

**PATENTABILITY OF COMPUTER SOFTWARE AFTER *STATE STREET BANK & TRUST CO. V. SIGNATURE FINANCIAL GROUP, INC.*:
EVISCERATION OF THE SUBJECT MATTER REQUIREMENT**

ROBERT A. HULSE

U.C. Davis Law Review
Winter, 2000
(33 U.C. DAVIS L. REV. 491)

INTRODUCTION	1
I. PATENT LAW AND COMPUTER SOFTWARE	4
<i>A. Requirements for a Patent</i>	5
1. Subject Matter	6
2. Nonobviousness	8
<i>B. The Patent Application</i>	10
<i>C. The Mathematical Algorithm Exception</i>	11
1. Early Doctrines	12
2. Development of the Mathematical Algorithm Exception	14
3. Recent Precedent: <i>In re Alappat</i>	16
II. STATE STREET BANK & TRUST CO. V. SIGNATURE FINANCIAL GROUP, INC.	18
<i>A. Background</i>	18
<i>B. The Federal Circuit's Decision</i>	19
III. ANALYSIS	21
<i>A. State Street Was Wrongly Decided</i>	21
1. <i>State Street</i> Misapplied <i>Alappat</i>	21
2. The <i>State Street</i> Invention Was Not a Machine	22
3. <i>State Street</i> Wrongly Construed the Mathematical Algorithm Exception	25
4. The <i>State Street</i> Patent Was an Unpatentable Advance in the Liberal Arts	26
<i>B. Subject Matter and Policy</i>	27
1. <i>State Street</i> Allows Patent Applicants to Circumvent the Subject Matter Requirement	28
2. After <i>State Street</i> Nearly All Software Is Patentable	29
<i>C. Proposal: A Nexus Requirement</i>	30
1. A Nexus Requirement	30
2. Application of the Proposal to Computer Software	31
3. Application of the Nexus Requirement to Other Fields of Technology	32
CONCLUSION	33

INTRODUCTION

The law often faces challenges brought on by advances in technology, in which it must accommodate the new technology.¹ In particular, patent law

¹ See *Computer Assocs. Int'l, Inc. v. Altai, Inc.*, 982 F.2d 693, 706 (2d Cir. 1992) (observing that rapid growth in technical fields such as computer software “can quickly outpace judicial decisionmaking”). See generally Symposium, *Pornography: Free Speech or Censorship in Cyberspace?*, 3 B.U. J. SCI. & TECH. L. 3 (1997) (discussing how Internet and computers have affected law).

must continually evolve because it, by definition, deals with the state of the art.² The United States patent system, rooted in the federal Constitution,³ has adapted over time to its present form.⁴ Computer software is one example of how recent technological advances have challenged the patent system.⁵

Computer software presents unique problems to the patent system.⁶ Although patent protection does not extend to mathematical formulas and abstract concepts it does embrace useful machines and tangible processes.⁷ Because it has elements of both tangible products and abstract concepts, computer software blurs the distinction between patentable and unpatentable subject matter.⁸

In *State Street Bank & Trust Co. v. Signature Financial Group, Inc.*,⁹ the United States Court of Appeals for the Federal Circuit attempted to outline a

² See 35 U.S.C. § 103 (1994 & Supp. III 1997) (requiring patents to be nonobvious and, therefore, inventive).

³ See U.S. CONST. art. I, § 8, cl. 8 (granting Congress power to grant limited monopolies to inventors for their advancements in useful arts and sciences).

⁴ See generally 35 U.S.C. §§ 1-376 (1994 & Supp. III 1997) (codifying current patent law).

⁵ See Frank H. Easterbrook, *Cyberspace and the Law of the Horse*, 1996 U. CHI. LEGAL F. 207, 210 (suggesting that computer technology is moving too fast to formulate specialized legal solutions); Pamela Samuelson, *Digital Media and the Changing Face of Intellectual Property Law*, 16 RUTGERS COMPUTER & TECH. L.J. 323, 323-33 (1990) (observing that nature of computer software has stretched patent law beyond traditional bounds).

Less than 20 years ago, the law did not allow patents on computer software. See, e.g., *Gottschalk v. Benson*, 409 U.S. 63, 73 (1972) (refusing to allow patent for invention involving computer program). In *Benson*, the Supreme Court refused to recognize patents that included computer algorithms, without specific authorization from Congress. See *id.* Despite *Benson*, however, courts have allowed computer software patents. See, e.g., *Diamond v. Diehr*, 450 U.S. 175, 191-94 (1981) (holding patent using computer program to control rubber curing process valid); *In re Alappat*, 33 F.3d 1526, 1544-45 (Fed. Cir. 1994) (in banc) (holding patent for invention that used computer algorithm valid).

⁶ See *infra* note 84 (chronicling courts' struggle with software patentability issue); see also Easterbrook, *supra* note 5, at 210 (explaining that computer technology challenges law).

⁷ See 35 U.S.C. § 101 (1994); see also *Kewanee Oil Co. v. Bicron Corp.*, 416 U.S. 470, 483 (1974) (holding that inventions cannot receive patent protection unless they fall within express category of 35 U.S.C. § 101).

⁸ See *Diehr*, 450 U.S. at 185-87 (identifying laws of nature, natural phenomena, and abstract ideas as three types of subject matter that are unpatentable). See generally *Mackay Radio & Tel. Co. v. Radio Corp. of Am.*, 306 U.S. 86, 94 (1939) (holding that mathematical expressions of scientific truths are not patentable, but novel and useful structures applying knowledge of scientific truths may be patentable).

⁹ 149 F.3d 1368 (Fed. Cir. 1998), cert. denied, 119 S. Ct. 851 (1999).

standard for computer software patentability.¹⁰ Unfortunately, the *State Street* decision destroyed an important distinction between patentable and unpatentable subject matter.¹¹ In *State Street*, the Federal Circuit held that a software program is patentable if it produces a tangible result, even if the result is merely a number that a set of calculations produces.¹²

By making practically any computer program patentable, *State Street* significantly expands the patent system's reach.¹³ The decision will likely cause a surge of patent infringement suits in the software industry.¹⁴ At a minimum, the *State Street* decision will likely induce the filing of new patent applications for financial software and internet commerce.¹⁵

This Note argues that the Federal Circuit erred in upholding the validity of the *State Street* patent. Part I of this Note provides a general background on patent law and addresses specific issues that involve the patenting of computer software. Part II discusses the facts, procedure, holding, and rationale of *State Street*. Part III argues that *State Street* upheld a patent that was not the type of invention that patent law should protect, and it proposes a new standard for software patentability.

¹⁰ See *id.* at 1375.

¹¹ See *infra* Part III.B.1 (arguing that subject matter requirement and mathematical algorithm exception have little meaning after *State Street*).

¹² See *State Street*, 149 F.3d at 1373.

¹³ See *Hughes Aircraft Co. v. United States*, 148 F.3d 1384, 1385 (Fed. Cir. 1998) (Clevenger, J., dissenting) (observing that, after *State Street*, “virtually anything is patentable”); see also William T. Ellis & Aaron C. Chatterjee, *State Street Sets Seismic Precedent*, NAT’L L.J., Sept. 21, 1998, at B13 (advising financial institutions how to react to *State Street*); Barry D. Rein, *A New World for Money Managers*, N.Y. L.J., Sept. 21, 1998, at S1 (explaining that industry, before *State Street*, generally disregarded patents and assumed that financial software was not within patent system); Teresa Riordan, *An Appeals Court Says a Mathematical Formula Can Be Patented, If It Is a Moneymaker*, N.Y. TIMES, Aug. 3, 1998, at D4 (reporting that *State Street* went further than expected); Jaret Seiberg, *Docket: Ruling Threatens Banks with Patent Lawsuits*, AM. BANKER, Sept. 2, 1998, at 3 (reporting that reliance on “method of business” defense has led financial institutions to ignore patents on financial software).

¹⁴ See Ellis & Chatterjee, *supra* note 13, at B13 (suggesting that users of financial software ascertain whether they are infringing any patents); Seiberg, *supra* note 13, at 3 (warning of hundreds of patent infringement suits in financial services industry after *State Street*).

¹⁵ See Riordan, *supra* note 13, at D2 (predicting surge of patents relating to financial instruments); Brenda Sandburg, *Madness in PTO’s E-Commerce Method?*, RECORDER, Aug. 27, 1998, at 1 (reporting that *State Street* opened floodgates for patent filings on internet commerce, but expressing doubt as to their validity and effect on market). *But see* Jeff Blumenthal, *Dilworth Attorney Sees Beauty Contest Pay Off in Big Victory in Patent Case*, LEGAL INTELLIGENCER, Aug. 6, 1998, at 3 (observing that Patent Trademark Office has already issued more than 20,000 financial instrument patents).

I. PATENT LAW AND COMPUTER SOFTWARE

Because free trade is a cornerstone of its capitalist economy, the United States has a public policy that strongly disfavors economic monopolies.¹⁶ Patents, which are temporary monopolies,¹⁷ appear at first blush to contradict this policy for free competition.¹⁸ In exchange for the monopoly grant, however, the patent owner must give the invention to the public.¹⁹ The benefits accruing to the public from this disclosure offset the cost to the public of the patent's monopoly.²⁰ The patent system also encourages research and development in technology by rewarding inventions with a monopoly.²¹ Patents, therefore, are the price that society pays to encourage inventors to invent and then share their inventions with the public.²²

The patent system seeks an optimal balance between encouraging innovation and maintaining free competition.²³ The Patent and Copyright

¹⁶ See Sherman Act § 2, 15 U.S.C. § 2 (1994) (outlawing economic monopolies); see also *Standard Oil Co. v. United States*, 221 U.S. 1, 61-62 (1911) (prohibiting restraint of trade through monopoly); 12 CONG. REC. 2455-68 (1890) (explaining that Sherman Act protects competition by preventing consolidation of economic power); HANS B. THORELLI, *THE FEDERAL ANTITRUST POLICY* 226-27 (1954) (observing strong public policy favoring free competition, which benefits consumers).

¹⁷ See 35 U.S.C. § 154(a) (1994 & Supp. III 1997) (granting exclusive rights to patent owner to make, use, or sell invention); *id.* § 271(a) (1994 & Supp. III 1997) (providing cause of action for patent infringement). A patent owner has a cause of action against anyone who makes, uses, offers to sell, sells, or imports the subject matter of a patent without authority from the owner. See *id.* The statute only applies to activities inside the United States. See *id.* § 154(a) (1).

A patent lasts for 20 years from the date the patentee filed the application. See *id.* § 154(a)(2). If the application contains a reference to an earlier application, the patent's term begins from the earlier application's date. See *id.*

¹⁸ See PHILLIP AREEDA & LOUIS KAPLOW, *ANTITRUST ANALYSIS* 150-51 (5th ed. 1997); Gordon L. Doerfer, *The Limits on Trade Secret Law Imposed by Federal Patent and Antitrust Supremacy*, 80 HARV. L. REV. 1432, 1440-41 (1967) (explaining policy justifications of patent system).

¹⁹ See 35 U.S.C. § 112 (1994). In a patent, the patent applicant must describe the invention sufficiently to enable a person skilled in the relevant art to practice the invention. See *id.*

²⁰ See AREEDA & KAPLOW, *supra* note 18, at 151-52 (explaining justifications of patent system and benefit of public disclosure of inventions); Doerfer, *supra* note 18, at 1440-41 (explaining "exchange for secrets" theory of patent system whereby inventors receive patents in exchange for disclosure of invention to public).

