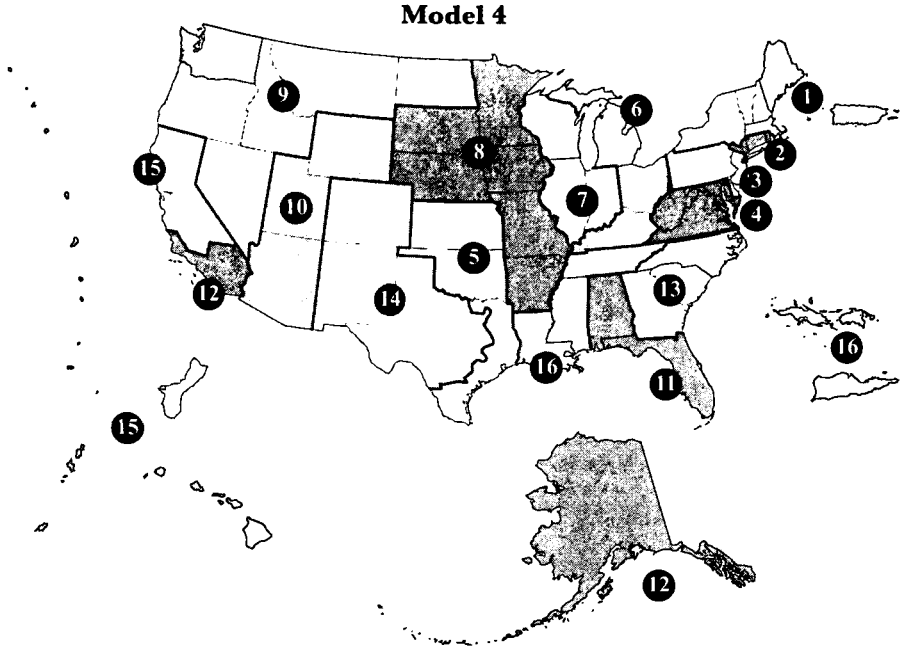


D. Model 4

In the fourth model, I applied the rules relaxations from Models 2 and 3. The model could make two-state circuits and could split states between two circuits. For purposes of the two-states-per-circuit minimum, partial states counted as a whole. Again, if a circuit contained multiple districts from the same state, those districts had to be contiguous.

This model finally brought most circuits under the seventeen-judge maximum. The only circuits in Model 4 with more than seventeen judges on the bench are the new Second, Eleventh, and Twelfth Circuits, which respectively contain the Southern and Eastern Districts of New York, the Southern and Central Districts of California, and the state of Florida. However, to accomplish this goal, the model had to create a total of five new circuits.

Model 4 exacerbates the problem, also apparent in Model 3, that some circuits are effectively dominated by a single large state or portion thereof. The most egregious examples are the Twelfth and Fifteenth Circuits, which are dominated by California.[82]



82 In Model 4, the Twelfth Circuit contains solely Alaska and the Southern and Central Districts of California. Of the circuit's approximately 3,290 adjusted case filings, 3,146 (95.6%) originate from California. Similarly, of the approximately 2,390 adjusted case filings in the Fifteenth Circuit, 2,147 (89.8%) originate from California, while the remainder originate from Guam, Hawaii, and the Northern Mariana Islands. *Cf.* WHITE REPORT, *supra* note 1, at 53 (outlining some potential problems with allowing a single state to dominate a circuit, particularly a two-state circuit).

SUMMARY OF CASELOAD BY MODEL AND CIRCUIT

Current Circuits			Model 1			Model 2		
Circuit	Judges	Caseload	Circuit	Judges	Caseload	Circuit	Judges	Caseload
1	6	1243	1	9	1460	1	11	1691
2	13	5000	2	29	4786	2	28	4555
3	14	2758	3	17	2760	3	16	2652
4	15	3069	4	15	2414	4	11	1799
5	17	4883	5	25	4145	5	12	1984
6	16	3238	6	16	2568	6	16	2568
7	11	2165	7	13	2166	7	13	2166
8	11	2075	8	17	2806	8	13	2079
9	29	8988	9	17	2780	9	16	2644
10	12	1524	10	11	1668	10	14	2225
11	12	4439	11	22	3536	11	19	3128
			12	35	5677	12	33	5434
			13	16	2641	13	17	2692
						14	23	3790