²¹ See *Aronson v. Quick Point Pencil Co.*, 440 U.S. 257, 265-66 (1979) (stating that patents provide incentives by rewarding invention); AREEDA & KAPLOW, *supra* note 18, at 152-53 (explaining how patent system provides incentives to invent).

²² See AREEDA & KAPLOW, *supra* note 18, at 150-53.

²³ See *Brenner v. Manson*, 383 U.S. 519, 533-36 (1966).

Clause of Article I of the United States Constitution specifically authorizes Congress to establish a patent system that fosters these policies.²⁴ Congress has exercised this power by crafting the Patent Act, which outlines a set of requirements and procedures to obtain a patent.²⁵

A. Requirements for a Patent

To receive a patent, an inventor must apply to the United States Patent and Trademark Office (“PTO”) and prove that the alleged invention satisfies the requirements for a patent.²⁶ To be valid under the Patent Act, a patent must be proper subject matter,²⁷ useful,²⁸ novel,²⁹ and nonobvious.³⁰ The subject matter

²⁴ See U.S. CONST. art. I, § 8, cl. 8. The Patent and Copyright Clause grants Congress the power “to promote the Progress of Science and useful Arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries.” *Id.* Congress first exercised this power by passing the Patent Act of 1790. See Act of Apr. 10, 1790, ch. 7, § 1, 1 Stat. 109. Congress has amended the patent code several times to its present form. See 35 U.S.C. §§ 1-376 (1994 & Supp. III 1997).

²⁵ See 35 U.S.C. §§ 1-376.

²⁶ See AREEDA & KAPLOW, *supra* note 18, at 158-59 (describing patent application and examination process); see also United States Patent and Trademark Office, *Examination of Applications and Proceedings in the Patent and Trademark Office* (visited Oct. 13, 1998) <<http://www.uspto.gov/web/offices/pac/doc/general/exam.htm>> [hereinafter *Examination of Applications*] (on file with author) (describing patent examination procedure).

²⁷ See 35 U.S.C. § 101 (1994); *infra* notes 32-41 and accompanying text (discussing subject matter requirement).

²⁸ See 35 U.S.C. § 101. In the context of patent law, “useful” means that the invention has some kind of practical or industrial application. See *Brenner*, 383 U.S. at 535-36 (stating that utility requirement means that patent system promotes commerce rather than general enlightenment); *Fujikawa v. Wattanasin*, 93 F.3d 1559, 1563 (Fed. Cir. 1996) (observing principle that patents have practical utility). Inventions that fail to operate as claimed also fail the utility requirement. See *Mitchell v. Tilghman*, 86 U.S. (19 Wall.) 287, 396 (1873) (requiring that patents be “operable,” or capable of achieving stated objective); see also *Newman v. Quigg*, 877 F.2d 1575, 1582 (Fed. Cir. 1989), *modified*, 886 F.2d 329 (Fed. Cir. 1989) (finding invalid patent on perpetual motion machine, which violated first and second laws of thermodynamics); *Fregeau v. Mossinghoff*, 776 F.2d 1034, 1039 (Fed. Cir. 1985) (finding inoperable and, thus, not useful, patent for improving taste of beverages by passing them through magnetic field). *But see Raytheon Co. v. Roper Corp.*, 724 F.2d 951, 958 (Fed. Cir. 1983) (stating that invention need only meet at least one stated objective to satisfy utility requirement).

The utility requirement stems from the notion that an inventor must give something of value in return for a patent. See *Brenner*, 383 U.S. at 534-35 (requiring that invention have substantial utility so that it benefits public in exchange for monopoly grant). When evaluating the utility requirement, courts seek a balance between promoting invention and maintaining free competition. See *id.* An invention, however, need not be the best or only way of solving a problem to satisfy the utility requirement. See *Raytheon*, 724 F.2d at 956.

²⁹ See 35 U.S.C. § 102 (1994). To qualify for a patent, an invention

and nonobviousness requirements are particularly relevant to the *State Street* case.³¹

1. Subject Matter

Not all types of inventions or discoveries are patentable.³² The Patent Act specifies that the subject matter of a patent must fall within one of four listed categories: process, machine, manufacture, or composition of matter.³³ By using these broad terms, Congress intended to include an expansive range of subject matter when it drafted the subject matter requirement.³⁴

must be novel, meaning that it must not already exist in the prior art at the time of its invention. *See id.*; *see also* *Connell v. Sears, Roebuck & Co.*, 722 F.2d 1542, 1548 (Fed. Cir. 1983) (stating that prior art invalidates patent when it completely describes patent's claim). Additionally, inventors may lose their rights to a patent by not diligently applying for a patent. *See* 35 U.S.C. § 102(b)-(d).

³⁰ *See* 35 U.S.C. § 103 (1994 & Supp. III 1997); *see also infra* notes 50-57 and accompanying text (discussing nonobviousness requirement).

³¹ *See* *State St. Bank & Trust Co. v. Signature Fin. Group, Inc.*, 149 F.3d 1368 *passim* (Fed. Cir. 1998).

³² *See* 35 U.S.C. § 101 (listing categories of patentable subject matter); *see also* *Diamond v. Diehr*, 450 U.S. 175, 185 (1981) (identifying laws of nature, natural phenomena, and abstract ideas as three types of subject matter that are unpatentable); *Mackay Radio & Tel. Co. v. Radio Corp. of Am.*, 306 U.S. 86, 94 (1939) (holding that mathematical expressions of scientific truths are not patentable); *O'Reilly v. Morse*, 56 U.S. (15 How.) 61, 113 (1853) (denying patent claiming transmission of letters using general principle of electromagnetism). *See generally* Annotation, *Supreme Court's Views as to What Is Patentable Subject Matter Under Federal Law as "Process," "Machine," "Manufacture," or "Composition of Matter,"* 65 L. Ed. 2d 1197 (1981) (discussing Court's interpretation of categories of statutory subject matter in 35 U.S.C. § 101).

³³ *See* 35 U.S.C. § 101; *see also* *Kewanee Oil Co. v. Bicron Corp.*, 416 U.S. 470, 483 (1974) (holding that inventions cannot receive patent protection unless they fall within express category of 35 U.S.C. § 101).

The Patent Act of 1790, the first in the United States, identified as patentable subject matter "any useful art, manufacture, engine, machine, or device . . ." Act of Apr. 10, 1790, ch. 7, § 1, 1 Stat. 109. Congress soon amended this Act to identify the four classes of subject matter — art, machine, manufacture, and composition of matter — currently in the present statute. *See* Act of Feb. 21, 1793, ch. 11, § 1, 1 Stat. 318; *see also* 35 U.S.C. § 100 (1994) (defining "process" as used in 35 U.S.C. § 101 to mean "process, art, or method").

³⁴ *See* S. REP. NO. 82-1979, at 5 (1952), *reprinted in* 1952 U.S.C.C.A.N. 2394, 2398-99; H.R. REP. NO. 82-1923, at 6 (1952), *reprinted in* 1952 U.S.C.C.A.N. 2394, 2398-99; *see also* 35 U.S.C. § 101 (using expansive terms in conjunction with "any" indicating broad scope of intended subject matter); *Diamond v. Chakrabarty*, 447 U.S. 303, 308-09 (1980) (construing legislative history and concluding that Congress contemplated broad scope of patent laws). In passing the Patent Act of 1952, Congress expressed that patents may "include anything under the sun that is made by man." S. REP. NO. 82-1979, at 5, *reprinted in* 1952 U.S.C.C.A.N. at 2399; *accord* H.R. REP. NO. 82-

However, the subject matter requirement has limits.³⁵ Specifically, it prohibits patents on abstract ideas, laws of nature, and physical phenomena.³⁶ Of course, every invention necessarily draws on abstract ideas, laws of nature, and physical phenomena.³⁷ To receive a patent, however, an inventor must use an abstract idea, law of nature, or physical phenomenon to achieve a useful result.³⁸ For example, Newton could not have patented his law of gravity, nor could a discoverer of a new mineral receive a patent for it.³⁹ In contrast, an inventor could receive a patent for a pendulum clock that applies the law of gravity,⁴⁰ and the discoverer of a new mineral could patent a chemical process that uses that mineral.⁴¹

The limits that the subject matter requirement places on patents emanate from the constitutional mandate that patent law promote useful technological arts.⁴² Advances in purely scientific theory are not appropriate for patent protection, as protecting these abstract scientific concepts would not promote technological development.⁴³ In fact, such protection would hinder

1923, at 6, *reprinted in* 1952 U.S.C.C.A.N. 2399 (suggesting broad scope of subject matter under 35 U.S.C. § 101).

³⁵ See *Diehr*, 450 U.S. at 185; *Chakrabarty*, 447 U.S. at 309 (maintaining that, while subject matter requirement is liberal, it is not limitless).

³⁶ See *Diehr*, 450 U.S. at 185 (identifying laws of nature, natural phenomena, and abstract ideas as three types of subject matter that are unpatentable); *Mackay Radio*, 306 U.S. at 94 (holding that mathematical expressions of scientific truths are not patentable, but novel and useful structures applying knowledge of scientific truths may be patentable). A fundamental precept of patent law is that Einstein could not have patented his law, $E=mc^2$. See *Chakrabarty*, 447 U.S. at 309.

³⁷ See *State St. Bank & Trust Co. v. Signature Fin. Group, Inc.*, 149 F.3d 1368, 1374 (Fed. Cir. 1998) (quoting *In re Iwahashi*, 888 F.2d 1370, 1374 (Fed. Cir. 1989)); *Arrhythmia Research Tech., Inc. v. Corazonix Corp.*, 958 F.2d 1053, 1056 n.3 (Fed. Cir. 1992) (noting that descriptions of any step-by-step process involve algorithms).

³⁸ See *State Street*, 149 F.3d at 1373; *In re Alappat*, 33 F.3d 1526, 1544 (Fed. Cir. 1994) (in banc); see also *Funk Bros. Seed Co. v. Kalo Inoculant Co.*, 333 U.S. 127, 130 (1948) (explaining that discoveries of natural laws and abstract ideas are not patentable subject matter, but applications of such discoveries to new and useful ends are patentable).

³⁹ See *Chakrabarty*, 447 U.S. at 309; see also P. ROSENBERG, *PATENT LAW FUNDAMENTALS* 13 (1975) (explaining that Newton could not patent his law of gravity because it always existed, and his mere recognition of it “carried with it no rights to exclude others from its enjoyment”).

⁴⁰ See, e.g., U.S. Patent No. 5,822,277 (Oct. 13, 1998) (describing new pendulum with application in grandfather clocks).

⁴¹ See, e.g., U.S. Patent No. 5,876,683 (Mar. 2, 1999) (describing process for synthesizing new class of material – “nanostructure” materials).

⁴² See U.S. CONST. art. I, § 8, cl. 8.

⁴³ See *Chakrabarty*, 447 U.S. at 309 (stating that manifestations of nature, such as the law of gravity, are not patentable); *Gottschalk v. Benson*, 409 U.S. 63, 67 (1972) (explaining that natural phenomena and abstract concepts are basic tools of scientific work and cannot be subject of patent); see also Ernest D. Buff et al., *Protection and Exploitation of Financial Services Software*, N.J. L.J.,

technological development by preventing others from using those scientific concepts in future inventions.⁴⁴ By excluding subject matter outside the useful arts, the patent system promotes the policy justification of encouraging innovation.⁴⁵

As with purely scientific theory, the patent system does not protect advances in the liberal arts.⁴⁶ Liberal arts, such as economics and other social sciences, are fields outside the technological arts.⁴⁷ Because they are not “useful arts” in the constitutional sense, they are outside the scope of the patent system.⁴⁸ Whether the subject matter of an invention is proper, however, is merely the first test for patentability.⁴⁹

2. Nonobviousness

In addition to being proper subject matter, a patent must be nonobvious.⁵⁰ To be nonobvious, a patent must constitute an inventive step over

Sept. 21, 1998, at 28 (arguing that patents on natural phenomena and abstract ideas controvert constitutional purpose behind patent law).

⁴⁴ See *Benson*, 409 U.S. at 67 (stating that nobody may claim monopolies of abstract mental concepts and natural phenomena because they are fundamental tools of scientific work).

⁴⁵ See AREEDA & KAPLOW, *supra* note 18, at 151-53 (discussing policy considerations of granting patents); Doerfer, *supra* note 18, at 1440-41 (explaining major policy justifications of patent system).

⁴⁶ See *Hotel Security Checking Co. v. Lorraine Co.*, 160 F. 467, 469 (2d Cir. 1908) (noting that patent law does not cover arts that are mere abstractions); Samuelson, *supra* note 5, at 339 (noting that § 101’s limitation to “useful arts” does not incorporate most liberal definition of arts); see also *In re Russell*, 48 F.2d 668, 669 (C.C.P.A. 1931) (holding that new method of organizing train schedule is not technological advance and, hence, not patentable).

The Patent and Copyright Clause of the United States Constitution limits Congress’s power to grant patents to advancements in “Science and the useful Arts.” See U.S. CONST. art. I, § 8, cl. 8. In the constitutional sense, useful arts are synonymous with technological arts. See *In re Waldbaum*, 457 F.2d 997, 1003 (C.C.P.A. 1972); see also *In re Benson*, 441 F.2d 682, 688 (C.C.P.A. 1971) (stating that computers are patentable because they are technological, rather than liberal, arts). Implicit in *In re Benson*’s reasoning is that the liberal arts are not patentable subject matter. See *id.* at 688.

⁴⁷ See, e.g., *In re Toma*, 575 F.2d 872, 877 (C.C.P.A. 1978) (distinguishing between technological and social sciences and holding that invention, which was language translation on computer, had aspects of both).

⁴⁸ See U.S. CONST. art. I, § 8, cl. 8; see also *Waldbaum*, 457 F.2d at 1003 (holding that invention met subject matter requirement because it was within useful, or technological, arts).

⁴⁹ See 35 U.S.C. § 101 (1994). If a patent is proper subject matter, it must then satisfy the other requirements of the Patent Act. See *id.*

⁵⁰ See *id.* § 103 (1994 & Supp. III 1997). The Supreme Court applied an inventiveness requirement to patents before Congress added the nonobvious requirement to the Patent Act. See *Hotchkiss v. Greenwood*, 52 U.S. (11 How.) 248, 262 (1850). In requiring that patentable inventions constitute an inventive step above the prior art, the Court observed that not everything that is new is an

the “prior art.”⁵¹ Prior art is the body of information that is available to the public.⁵² The legal test for nonobviousness is whether an invention would be obvious to a person having ordinary skill in the relevant art and knowledge of the prior art at the time of the invention.⁵³ In other words, a patented invention

invention. *See id.* at 262, 266-67. For example, in *Hotchkiss* the plaintiff owned a patent for clay doorknobs. *See id.* at 264. Although the plaintiff may have been the first to make doorknobs of clay, the Court held, the improvement lacked the degree of ingenuity that patents require. *See id.* at 266 (concluding that patent was invalid). Congress used the *Hotchkiss* formulation to codify the nonobvious requirement. *Compare id.*, with 35 U.S.C. § 103 (requiring that difference between original invention and subject matter sought to be patented cannot be obvious to skilled person in that field).

⁵¹ *See* 35 U.S.C. § 103; *Graham v. John Deere Co.*, 383 U.S. 1, 11-12 (1966). While the novelty requirement mandates that an invention be new over the prior art, the nonobviousness requirement mandates that the invention be new and inventive over that art. *See* 35 U.S.C. § 102 (1994) (providing novelty requirement); *id.* § 103; DONALD S. CHISUM, 2 CHISUM ON PATENTS § 5.01 (1998) (explaining difference between novelty and nonobviousness requirements); *cf.* *Hotchkiss*, 52 U.S. (11 How.) at 265-66 (providing precursor of nonobvious requirement, by requiring that patents be inventive, not just new).

⁵² *See* 35 U.S.C. § 102. The types of prior art that can anticipate an invention include publications or patents in the United States or a foreign country, use or knowledge of inventions in the United States, patent applications pending in the PTO, and inventions in the United States not concealed from the public. *See id.*

⁵³ *See id.* § 103; *see also Graham*, 383 U.S. at 17 (outlining test for applying 35 U.S.C. § 103). Although well established, *Graham*’s test for nonobviousness is not easy to apply. *See Harries v. Air King Prods. Co.*, 183 F.2d 158, 162 (2d Cir. 1950) (discussing test for nonobviousness, Judge Learned Hand wrote that test of invention “is as fugitive, impalpable, wayward, and vague a phantom as exists in the whole paraphernalia of legal concepts”).

The same prior art that can anticipate an invention under 35 U.S.C. § 102 can render an invention nonobvious. *See* 35 U.S.C. § 103(a). Secondary considerations, such as commercial success and failure of others to solve the problem, are also relevant in determining the nonobviousness of an invention. *See Graham*, 383 U.S. at 17-18 (suggesting that secondary considerations like commercial success, persisting unsolved needs, and failure of others to solve problem may be relevant in nonobviousness determination). A secondary consideration only supports nonobviousness, however, if there is a nexus between the invention and the secondary consideration. *See Stratoflex, Inc. v. Aeroquip Corp.*, 713 F.2d 1530, 1539 (Fed. Cir. 1983). For example, the commercial success of a new product may indicate that it is inventive. *See id.* However, that success must result from the alleged inventive aspects of the product, not some other factor unrelated to the invention. *See id.*

Since *Graham*, the Federal Circuit has held that courts must always weigh secondary considerations, regardless of their relative importance. *See id.* at 1538. The Federal Circuit has expanded the list of secondary considerations that *Graham* identified. *See, e.g., In re Dow Chem. Co.*, 837 F.2d 469, 473 (Fed. Cir. 1988) (suggesting that courts may consider previously expressed skepticism of experts as well as years or research preceding invention to determine if invention is obvious under 35 U.S.C. § 103); *Custom Accessories, Inc. v. Jeffrey-Allan Indus., Inc.*, 807 F.2d 955, 960 (Fed. Cir. 1986) (considering

must be beyond the ability of the ordinary artisan or mechanic skilled in the art at the time of the invention.⁵⁴

The nonobviousness requirement ensures that patents provide the public with something new and inventive.⁵⁵ As long as the patent is inventive, the inventor has given sufficient compensation to the public in exchange for the patent's monopoly grant.⁵⁶ Because existing and uninventive products do not benefit the public, they do not receive a patent.⁵⁷

The nonobviousness requirement also encourages industry to use available solutions before wasting resources on unnecessary research.⁵⁸ For industry to use the inventions of prior patents, they must be publicly available.⁵⁹ To serve this purpose, the PTO publishes patent applications when it issues a patent.⁶⁰

B. The Patent Application

If an inventor believes that an invention meets the requirements of the patent system, the inventor may apply to the PTO for a patent.⁶¹ If, after examining the patent application,⁶² the PTO agrees that the patent meets the requirements for patentability, it will issue a patent to the applicant.⁶³

evidence that invention had been copied by competitors as secondary consideration); *Stratoflex*, 713 F.2d at 1538-39 (considering acceptance of licenses by competitors as indicative of nonobviousness).

⁵⁴ See *supra* note 53 (discussing nonobvious requirement). See generally CHISUM, *supra* note 51, at § 5.01 (discussing nonobvious requirement).

⁵⁵ See 35 U.S.C. § 103; see also AREEDA & KAPLOW, *supra* note 18, at 151-52 (describing benefit of patent's disclosure to public).

⁵⁶ See *id.*; Doerfer, *supra* note 18, at 1441-47 (explaining that disclosure requirement ensures that inventor does not keep patented invention secret by insufficiently describing invention in patent application).

⁵⁷ See *Bonito Boats Inc. v. Thunder Craft Boats, Inc.*, 489 U.S. 141, 148-49 (1989) (stating that policy behind novelty and nonobviousness requirements dictates that subject matter in public domain should remain there, unencumbered by patent monopolies); see also AREEDA & KAPLOW, *supra* note 18, at 151-52 (discussing rationale for granting inventors monopolies).

⁵⁸ See *Dewey & Almy Chem. Co. v. Mimex Co.*, 124 F.2d 986, 987-88 (2d Cir. 1942) (explaining that novelty requirement deters people from reinventing that which others have already invented).

⁵⁹ See *id.*

⁶⁰ See AREEDA & KAPLOW, *supra* note 18, at 151-52 (explaining that one purpose of patent system is to share inventions with public); see also 35 U.S.C. § 157 (1994) (authorizing PTO to publish patents).

⁶¹ See 35 U.S.C. § 101 (1994). Only the inventor may apply for the patent. See *id.*

⁶² See AREEDA & KAPLOW, *supra* note 18, at 158-59 (describing patent application and examination process); see also *Examination of Applications*, *supra* note 26 (describing patent examination procedure).

⁶³ See *Examination of Applications*, *supra* note 26 (describing process of applying for patent).

The patent application must include a specification that describes the invention and enables a skilled person in the relevant technical field to practice the invention.⁶⁴ The application concludes with one or more claims.⁶⁵ A claim is a single sentence in which the applicant defines the scope of the proposed patent's exclusive right.⁶⁶ As such, claims measure the extent of the patent owner's property interest in the patent.⁶⁷

C. The Mathematical Algorithm Exception

When a patent's claims describe a computer program, courts have struggled to determine the patent's validity.⁶⁸ A computer program is a set of

⁶⁴ See 35 U.S.C. § 112 (1994). The patent application must also set forth the best mode for the invention. *See id.* The disclosure requirement warns the public about infringement and enables it to benefit from the invention once the patent's term expires. *See Glaxo, Inc. v. Novopharm Ltd.*, 52 F.3d 1043, 1050 (Fed. Cir. 1995).

⁶⁵ See 35 U.S.C. § 112 (requiring claims to "particularly point[] out and distinctly claim[]" scope of protection conferred by patent). The claims must be sufficiently definite to outline the scope of the patent clearly. *See id.* Ambiguous claims fail to put the public on notice of the patentee's property rights. *See Glaxo*, 52 F.3d at 1050 (stating that disclosure prevents inventors from concealing preferred embodiments of their inventions from public).