Model 3			Model 4		
Circuit	Judges	Caseload	Circuit	Judges	Caseload
1	14	2275	1	14	2275
2	24	3971	2	24	3971
3	16	2652	3	16	2652
4	16	2522	4	11	1691
5	18	2928	5	15	2338
6	16	2568	6	16	2568
7	13	2166	7	13	2166
8	11	1703	8	13	2026
9	11	1755	9	15	2454
10	10	1558	10	8	1180
11	22	3536	11	19	3128
12	22	3533	12	20	3290
13	16	2641	13	17	2692
14	16	2613	14	15	2498
15	18	2987	15	15	2390
			16	13	2092

IV
MODEL LIMITATIONS

Although integer programs are very powerful, they do have limitations. The two limitations that are most directly relevant to this Note are computational limits and the difficulty of precisely defining the relationships and relative weights of an integer program's variables. First, despite advances in computer technology, modern computers could still take years to solve a theoretically proper integer program.[83] Many such models can be simplified or more tightly con-

[83] This shortcoming is partly due to the manner in which computerized solvers approach integer programs. Although many algorithms can solve linear programs relatively quickly, no algorithm can solve integer programs. Instead, integer-program solvers generally use two main approaches. The first involves converting (or "relaxing") integer programs into related linear programs, solving the linear programs, and testing the results. The second involves systematically trying different combinations of variable values. This process is, of course, a gross oversimplification, but it does serve to illustrate the general difficulty involved. *See* FOURER ET AL, *supra* note 56, at 448–49.

structed to shorten the time the computer takes to solve them; other models cannot. One relatively straightforward way to address this problem is to reduce the number of possible solutions the model has to consider by adding constraints to exclude solutions that are known to be incorrect. However, there is a fine line between a solution that is "incorrect" and one that is "unexpected but not wrong." This problem did not arise for these models because they already had to keep each new circuit in roughly the same location as the old circuit. If, however, the model was modified to ignore established circuit boundaries, these constraints would have to be removed, greatly increasing the amount of time necessary to obtain solutions.

More significantly, integer programs, like all computer programs, rarely produce useful results unless they are given precise, complete instructions. For example, everyone knows that Virginia and West Virginia are adjacent. The model, however, does not know this fact until and unless it is told.[84] This deficiency can cause much more vexing difficulties, however, when it is necessary to assign relative weights to different outcomes. Here, everyone knows that in some situations, adding additional judges to existing courts of appeals is preferable to allowing the courts to continue operating with very large caseloads, and relatively large caseloads may likewise be preferable to entirely new courts of appeals; but there is no general consensus on when each of these options is appropriate. Indeed, this model dodged this issue by assuming a limit of five hundred adjusted case filings per three-judge panel and assuming that circuit realignment is preferable to assigning too many judges to a court of appeals. This approach, however, is by no means the only way to address the problem.

These two limitations, acting in concert, have a third important implication for this model. An integer program usually cannot include everything relevant to the problem that it is trying to solve. Properly accounting for all influences in a situation would often require so many variables and constraints that the program could not finish its calculations in a reasonable amount of time. Furthermore, programmers sometimes intentionally omit important influences, perhaps because they arise infrequently or are too difficult to quantify. If the simpler version of the program is adequate, the omitted influences might simply never make it into the program. This program omits several factors for a combination of these reasons. Most obvi-

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84 Indeed, the most difficult part of programming these models was designing and implementing a series of constraints to check for adjacencies properly. The model incorporates these constraints by making use of two lists: "pairs" and "triples." "Pairs" lists each pair of adjacent states. Similarly, "Triples" lists each set of three states that are all adjacent to each other. Constraints in the program total interstate adjacencies for each circuit, adjust this total using the "Triples" list, and then make sure that this number is appropriate for the number of states in the circuit.

ously, it disregards the negative impact of splitting a single economically integrated area between different circuits.[85] Similarly, the objective function that these models use is relatively naïve. In short, although the model may be "good enough," it almost certainly is not the best it can be.

CONCLUSIONS

Regardless of what circuit court criteria one prefers, the models discussed in this Note were all successful in two key ways. First, each illustrates a "perfect" circuit map based on the parameters given to it. Second, by providing concrete examples, the models highlight issues and approaches not otherwise apparent. Each of these points deserves further elaboration.