An application may include multiple claims, each claiming a slightly different variation on the subject matter that the specification describes. *See* 35 U.S.C. § 112. The Patent Act specifically authorizes multiple claims that may depend on each other. *See id.* A dependent claim is one which incorporates by reference the elements, or limitations, of a previous claim. *See id.* Patent attorneys usually draft independent claims that cover a very broad scope of protection. *See* HERBERT F. SCHWARTZ, PATENT LAW & PRACTICE 11-12 (2d ed. 1996). Then, attorneys add dependent claims that are narrower in scope than the previous claims until the final claim represents a very narrow description of the invention. *See id.* Attorneys use this technique to yield the broadest claim that is still valid under the requirements of the Patent Act. *See id.* If the claim is too broad, prior art may invalidate the claim by anticipating it or rendering it obvious. *See* 35 U.S.C. § 102 (1994) (requiring patents to be novel over prior art); *id.* § 103 (1994 & Supp. III 1997) (providing nonobvious requirement).

⁶⁶ See 35 U.S.C. § 112; *see also* *Graver Tank Mfg. Co. v. Linde Air Prods. Co.*, 339 U.S. 605, 607 (1950) (stating that to determine infringement, one must first examine claims of patent). The patent's specification must enable a skilled person to practice the invention as each claim describes it; otherwise, the claims are invalid. *See* 35 U.S.C. § 112.

⁶⁷ *See Graver Tank*, 339 U.S. at 607 (noting that infringement occurs when alleged infringer's invention fall within patent's claims).

⁶⁸ *See, e.g.*, *Gottschalk v. Benson*, 409 U.S. 63, 71-72 (1972) (holding that computer process for converting binary-coded decimals was not patentable subject matter); *In re Alappat*, 33 F.3d 1526, 1542-45 (Fed. Cir. 1994) (in banc) (determining that machine using computer algorithm was patentable subject matter); *In re Walter*, 618 F.2d 758, 768-71 (C.C.P.A. 1980) (holding that method of underground surveying using computer to interpret seismic waves was not patentable subject matter). Despite the problems in the past with patenting software, many applicants have successfully prosecuted software patents before the PTO. *See, e.g.*, U.S. Patent No. 4,068,298 (information storage and retrieval system); U.S. Patent No. 4,334,270 (securities valuation

instructions that directs how a computer will run.⁶⁹ Because the nature of computer software is so abstract, innovations in this field are similar to mathematical formulas and laws of nature, which are unpatentable.⁷⁰ But computer software is an essential part of a computer and often has a useful application that falls within the ambit of the patent system should protect.⁷¹ Therefore, computer programs tread a fine line between patentable and unpatentable subject matter.⁷² In recognition of this problem, courts have developed rules that deny patents to certain types of inventions.⁷³

1. Early Doctrines

Before the advent of computers, courts developed the “mental steps” doctrine to exclude certain subject matter from patentability.⁷⁴ Based on the constitutional notion that patents should not protect abstract ideas, courts applied the mental steps doctrine to inventions that used human judgment to achieve the desired result.⁷⁵ The mental steps doctrine required that an invention physically transform matter to a different form to be patentable.⁷⁶ For example, one court

system); U.S. Patent No. 4,468,728 (database management system).

⁶⁹ See THOMAS H. CORMEN ET AL., INTRODUCTION TO ALGORITHMS I (8th prtg. 1992).

⁷⁰ See *Walter*, 618 F.2d at 764 (observing that subject matter requirement has proven difficult issue in computer field because of mathematical nature of computer software).

⁷¹ See, e.g., *Alappat*, 33 F.3d at 1544 (holding that invention based on computer algorithm is valid subject matter because it produces concrete and tangible result).

⁷² See *Parker v. Flook*, 437 U.S. 584, 589 (1978) (discussing difficulty of differentiating between patentable “process,” like computer program, and unpatentable “principle”).

⁷³ See, e.g., *Diamond v. Diehr*, 450 U.S. 175, 185 (1981) (identifying laws of nature, natural phenomena, and abstract ideas as three types of subject matter that are unpatentable); *Mackay Radio & Tel. Co. v. Radio Corp. of Am.*, 306 U.S. 86, 94 (1939) (holding that mathematical expressions of scientific truths are not patentable, but novel and useful structures applying knowledge of scientific truths may be patentable); *Cochrane v. Deener*, 94 U.S. 780, 786-87 (1876) (denying patent to process that merely improved pre-existing patent).

⁷⁴ See, e.g., *Gottschalk v. Benson*, 409 U.S. 63, 67 (1972) (holding invalid patent in which computer processed arithmetic steps that human could perform); *In re Shao Wen Yan*, 188 F.2d 377, 379-80 (C.C.P.A. 1951) (applying mental steps doctrine to affirm rejection of claim that involved mental steps of calculating airfoil profile with desired characteristics according to mathematical formula); *Don Lee, Inc. v. Walker*, 61 F.2d 58, 62, 67 (9th Cir. 1932) (invalidating claim for method of calculating position of weights on engine according to mathematical formula because effect would be monopoly of that formula); *Ex parte Read*, 123 U.S.P.Q. (BNA) 446, 447 (Pat. Off. Bd. App. 1943) (denying claims on method of determining vehicle speeds by reading value on sliding scale because it involved purely mental step).

⁷⁵ See, e.g., *Shao Wen Yan*, 188 F.2d at 380; see also DONALD S. CHISUM, 1 CHISUM ON PATENTS § 1.03[6][a] (1998) (tracing development of mental steps doctrine).

⁷⁶ See *Benson*, 409 U.S. at 70; *Cochrane*, 94 U.S. at 787-88; see also *In*

invalidated a patent on a process in which a person would calculate an airplane wing's geometry according to a mathematical formula.⁷⁷ In that case, because the computation involved human judgment, the mental steps doctrine invalidated the patent.⁷⁸ In sum, the mental steps doctrine denied a patent to any invention that required human interaction.⁷⁹

With the advent of computers, inventors could program machines to perform the mental steps previously performed by humans.⁸⁰ However, courts did not deny patents for computer software based on the mental steps doctrine because they realized that computers physically alter electricity.⁸¹ Computers can make choices and perform other tasks that can substitute for human interaction, so little difference exists between software patents and patents that the mental steps doctrine invalidated.⁸² Nevertheless, courts refused to use the mental steps doctrine to reject computer software patent applications.⁸³

Subsequently, the Supreme Court attempted to set guidelines for computer software patentability in a series of discordant decisions that generated more confusion than clarity.⁸⁴ Ultimately, the Court held that computer software

re Bolongaro, 62 F.2d 1059, 1060 (C.C.P.A. 1933) (rejecting patent for method of determining number of pages manuscript will cover because process involved human interaction); Johnson v. Duquesne Light Co., 29 F.2d 784, 786 (W.D. Pa. 1928) (invalidating patent for testing transmission wires' insulation because it used mental comparisons of operator).

⁷⁷ See *Shao Wen Yan*, 188 F.2d at 379-80.

⁷⁸ See *id.*

⁷⁹ See CHISUM, *supra* note 75, at § 1.03[6].

⁸⁰ See *Benson*, 409 U.S. at 67 (noting that human could perform, without computer, arithmetic steps that computers process).

⁸¹ See *Diamond v. Diehr*, 450 U.S. 175, 198 (1981) (refusing to extend mental steps doctrine to invalidate computer programs).

⁸² See *Benson*, 409 U.S. at 65. The Court noted that computers “operate[] on data . . . solving a problem by doing arithmetic as a person would do it by head and hand.” *Id.*

⁸³ See, e.g., *Parker v. Flook*, 437 U.S. 584, 590 (1978) (rejecting argument that *Benson*'s holding invalidates all patents on computers); *In re Pardo*, 684 F.2d 912, 916-17 (C.C.P.A. 1982) (applying different test than mental steps doctrine to computer patent); *In re Musgrave*, 431 F.2d 882, 889 (C.C.P.A. 1970) (rejecting mental steps doctrine). The *Musgrave* court held that an invention is not unpatentable merely “because some or all the steps therein can also be carried out in or with the aid of the human mind.” *Musgrave*, 431 F.2d at 893.

⁸⁴ See *Diehr*, 450 U.S. at 187; *Flook*, 437 U.S. at 594; *Benson*, 409 U.S. at 71-73 (suggesting that Congress consider patentability of computer algorithms); see also *Arrhythmia Research Tech., Inc. v. Corazonix Corp.*, 958 F.2d 1053, 1060-61 (Fed. Cir. 1992) (complaining about Supreme Court's “twisted knot of precedent” for patentability of computer software). In a widely criticized opinion, the Court apparently held that all claims involving computer algorithms were not patentable. See *Benson*, 409 U.S. at 73; see also *In re Johnston*, 502 F.2d 765, 773 (C.C.P.A. 1974) (Rich, J., dissenting) (expressing confusion from *Benson*'s wording); Donald S. Chisum, *The Future of Software Protection: The Patentability of Algorithms*, 47 U. PITT. L. REV. 959, 971-78 (1986) (criticizing *Benson* for unreasonably restricting patents in computer

is patentable when, considered as a whole, it is the type of invention that the patent laws seek to protect.⁸⁵ The Court of Customs and Patent Appeals then formulated its own test based on the Supreme Court's precedent.⁸⁶ All of these decisions ultimately failed to lay out a precise standard for computer software patentability.⁸⁷ But they did produce one doctrine that survived: the mathematical algorithm exception.⁸⁸

2. Development of the Mathematical Algorithm Exception

A large source of the confusion that surrounds software patentability emanates from courts' difficulty in defining mathematical algorithms.⁸⁹ An algorithm is a series of steps, like a recipe, that produces a desired result.⁹⁰ For

software field). The Court subsequently approached the problem by treating algorithms as prior art, even if the algorithms were novel. *See Flook*, 437 U.S. at 594. Under this approach, claims in which the algorithm was the only inventive part of the patent were invalid. *See id.* Retreating from its position yet again, the Court rejected the *Flook* approach and held that a claim may be patentable subject matter even if it contains elements that alone would not be patentable. *See Diehr*, 450 U.S. at 187. In direct contrast to *Flook*, the Court held that courts should examine claims as a whole, not dissect them into old and new elements. *See id.* at 188.

⁸⁵ *See Diehr*, 450 U.S. at 192; *see also supra* notes 42-44 and accompanying text (explaining policy behind subject matter requirement and function that it serves).

⁸⁶ *See In re Freeman*, 573 F.2d 1237, 1245 (C.C.P.A. 1978), *modified by In re Walter*, 618 F.2d 758, 767 (C.C.P.A. 1980). Called the Freeman-Walter-Abele test, the test first asks whether the claim directly or indirectly recites a mathematical algorithm. *See State St. Bank & Trust Co. v. Signature Fin. Group, Inc.*, 149 F.3d 1368, 1374 (Fed. Cir. 1998) (analyzing Freeman-Walter-Abele test). If so, the claim is patentable only if it applies the algorithm to physical elements or steps of a process. *See Walter*, 618 F.2d at 767. The court later added a final consideration for the test: the extent to which the invention constituted more than just an algorithm. *See In re Abele*, 684 F.2d 902, 909 (C.C.P.A. 1982).

⁸⁷ *See State St.*, 149 F.3d at 1374 (expressing doubt as to validity of Freeman-Walter-Abele test after *Diehr* and *Chakrabarty*); *In re Meyer*, 688 F.2d 789, 796 (C.C.P.A. 1982) (holding that Freeman-Walter-Abele test was not exclusive test for identifying unpatentable algorithms); *see also* Turkevich, *In re Alappat: The End of 'Mathematical Algorithm' Confusion?*, 11 *Computer Lawyer* 1, 8 (1994) (noting that Federal Circuit created confusion for patent practitioners in preparing computer software applications). *But see Arrhythmia*, 958 F.2d at 1058-59 (applying elements of Freeman-Walter-Abele test).

⁸⁸ *See Diehr*, 450 U.S. at 185 (holding that inventor cannot patent algorithm to extent that it constitutes abstract idea); *see also In re Alappat*, 33 F.3d 1526, 1542-44 (Fed. Cir. 1994) (in banc) (determining that mathematical algorithm exception did not invalidate patent that involved mathematical algorithm).

⁸⁹ *See Alappat*, 33 F.3d at 1543 n.19 (noting that Supreme Court has used "mathematical algorithm," "mathematical formula," and "mathematical equation" interchangeably to describe unpatentable subject matter, but has never defined standard for these terms).

⁹⁰ *See* C. SIPPL & R. SIPPL, *COMPUTER DICTIONARY AND HANDBOOK*

example, an algorithm for converting inches into centimeters comprises three steps: provide a number in inches, multiply that number by 2.54,⁹¹ and display the result in centimeters.

Essentially, computer software programs are algorithms written in a programming language that a computer can understand.⁹² A computer, therefore, could easily implement the inch-centimeter conversion algorithm.⁹³ Like this algorithm, a computer program is just an expression of a mathematical relationship.⁹⁴

Patent law prohibits a patent from monopolizing an abstract idea or law of nature, such as the conversion algorithm.⁹⁵ A patent monopolizes a

23 (2d ed. 1972). A useful definition of an algorithm in a scientific context is: “A defined process or set of rules that leads and assures development of a desired output from a given input. A sequence of formulas and/or algebraic/logical steps to calculate or determine a given task; processing rules.” *Id.* Mathematical formulas, or equations, are a special type of algorithm. *See id.* They describe a law of nature in mathematical terms, allowing one to calculate a desired result from a set of input variables. *See id.*

⁹¹ *See* CRC HANDBOOK OF CHEMISTRY AND PHYSICS 1-29 (David R. Lide ed., 74th ed. 1993) (providing conversion factor between inches and centimeters).

⁹² *See* CORMEN, *supra* note 69, at 1 (introducing algorithms in computer science context); *see also* *In re* Walter, 618 F.2d 758, 764 (C.C.P.A. 1980) (describing role of computers in processing data and enabling complex computations).

⁹³ *See, e.g.,* BJARNE STROUSTRUP, THE C++ PROGRAMMING LANGUAGE 23-25 (2d ed. 1991) (describing basic programming techniques that would implement the algorithm).

⁹⁴ *See* CORMEN, *supra* note 69, at 1 (defining computer algorithm as computational procedure that converts value, or set of values, to produce output).

⁹⁵ *See* *Diamond v. Diehr*, 450 U.S. 175, 185 (1981) (identifying laws of nature, natural phenomena, and abstract ideas as three types of subject matter that are unpatentable); *Mackay Radio & Tel. Co. v. Radio Corp. of Am.*, 306 U.S. 86, 94 (1939) (holding that mathematical expressions of scientific truths are not patentable, but novel and useful structures applying knowledge of scientific truths may be patentable).

An invention is not unpatentable merely because it includes a mathematical algorithm. *See Diehr*, 450 U.S. at 187. Indeed, every invention necessarily involves a multitude of laws of nature and mathematical relationships. *See* *State St. Bank & Trust Co. v. Signature Fin. Group, Inc.*, 149 F.3d 1368, 1374 (Fed. Cir. 1998); *Arrhythmia Research Tech., Inc. v. Corazonix Corp.*, 958 F.2d 1053, 1056 n.3 (Fed. Cir. 1992) (recognizing that any technological step-by-step process broadly comprises algorithm). Furthermore, every new process, as well as many other inventions, is necessarily a discovery of a new algorithm. *See* SIPPL & SIPPL, *supra* note 90, at 23 (defining algorithm). Applying this definition, any process in a patent application is simply a high-level algorithm. *See id.* When the invention itself is a law of nature or an abstract mathematical relationship, however, the invention is not the kind of discovery that the patent laws protect. *See Diehr*, 450 U.S. at 185 (noting that patent laws do not protect laws of nature or abstract ideas). Laws of nature and mathematical relationships are not proper subject matter for a patent

mathematical relationship if it prevents others from applying the relationship in their own inventions.⁹⁶ Therefore, courts have carved out the mathematical algorithm exception to exclude these types of patents.⁹⁷

The mathematical algorithm exception invalidates a patent when it would monopolize a mathematical relationship or the law of nature that it describes,⁹⁸ even if it otherwise meets the subject matter test.⁹⁹ Under the exception, an inventor cannot receive a patent for discovering a purely mathematical concept, such as the law describing how steam expands.¹⁰⁰ The inventor can receive a patent, however, by applying the concept to a useful end, such as a steam-powered engine.¹⁰¹ Courts often struggle to determine whether a patent claims a mathematical concept, and if so, whether the concept is applied to a useful end. The Federal Circuit faced this problem recently in *In re Alappat*.¹⁰²

3. Recent Precedent: *In re Alappat*

In *In re Alappat*, the Court of Appeals for the Federal Circuit, sitting in banc,¹⁰³ held that an invention involving a mathematical algorithm was patentable because it employed the algorithm to achieve a concrete and tangible

monopoly because they should remain free for all to use. *See Funk Bros. Seed Co. v. Kalo Inoculant Co.*, 333 U.S. 127, 130 (1948).

⁹⁶ *See Gottschalk v. Benson*, 409 U.S. 63, 67 (1972) (explaining that laws of nature must be available for all to apply to inventions, and are, therefore, unpatentable).

⁹⁷ *See, e.g., Diehr*, 450 U.S. at 185 (holding that inventor cannot patent algorithm to extent that it constitutes abstract idea); *Parker v. Flook*, 437 U.S. 584, 594 (1978) (holding that patent involving mathematical formula must have inventive aspect apart from formula); *Benson*, 409 U.S. at 71-72 (holding that patent for computer process was invalid because its effect would be to monopolize mathematical formula).

⁹⁸ *See State Street*, 149 F.3d at 1373 n.4 (noting that mathematical algorithms are unpatentable to extent that they represent abstract ideas).

⁹⁹ *See id.* at 1373 (instructing that while Congress intended 35 U.S.C. § 101 to extend to any human-made object “under the sun,” algorithms are patentable only if usefully applied); *In re Alappat*, 33 F.3d 1526, 1542 (Fed. Cir. 1994) (in banc) (same); *In re Pardo*, 684 F.2d 912, 915 (C.C.P.A. 1982) (same); *see also* 35 U.S.C. § 101 (1994) (listing categories of patentable subject matter).

¹⁰⁰ *See Diehr*, 450 U.S. at 185 (identifying laws of nature, natural phenomena, and abstract ideas as three types of subject matter that are unpatentable); *Diamond v. Chakrabarty*, 447 U.S. 303, 308-09 (1980) (explaining that scientists cannot patent their discoveries of laws of nature); *Mackay Radio*, 306 U.S. at 94 (holding that mathematical expressions of scientific truths are not patentable).

¹⁰¹ *See Alappat*, 33 F.3d at 1544; *see also O’Reilly v. Morse*, 56 U.S. (15 How.) 61, 113 (1853) (explaining that discoverer of steam power could patent invention of propelling vessels by steam, but could not patent steam as general motive power).

¹⁰² *See* 33 F.3d at 1544.

¹⁰³ *See id.*

result.¹⁰⁴ The invention in *Alappat* involved an improved display screen, similar to a television screen.¹⁰⁵ This display used a novel mathematical algorithm that improved the clarity of the screen's picture.¹⁰⁶ The invention performed this algorithm using standard electronic devices,¹⁰⁷ therefore, the invention's only novel element was the mathematical algorithm.¹⁰⁸

Alappat, the inventor, applied to the PTO for a patent on his improved display.¹⁰⁹ The PTO rejected some of Alappat's claims as unpatentable subject matter.¹¹⁰ Alappat ultimately appealed this rejection to the Federal Circuit.¹¹¹

The Federal Circuit reversed the PTO's rejection and approved Alappat's patent application.¹¹² The court found that the patent's subject matter was a machine, which is one of the four categories of statutory subject matter.¹¹³ Although this patent technically recited statutory subject matter, the PTO argued that the mathematical algorithm exception invalidated the patent.¹¹⁴

Turning to the mathematical algorithm exception, the *Alappat* court identified the issue as whether the claims, as a whole, represented an abstract mathematical concept.¹¹⁵ The court held that the mathematical algorithm exception did not invalidate the patent because, as a whole, the claims did not represent an abstract mathematical concept.¹¹⁶ Instead, the court held that Alappat had used a mathematical concept to achieve a "useful, concrete, and

¹⁰⁴ *See id.*

¹⁰⁵ *See id.* at 1537. The claims described a machine that performs a series of mathematical steps that result in an output value: the desired illumination intensity at any point on the screen. *See id.* at 1538-39 (describing claims that PTO rejected).

¹⁰⁶ *See id.* at 1537.

¹⁰⁷ *See id.* at 1539.

¹⁰⁸ *See id.*

¹⁰⁹ *See id.* at 1537-38.

¹¹⁰ *See id.* at 1538-39. The PTO examiner rejected claims 15 through 19 of Alappat's patent application for failure to state patentable subject matter under 35 U.S.C. § 101. *See id.* at 1539. The decision did not address the other claims of Alappat's patent. *See id. passim.*

¹¹¹ *See id.* at 1526. The lower court decision that Alappat appealed was *Ex parte Alappat*, 23 U.S.P.Q. 2d (BNA) 1340 (Bd. Pat. App. & Interf. 1992).

¹¹² *See Alappat*, 33 F.3d at 1544.

¹¹³ *See id.* at 1540-41 (applying 35 U.S.C. § 112 to construe claim as to machine); *see also* 35 U.S.C. § 101 (1994) (identifying four categories of patentable subject matter).

¹¹⁴ *See Alappat*, 33 F.3d at 1542 (addressing PTO's argument that mathematical algorithm exception invalidated patent).

¹¹⁵ *See id.* at 1544 (relying on Supreme Court precedent in *Diamond v. Diehr*, 450 U.S. 175, 192 (1981)). Before *Alappat*, the Supreme Court stated that a patent that recites a mathematical algorithm is patentable when it is a component of a machine or process that, "considered as a whole, is performing a function which the patent laws were designed to protect." *Diamond v. Diehr*, 450 U.S. 175, 192 (1981).

¹¹⁶ *See Alappat*, 33 F.3d at 1544.

tangible result,” a smooth curve on an electronic display.¹¹⁷ The Federal Circuit adopted this “tangible result” standard as the test for proper subject matter in a recent software patentability case, *State Street Bank & Trust Co. v. Signature Financial Group, Inc.*¹¹⁸

II. STATE STREET BANK & TRUST CO. V. SIGNATURE FINANCIAL GROUP, INC.

In *State Street*, the Federal Circuit addressed the subject matter requirement as applied to computer software.¹¹⁹ The court held that a software program satisfies *Alappat*’s tangible result test when the program’s output is merely a useful number that a set of calculations produce.¹²⁰ The court also analyzed the applicability of the mathematical algorithm exception to computer programs.¹²¹ In a decision that will profoundly affect the software and financial industries,¹²² the *State Street* court attempted to set a clear rule for software patentability.¹²³

A. Background

On March 11, 1991, inventor Todd Boes applied for a patent on an invention entitled “Data Processing System for Hub and Spoke Financial Services Configuration.”¹²⁴ The patent described a computer program that implemented an accounting system for a novel business method.¹²⁵ The business method was a financial arrangement in which several mutual funds formed a partnership and pooled their assets into a common investment portfolio.¹²⁶ The computer program calculated, among other values necessary for implementing the business method, a final share price for each mutual fund

¹¹⁷ *See id.*

¹¹⁸ *See* 149 F.3d 1368 (Fed. Cir. 1998).