First, the models' results clearly confirm that the ideal circuit criteria are fundamentally irreconcilable. Even the very significant structural changes that Model 4 envisions fail to bring all circuit caseloads down to ideal levels. Ultimately, meeting the seventeen-judge limit would require, at a minimum, placing the Southern District of New York in a separate circuit from the Eastern District of New York, as well as splitting California between three separate circuits.[86] Neither of these approaches is likely to be widely accepted.

Although not immediately clear from the models' results, analysis of the circuit maps and caseload figures reveals eleven states that under ideal circuit criteria cannot be in the same circuit as one another. These states are Arizona, California, Florida, Georgia, Louisiana, Michigan, New York, Pennsylvania, Virginia, and Texas.[87] Many, but not all, of these states are already in separate circuits. Dealing with this problem necessitates changes to the Fourth, Fifth, Ninth, and Eleventh Circuits; these changes require further changes to neighboring circuits as well. Accordingly, as the models are allowed to deviate from the ideal criteria, the models split these states between circuits or place them in two-state circuits.

Integer programming models are only as good as the information and constraints given to them. When a program returns unexpected, unusual, or unreasonable results, it forces the programmer to determine what caused those results and adjust the assumptions (and the program) accordingly. Through this iterative process, the programmer can improve the models over time.

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85 *See, e.g.*, WHITE REPORT, *supra* note 1, at 52 (discussing the downsides of splitting California between different circuits); Marshall H. Tanick, *Split in the Circuits: Breaking Up the Eighth*, 61 BENCH & B. MINN., Mar. 2004, at 30 (discussing how combining states with different legal and cultural climates produces undesirable results).

86 *See supra* tbl.1. Relevant calculations are on file with the author.

87 Relevant calculations are on file with the author.

The most novel suggestion to arise from these models' results is that of creating a new circuit in the South. This new circuit would relieve the current Eleventh Circuit of the necessity of dealing with cases from both Georgia and Florida, both of which independently generate enough cases to dominate a circuit.[88]

On the other hand, a glaring problem in the models' results is the lack of explicit standards stating when switching a state from one circuit to another to reduce caseload pressures is appropriate and when a circuit split is preferable to jointly reorganizing two or more circuits. Clearly, such changes impose significant costs. Similarly, the models do not explicitly consider the legal and administrative disruptions that would be inherent in any changes to the circuits' boundaries. Unfortunately, the literature discussing circuit reorganizations has not clearly addressed the issue of cost,[89] and such considerations are beyond the scope of this Note. Accordingly, I did not factor cost into any of the models.

Nevertheless, omitting relative weights for splitting or altering circuits has clear effects on the models' results. For example, Models 1 and 3 both altered the Eleventh Circuit to contain Mississippi instead of Georgia because more cases originate in Georgia than Mississippi and because any circuit containing Florida would have too many judges.[90] Similarly, Model 1 put Maine and New Hampshire in the Second Circuit and Connecticut in the First because Maine and New Hampshire collectively generate fewer appellate cases than Connecticut. Intuitively, these assignments seem questionable. However, absent an explicit statement of when such changes are appropriate, the models simply cannot adequately consider the problem.

The question becomes more complicated when splitting states across multiple circuits. This division raises the additional question of whether splitting a circuit into components containing fewer than three states is preferable to including at least part of three states if doing so requires reconfiguring more than one current circuit. This tradeoff can be seen in the ways that Models 3 and 4 split California and Texas. However, even though the models did not explicitly consider these subjects, they were nevertheless successful in framing the questions by highlighting specific circuits and states where the problems arose.

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88 Relevant calculations are on file with the author.

89 *See* WHITE REPORT, *supra* note 1, at 52–57 (briefly considering circuit realignments that would involve splitting the current Ninth Circuit as well as slightly altering the arrangement of the current Tenth Circuit). *See generally* Baker, *supra* note 6 (summarizing several studies and proposals).

90 *See supra* note 87 and accompanying text.

Ultimately, none of the models is perfect. All would impose significant transition costs on the federal court system, and the models are simply not set up to consider those costs. However, the models successfully demonstrate the practical effects of proposed changes to ideal circuit criteria, highlight potential theoretical and real-world issues that accompany those proposed changes, and help identify new problems and possibilities.