¹¹⁹ *See id. passim* (evaluating subject matter of patent for computer program).

¹²⁰ *See id.* at 1373.

¹²¹ *See id.* at 1373-75.

¹²² *See* Ellis & Chatterjee, *supra* note 13, at B13 (advising financial institutions how to adapt after *State Street*); Rein, *supra* note 13, at S1 (explaining that *State Street* thrusts financial software industry, which generally disregarded patents in the past, within patent system); Sandburg, *supra* note 15, at 1 (predicting surge of patent application filings in response to *State Street*).

¹²³ *See State Street*, 149 F.3d at 1373 (holding that computer program that produces numerical output satisfies subject matter requirement).

¹²⁴ *See id.* at 1370; U.S. Patent No. 5,193,056 (Mar. 9, 1993).

¹²⁵ *See* U.S. Patent No. 5,193,056; *see also State Street*, 149 F.3d at 1371 (describing patent). In essence, the investment scheme, under the proprietary name Hub and Spoke, consisted of mutual funds (“Spokes”) that pool into a central portfolio (“Hub”). *See State Street*, 149 F.3d at 1370-71. The invention reduced costs by sharing management costs and fees among a number of mutual funds. *See State Street*, 149 F.3d at 1371; U.S. Patent No. 5,193,056 (describing benefits of invention).

¹²⁶ *See State Street*, 149 F.3d at 1370; *see also* U.S. Patent No. 5,193,056 (describing method of practicing invention). Under this method, mutual funds reduce their costs by sharing resources and spreading management expenses among themselves. *See State Street*, 149 F.3d at 1371.

in the portfolio.¹²⁷ After the PTO granted the patent and issued it to Boes, he assigned the patent to Signature Financial Group (“Signature”).¹²⁸

Signature and State Street Bank & Trust Company (“State Street”) both managed complex financial services for their clients.¹²⁹ State Street negotiated with Signature for a license to use Boes’s invention so that it could implement its own mutual fund pooling system.¹³⁰ Eventually, these negotiations failed.¹³¹ In anticipation of a patent infringement suit, State Street brought an action for declaratory judgment action in a federal district court.¹³² State Street alleged that the patent was invalid because it claimed unpatentable subject matter.¹³³

The district court granted State Street’s motion for partial summary judgment, ruling that the patent’s subject matter was not patentable.¹³⁴ In reaching this decision, the district court relied on the mathematical algorithm exception characterizing Boes’s invention as an abstract mathematical concept.¹³⁵ Signature appealed this ruling to the Federal Circuit.¹³⁶

B. The Federal Circuit’s Decision

The Federal Circuit reversed the trial court’s ruling.¹³⁷ The court analyzed Boes’s patent to determine whether his invention was patentable subject matter, concluding that the patent did claim patentable subject matter.¹³⁸ In its analysis, the court first addressed the statutory subject matter requirement.¹³⁹

The court noted that Boes’s patent described a computer system that performed certain computations.¹⁴⁰ From this description, the court construed

¹²⁷ See *State Street*, 149 F.3d at 1371.

¹²⁸ See *id.* at 1370.

¹²⁹ See *id.*

¹³⁰ See *id.*

¹³¹ See *id.*

¹³² See *id.*

¹³³ See *id.* Signature also alleged unenforceability and noninfringement in its complaint, but the only issue on appeal in *State Street* was the patent’s subject matter. See *id.* Once the PTO issues a patent, courts presume that the patent is valid. See 35 U.S.C. § 282 (1994 & Supp. III 1997).

¹³⁴ See *State St. Bank & Trust Co. v. Signature Fin. Group, Inc.*, 927 F. Supp. 502, 517 (D. Mass. 1996), *rev’d*, 149 F.3d 1368 (Fed. Cir. 1998).

¹³⁵ See *id.* at 513-15.

¹³⁶ See *State Street*, 149 F.3d at 1370. The federal district courts have original and exclusive jurisdiction over all disputes relating to patent law. See 28 U.S.C. § 1338(a) (1994). The United States Court of Appeals for the Federal Circuit has exclusive appellate jurisdiction over these patent cases. See *id.* § 1295(a)(1) (1994).

¹³⁷ See *State Street*, 149 F.3d at 1377.

¹³⁸ See *id.* at 1377.

¹³⁹ See *id.* at 1372-73.

¹⁴⁰ See *State Street*, 149 F.3d at 1371-72 U.S.; see also Patent No. 5,193,056 (Mar. 9, 1993) (describing invention as computer system that

the patent to claim a machine.¹⁴¹ Because machines are patentable subject matter,¹⁴² the court held that the patent literally satisfied the subject matter requirement absent any relevant exceptions.¹⁴³

The *State Street* court then addressed the district court's holding that the mathematical algorithm exception applied to invalidate the patent.¹⁴⁴ Citing *Alappat*, the court held that the mathematical algorithm exception applies only when a patent recites an abstract idea.¹⁴⁵ The *State Street* court noted that *Alappat* extended patent protection to inventions that apply an algorithm in a useful way to yield a concrete and tangible result.¹⁴⁶ The result of Boes's machine, the court observed, was a final output value -- a set of numbers on a computer screen necessary to run the financial scheme.¹⁴⁷ Although the result was merely a set of numbers, the court held that under *Alappat*, the final value output was sufficiently concrete and tangible to avoid the mathematical

calculated result from set of data).

¹⁴¹ See *State Street*, 149 F.3d at 1372 (holding that claim 1, properly construed, claims machine). The court quoted the patent's first claim and paraphrased it in brackets:

1. A data processing system for managing a financial services configuration of a portfolio established as a partnership, each partner being one of a plurality of funds, comprising:

(a) computer processor means [a personal computer including a CPU] for processing data;

(b) storage means [a data disk] for storing data on a storage medium;

(c) first means . . . for initializing the storage medium;

(d) second means . . . for processing data regarding assets in the portfolio and each of the funds from a previous day and data regarding increases or decreases in each of the funds [sic, funds'], assets and for allocating the percentage share that each fund holds in the portfolio;

(e) third means . . . for processing data regarding daily incremental income, expenses, and net realized gain or loss for the portfolio and for allocating such data among each fund;

(f) fourth means . . . for processing data regarding daily net unrealized gain or loss for the portfolio and for allocating such data among each fund; and

(g) fifth means . . . for processing data regarding aggregate year-end income, expenses, and capital gain or loss for the portfolio and each of the funds.

Id. at 1371-72.

¹⁴² See 35 U.S.C. § 101 (1994).

¹⁴³ See *State Street*, 149 F.3d at 1372.

¹⁴⁴ See *id.* at 1373

¹⁴⁵ See *id.* at 1373 n.4. In its holding, the court compared Boes's data processing system with *Alappat*'s display, which was patentable subject matter. See *id.* at 1373.

¹⁴⁶ See *id.* (citing *In re Alappat*, 33 F.3d 1526, 1544 (Fed. Cir. 1994) (in banc)).

¹⁴⁷ See *id.*

algorithm exception.¹⁴⁸ Thus, the court refused to apply the mathematical algorithm exception to invalidate the patent and ruled that Boes's invention was proper subject matter for a patent.¹⁴⁹

III. ANALYSIS

A. State Street Was Wrongly Decided

In its attempt to apply a clear test for software patents, the *State Street* court misapplied *Alappat* and ignored the purposes behind the subject matter requirement.¹⁵⁰ Although Boes's patent described a computer program,¹⁵¹ his discovery was really no more than a novel mathematical formula -- not a machine.¹⁵² The *State Street* court should have used the mathematical algorithm exception to invalidate Boes's patent, which is better classified as an advance in the liberal arts than an advance in useful arts. As a result, *State Street* upheld a patent that the patent system should not protect.

1. *State Street* Misapplied *Alappat*

In upholding Boes's patent, *State Street* heavily relied on *Alappat*'s test for patentability,¹⁵³ but it interpreted *Alappat* too broadly.¹⁵⁴ *Alappat* held an invention that contains a mathematical algorithm is patentable if it has a concrete and tangible result,¹⁵⁵ but the result in *Alappat* differed from the result of the invention at issue in *State Street*.¹⁵⁶

¹⁴⁸ *See id.*

¹⁴⁹ *See id.*

¹⁵⁰ *See State St. Bank & Trust Co. v. Signature Fin. Group, Inc.*, 927 F. Supp. 502, 507 (D. Mass. 1996) (discussing rationale of not patenting this invention), *rev'd*, 149 F.3d 1368 (Fed. Cir. 1998). *See generally* AREEDA & KAPLOW, *supra* note 18, at 151-55 (explaining policy behind patent system).

¹⁵¹ *See* U.S. Patent No. 5,193,056 (Mar. 9, 1993). For years, patent law has allowed patents involving computer software. *See, e.g., Diamond v. Diehr*, 450 U.S. 175, 192-93 (1981) (*affirming validity* of patent on invention that used computer to control process of curing rubber); *State Street*, 149 F.3d at 1373 (holding that patent for computer software was valid); *In re Freeman*, 573 F.2d 1237, 1247 (C.C.P.A. 1978) (reversing PTO's rejection of patent using computer to control typesetting process).

¹⁵² *See State Street*, 927 F. Supp. at 515 (holding that invention is merely accounting system for financial investment); *see also* U.S. Patent No. 5,193,056. Mathematical formulas alone are not patentable. *See Diehr*, 450 U.S. at 185-86 (equating mathematical formulas to laws of nature which cannot be patented); *Parker v. Flook*, 437 U.S. 584, 594 (1978).

¹⁵³ *See State Street*, 149 F.3d at 1373.

¹⁵⁴ *See infra* notes 155-61 and accompanying text (comparing *In re Alappat*, 33 F.3d 1526 (Fed. Cir. 1994), with *State Street* decision).

¹⁵⁵ *See In re Alappat*, 33 F.3d 1526, 1544-45 (Fed. Cir. 1994) (in banc).

¹⁵⁶ *Compare id.* (depicting invention's result as improved machine for displaying data on screen), with *State Street*, 149 F.3d at 1373 (identifying "tangible" result in invention as mere number representing share price of mutual fund).

In *Alappat*, the result that validated the patent was an improved appearance of a display screen.¹⁵⁷ Although *Alappat*'s machine displayed data, the invention was the improved means of displaying the data, not the data itself.¹⁵⁸ In contrast, the result of Boes's invention was merely data – a set of numbers.¹⁵⁹ Nevertheless, the *State Street* court ruled that this number satisfied *Alappat*'s concrete and tangible result test.¹⁶⁰ In doing so, *State Street* broadened *Alappat*'s holding beyond the boundaries of patent law.¹⁶¹

Because a fundamental precept of patent law is that inventors may not monopolize abstract mathematical concepts through the patent system,¹⁶² Boes could not patent the mathematical formulas exclusively.¹⁶³ Instead of claiming these equations directly, Boes claimed a machine – a computer – that performed these calculations.¹⁶⁴ The claim's language, however, did not change the nature of Boes's invention.¹⁶⁵ The invention was an abstract mathematical formula, not a machine, and the court should have rejected it as such.¹⁶⁶

2. The *State Street* Invention Was Not a Machine

The *State Street* court wrongly construed Boes's patent to be a machine.¹⁶⁷ Although the patent literally claimed a computer system, its only

¹⁵⁷ See *Alappat*, 33 F.3d at 1537-38, 1544-45.

¹⁵⁸ See *id.* at 1544-45 (holding that *Alappat*'s programming creates new special purpose machine).

¹⁵⁹ See *State Street*, 149 F.3d at 1373 (describing Boes's invention).

¹⁶⁰ See *id.*

¹⁶¹ See *Hughes Aircraft Co. v. United States*, 148 F.3d 1384, 1385 (Fed. Cir. 1998) (Clevenger, J., dissenting) (arguing that *State Street* effectively nullified subject matter requirement for computer software).

¹⁶² See *Diamond v. Diehr*, 450 U.S. 175, 185-86 (1981) (identifying mathematical algorithms as laws of nature).

¹⁶³ See *id.* (noting that mathematical formulas, as laws of nature, are not patentable). *Alappat*'s invention was patentable only because it applied the algorithms to create a specific machine to achieve a useful result. See *Alappat*, 33 F.3d at 1544.

¹⁶⁴ See U.S. Patent No. 5,193,056 (Mar. 9, 1993). Although the patent claimed a machine that implemented the accounting method, the effect of the patent was to foreclose anyone else from practicing the accounting method. See *State St. Bank & Trust Co. v. Signature Fin. Group, Inc.*, 927 F. Supp. 502, 516 (D. Mass. 1996), *rev'd*, 149 F.3d 1368 (Fed. Cir. 1998).

¹⁶⁵ Cf. *Parker v. Flook*, 437 U.S. 584, 593 (1978) (condemning literal reading of patent claims as depending too much on draftsman's art rather than policy behind patent laws). See generally *Alappat*, 33 F.3d at 1564 (Archer, C.J., dissenting in part) (observing that patent law should not exalt form over substance).

¹⁶⁶ See *State Street*, 927 F. Supp. at 515 (holding that bottom line invention was accounting system). See generally *Diehr*, 450 U.S. at 188 (holding that courts should evaluate patent as whole and determine whether patent performs function that patent law protects).

¹⁶⁷ See *infra* notes 168-190 and accompanying text (illustrating that inventive aspects of Boes's inventions were mathematical algorithms).

inventive aspect was its mathematical formula.¹⁶⁸ The court admitted that the inventive aspects of Boes's patent were the mathematical algorithms, not the computer system.¹⁶⁹ Therefore, Boes's invention was not a machine, but simply the algorithms that the machine performed.¹⁷⁰ The computer was incidental to these algorithms, and merely performed the necessary calculations.¹⁷¹ The *State Street* court should not have characterized the invention as a computer that ran software.¹⁷² Instead, the court should have recognized it as the discovery of a new mathematical formula.¹⁷³

The *State Street* court stated that patent law does not render an invention unpatentable merely because it includes a mathematical algorithm.¹⁷⁴ To support its position, the court cited previous decisions that evaluated a patent's subject matter as a whole, not simply the literal language of the patent's

¹⁶⁸ See U.S. Patent No. 5,193,056; see also *State Street*, 927 F. Supp. at 515 (describing Boes's invention as accounting system that does not require computer).

¹⁶⁹ See *State Street*, 149 F.3d at 1373 (holding that Boes's invention applies underlying mathematical algorithms).

¹⁷⁰ Cf. *Diehr*, 450 U.S. at 192 (holding that courts should evaluate patent as whole, not examine claims literally).

¹⁷¹ Compare *State Street*, 149 F.3d at 1371-72 (describing Boes's invention as computer program that produced number as result), with *In re Alappat*, 33 F.3d 1526, 1537-39 (Fed. Cir. 1994) (in banc) (describing Alappat's invention as machine that used computer algorithm to enhance picture quality of display screen).

¹⁷² See *State Street*, 927 F. Supp. at 515 (holding that '056 patent does not recite any significant solution activity, measure physical objects or phenomena, or physically convert data into different form).

¹⁷³ See generally *id.* at 514 (holding that '056 patent does nothing more than present and solve mathematical algorithm).

The only inventive concept in the *State Street* patent was the mathematical formulas that the computer program performed. See *State Street*, 149 F.3d at 1372. Therefore, the court was incorrect to characterize the invention as a machine; rather, the court should have recognized that the invention was merely a set of novel mathematical formulas. See *id.*; see also *Diehr*, 450 U.S. at 188 (holding that courts should evaluate patent as whole and determine whether patent performs function that patent law protects); *Parker v. Flook*, 437 U.S. 584, 593 (1978) (condemning literal reading of patent claims as depending too much on draftsman's art rather than policy behind patent laws); *Alappat*, 33 F.3d at 1564 (Archer, C.J., dissenting in part) (stating that patent law should not exalt form over substance).

¹⁷⁴ See *State Street*, 149 F.3d at 1374-75 (holding that mere fact that claimed invention involves mathematical algorithms does not render it nonstatutory subject matter; rather, claim's subject matter depends on its "essential characteristics"); see also *Diehr*, 450 U.S. at 187 (stating that invention may be patentable even though it contains subject matter which alone would not be patentable); *Flook*, 437 U.S. at 590 (holding that invention may be patentable even though it contains law of nature or mathematical algorithm); *In re Iwahashi*, 888 F.2d 1370, 1375 (Fed. Cir. 1989) (refusing to invalidate patent although invention operated according to algorithm).

claims.¹⁷⁵ Using this rule, the court concluded that Boes's invention, although based on mathematical algorithms, was a machine.¹⁷⁶

But this assertion defies the facts in *State Street*.¹⁷⁷ Boes's patent should be invalid, not because it contains an algorithm, but because the invention itself is merely an algorithm.¹⁷⁸ Unlike the mathematical formulas in *Alappat*, which were integral to the improved display screen, one could practice the formulas in *State Street* without a computer.¹⁷⁹ Thus, the computer's purpose in Boes's patent was only to satisfy the subject matter requirement and procure the patent; the computer was not an inherent part of the invention.¹⁸⁰

An inventor should not be able to patent an otherwise unpatentable discovery by merely claiming the practice of that discovery on a machine.¹⁸¹ To illustrate this point, consider a musician who composed a new song.¹⁸² The musician could not patent the song by claiming a player piano that played the new song.¹⁸³ Considered as a whole, the invention would merely be the song, not the player piano in combination with the song.¹⁸⁴

A player piano that performs a song is analogous to a computer that performs a mathematical formula.¹⁸⁵ Both are existing machines that manipulate a medium, either a song or computer program, to produce a result.¹⁸⁶ Therefore,

¹⁷⁵ See *State Street*, 149 F.3d at 1374 n.6 (citing *Diehr*, 450 U.S. at 192; *Iwahashi*, 888 F.2d at 1375; *In re Taner*, 681 F.2d 787, 789 (C.C.P.A. 1982)).

¹⁷⁶ See *id.* at 1375.

¹⁷⁷ Cf. *id.* at 1370-71 (presenting facts leading to *State Street*).

¹⁷⁸ See U.S. Patent No. 5,193,056 (Mar. 9, 1993). The *State Street* court noted that the invention executed a novel business method using a standard machine — a computer. See *State Street*, 149 F.3d at 1371. The original aspect of the patent, as the court described it, was the set of mathematical algorithms that implemented the financial scheme. See *id.* The patent's first claim, which describes the scope of the patent's right, lists seven elements of the invention. See U.S. Patent No. 5,193,056. The first two elements are a computer and a computer disk, both of which are common devices. See *id.* The other five elements describe mathematical algorithms that implement the business method. See *id.*

¹⁷⁹ Compare *State Street*, 149 F.3d at 1371 (noting that invention used computer merely because of complexity of calculations and data involved in process), with *In re Alappat*, 33 F.3d 1526, 1544-45 (Fed. Cir. 1994) (in banc) (explaining that invention's algorithms performed intermediate step of computing brightness at different places of display).

¹⁸⁰ See *State Street*, 149 F.3d at 1371-72; U.S. Patent No. 5,193,056.

¹⁸¹ See *Alappat*, 33 F.3d at 1553-54 (Archer, C.J., dissenting in part).

¹⁸² See *id.*

¹⁸³ See *id.*

¹⁸⁴ See *id.* at 1554; see also *Diamond v. Diehr*, 450 U.S. 175, 192 n.14 (1981) (holding that courts should consider patent's claim as whole when evaluating its subject matter).

¹⁸⁵ See *Alappat*, 33 F.3d at 1554 (comparing playing of new song on player piano or compact disc to implementing mathematical formula on computer).

¹⁸⁶ See *id.*

the reasoning of the analogy applies to computer software;¹⁸⁷ like the musician, a discoverer of a new mathematical formula should not receive a patent by claiming the practice of the formula on a computer.¹⁸⁸ Unless a patent does more than merely implement a new mathematical algorithm,¹⁸⁹ its subject matter is unpatentable under the mathematical algorithm exception.¹⁹⁰

3. *State Street* Wrongly Construed the Mathematical Algorithm Exception

The *State Street* court incorrectly stated that the mathematical algorithm exception applies only to claims that exclusively recite algorithms.¹⁹¹ The court also explained that whether a patent monopolizes a mathematical algorithm is irrelevant to the subject matter requirement.¹⁹² But the mathematical algorithm exception is not as narrow as *State Street* construed it.¹⁹³

Effectively, the court interpreted the mathematical algorithm exception as a redundancy of the subject matter requirement.¹⁹⁴ Claims that only recite mathematical algorithms are already invalid because they fail to state a category

¹⁸⁷ *See id.* (stating that arbitrary claim to physical structure should not turn unpatentable subject matter like music into patentable subject matter).

¹⁸⁸ *See id.* (arguing that majority's approach that looks only at claim's structure will result in patents that are beyond scope of patent law).

¹⁸⁹ *See id.* at 1554-55. Chief Judge Archer disagreed with the majority in that he believed that the only invention in Alappat's machine was the mathematical formula in his patent. *See id.* at 1552, 1564-65. He argued that Alappat merely used basic electrical components, effectively "writing" the mathematical formulas on the electronics, which any skilled person could easily do. *See id.* at 1564-65.

¹⁹⁰ *See* *Diamond v. Diehr*, 450 U.S. 175, 186 (1981) (holding that mathematical algorithm is like law of nature).

¹⁹¹ *See* *State St. Bank & Trust Co. v. Signature Fin. Group, Inc.*, 149 F.3d 1368, 1373 n.4 (Fed. Cir. 1998) (holding that mathematical algorithms are unpatentable only to extent that they represent abstract idea).

¹⁹² *See State Street*, 149 F.3d at 1376-77 (rejecting trial court's holding that Boes's patent was invalid because it foreclosed use of computers to implement any accounting method for Boes's financial scheme). A patent that monopolizes a law of nature is one that would prevent other inventors from applying that law in their own inventions. *See Diehr*, 450 U.S. at 192 n.14.

¹⁹³ *See* *Parker v. Flook*, 437 U.S. 584, 594 (1978) (holding that patent involving mathematical algorithm must have inventive aspect beyond novel formula); *Gottschalk v. Benson*, 409 U.S. 63, 71-72 (1972) (applying mathematical algorithm exception to computer process because its effect would be to monopolize mathematical formula).

¹⁹⁴ *See* 35 U.S.C. § 101 (1994) (listing categories of patentable subject matter); *see also* *O'Reilly v. Morse*, 56 U.S. (15 How.) 62, 112 (1853) (denying patent for transmission of letters using general principle of electromagnetism because it did not recite category of statutory subject matter). *See generally* William T. Goglia, Annotation, *Supreme Court's Views as to What Is Patentable Subject Matter Under Federal Law as "Process," "Machine," "Manufacture," or "Composition of Matter,"* 65 L. Ed. 2d 1197 (1981) (discussing Court's interpretation of categories of statutory subject matter in 35 U.S.C. § 101).

of patentable subject matter.¹⁹⁵ The exception does more than enforce the statutory subject matter requirement's literal mandate; it eliminates claims that, while technically reciting proper statutory subject matter, would effectively monopolize a law of nature.¹⁹⁶ The exception ensures that advances outside the technological arts, like those in pure science or the liberal arts, are unpatentable.¹⁹⁷

4. The *State Street* Patent Was an Unpatentable Advance in the Liberal Arts

As with abstract mathematical concepts, the patent system does not protect advances in the liberal arts.¹⁹⁸ The Constitution limits patents to the technological arts,¹⁹⁹ and Congress enacted the subject matter requirement to implement this constitutional limit.²⁰⁰ Accordingly, any invention that is not in the technological arts fails the subject matter requirement.²⁰¹

Although Boes's patent employed technology in his invention, none of the problems that Boes professed to solve were technological in nature.²⁰² The sole invention of the patent was an accounting system, an advance in the social

¹⁹⁵ See *Diehr*, 450 U.S. at 186 (holding mathematical algorithm is like unpatentable law of nature); see also 35 U.S.C. § 101 (listing four categories of patentable subject matter).

¹⁹⁶ See *Benson*, 409 U.S. at 67 (noting that nobody may claim mental processes and other abstract intellectual concepts as exclusive rights); see also *Diehr*, 450 U.S. at 191 (holding that patent which seeks to preempt mathematical formula in abstract is invalid); *In re Warmerdam*, 33 F.3d 1354, 1360 & n.5 (Fed. Cir. 1994) (stating that invention must be more than simply manipulating abstract ideas).

¹⁹⁷ See U.S. CONST. art. I, § 8, cl. 8 (requiring that patents be in useful arts); 35 U.S.C. § 101 (discussing subject matter of patents); *Benson*, 409 U.S. at 67 (holding that basic tools of scientific work are not patentable); *In re Alappat*, 33 F.3d 1526, 1555 n.16 (Fed. Cir. 1994) (explaining that *Benson*, *Flook*, and *Diehr* all hold that abstract ideas, principles and laws of nature are not patentable); *In re Walter*, 618 F.2d 758, 770 (C.C.P.A. 1978) (stating that pure mathematics is not art or technology).

¹⁹⁸ See *In re Toma*, 575 F.2d 872, 877 (C.C.P.A. 1978) (distinguishing between technological and liberal arts and holding that invention, language translation on computer, had aspects of both); Samuelson, *supra* note 5, at 339 (noting that patent law is "chiefly aimed at protecting technological inventions").

¹⁹⁹ See U.S. CONST. art. I, § 8, cl. 8; see also *In re Waldbaum*, 457 F.2d 997, 1003 (C.C.P.A. 1971) (Rich, J., concurring) (construing constitutional term "useful arts" to be synonymous with "technological arts").

²⁰⁰ See S. REP. NO. 82-1979, at 5 (1952), *reprinted in* 1952 U.S.C.C.A.N. 2394, 2396; H.R. REP. NO. 82-1923, at 6 (1952), *reprinted in* 1952 U.S.C.C.A.N. 2394, 2396; see also U.S. CONST. art. I, § 8, cl. 8 (limiting Congress's power to grant patents to advances in technological arts).

²⁰¹ See U.S. CONST. art. I, § 8, cl. 8; see also *Diehr*, 450 U.S. at 191 (holding that mathematical formulas are not patentable); *Graham v. John Deere Co.*, 383 U.S. 1, 5 (1966) (stating that Congress's patent authority is limited to advancing "useful arts").

²⁰² See U.S. Patent No. 5,193,056 (Mar. 9, 1993).

science of economics.²⁰³ The accounting system managed a financial scheme; it did not solve a technical problem.²⁰⁴ The *State Street* court even admitted that using a computer to implement the accounting system was incidental to the invention.²⁰⁵ The only technological aspect of the patent was the use of a computer to implement the accounting system.²⁰⁶ As the court acknowledged, the idea to use a computer was obvious in this case because of the amount of data involved.²⁰⁷ Thus, because the only inventive aspects of the patent were in the liberal arts, the court should have held the patent invalid.²⁰⁸

B. Subject Matter and Policy

A fundamental policy of patent law is that inventors should not use the patent system to monopolize laws of nature or mathematical formulas.²⁰⁹ *State Street*'s broad interpretation of *Alappat* validated a patent that violated this policy.²¹⁰ Although patent applicants still may not directly patent a

²⁰³ See *id.* Boes's invention was a financial scheme, not the machine for implementing it. See *id.* The "Background of the Invention" section of a patent application contains a brief summary of the invention that indicates the nature of the invention. See United States Patent and Trademark Office, *Specification (Description and Claims)* (visited Oct. 13, 1998) <<http://www.uspto.gov/web/offices/pac/doc/general/specifi.htm>> (on file with author). In Boes's patent, the Background of the Invention section describes at length the issues associated with the Hub and Spoke financial scheme. See U.S. Patent No. 5,193,056. The section only briefly mentions, in a final paragraph, that the system uses a computer to run the calculations. See *id.*

²⁰⁴ See *State St. Bank & Trust Co. v. Signature Fin. Group, Inc.*, 149 F.3d 1368, 1371-72 (Fed. Cir. 1998); U.S. Patent No. 5,193,056.

²⁰⁵ See *State Street*, 149 F.3d at 1371-72. The *State Street* court admitted that using a computer to implement the method was obvious. See *id.* at 1371 (observing that complexity of method and amount of data involved necessitated computer, or equivalent device, to perform invention). If it were obvious, the idea to use a computer could not have been the invention of the patent. See 35 U.S.C. § 103 (1994 & Supp. III 1997) (providing nonobvious requirement for subject matter sought to be patented); see also *Graham*, 383 U.S. at 11-12 (outlining test to determine when invention is obvious).

²⁰⁶ See *State Street*, 149 F.3d at 1371-72. The *State Street* court did not address whether the inventive concepts in the patent included the computer software. See *id.* It did suggest, however, that implementing the business method with a computer program was obvious. See *id.*

²⁰⁷ See *id.* at 1371.

²⁰⁸ See *id.* at 1371-72; see also *Diamond v. Chakrabarty*, 447 U.S. 303, 309 (1980) (stating that abstract ideas are not patentable).

²⁰⁹ See *Diamond v. Diehr*, 450 U.S. 175, 185 (1981) (identifying laws of nature, natural phenomena, and abstract ideas as three types of subject matter that are unpatentable); *Gottschalk v. Benson*, 409 U.S. 63, 67 (1972) (holding that natural phenomena, mental processes, and abstract concepts are not patentable); *Mackay Radio & Tel. Co. v. Radio Corp. of Am.*, 306 U.S. 86, 94 (1939) (holding that mathematical expressions of scientific truths are not patentable).

²¹⁰ See *supra* notes 155-160 and accompanying text (arguing that *State Street*'s reading of *Alappat*'s "concrete and tangible" test was overly broad); see also AREEDA & KAPLOW, *supra* note 18, at 151-55 (explaining policy behind

mathematical formula under *State Street*, they can monopolize the use of the formula on a computer.²¹¹ Because of its broad test for patentability, *State Street* seriously weakened the subject matter requirement.²¹²

1. *State Street* Allows Patent Applicants to Circumvent the Subject Matter Requirement

To be patentable, an invention must be proper subject matter.²¹³ In *State Street*, the court held that a computer program is proper subject matter if it produces a concrete and tangible result.²¹⁴ Further, *State Street* held that a number, which a computer program calculates according to a mathematical formula, is a sufficiently concrete and tangible result.²¹⁵ Unfortunately, this rule permits a patent applicant to evade the subject matter requirement through clever patent draftsmanship.²¹⁶ For example, an applicant that is attempting to patent a mathematical formula could simply claim a computer and computer program that processes data according to a mathematical formula and outputs the result.²¹⁷

But such a technical reading of patent claims is wrong.²¹⁸ An inventor should not be able to patent a mathematical relationship by couching it in terms of statutory subject matter -- a process or machine.²¹⁹ Instead, courts must

patent system).

²¹¹ See *Hughes Aircraft Co. v. United States*, 148 F.3d 1384, 1385 (Fed. Cir. 1998) (Clevenger, J., dissenting) (observing that *State Street* rendered virtually anything patentable). The only limitation in *State Street*'s subject matter test for computer software is that the software display a number, and that the number be useful in some way. See *State Street*, 149 F.3d at 1373 (ruling that share price for mutual fund is useful result).

²¹² See *State Street*, 149 F.3d at 1373 (holding that software that calculates and displays useful number is patentable).

²¹³ See 35 U.S.C. § 101 (1994).

²¹⁴ See *State Street*, 149 F.3d at 1373 (citing *In re Alappat*, 33 F.3d 1526 (Fed. Cir. 1994) (in banc)).

²¹⁵ See *id.*

²¹⁶ See *In re Alappat*, 33 F.3d 1526, 1554 (Fed. Cir. 1994) (in banc) (Archer, C.J., dissenting in part) (criticizing approach that emphasizes form over substance because it allows patent applicants to obtain patents that exceed scope of patent law); see also Sandburg, *supra* note 15, at 1 (suggesting that *State Street*'s broad standard will spawn many software patents).

²¹⁷ See, e.g., U.S. Patent No. 5,193,056 (Mar. 9, 1993) (providing example of this type of claim); see also *State Street*, 149 F.3d at 1373 (holding that this type of software patent satisfies subject matter requirement).

²¹⁸ See *In re Johnson*, 589 F.2d 1070, 1077 (C.C.P.A. 1978) (recognizing that category of subject matter in claim is mere exercise in drafting, so courts should not use mechanical classification standard); *Alappat*, 33 F.3d at 1554 (Archer, C.J., dissenting in part) (stating that patent law should not exalt form over substance). The dispositive inquiry is whether the claimed invention, as a whole, relates to patentable subject matter or a "disembodied mathematical concept." See *id.* at 1543, 1544 & n.21.

²¹⁹ See *Alappat*, 33 F.3d at 1543-44 (examining claims as whole in determining proper subject matter, but recognizing that breaking claims into

examine a patent's claims as a whole.²²⁰ An inventor should make unpatentable subject matter into a patentable invention through innovation, not patent draftsmanship.²²¹ By preferring form over substance, the *State Street* court opened the floodgates for computer software patents.²²²

2. After *State Street* Nearly All Software Is Patentable

In construing the mathematical algorithm exception, the *State Street* court effectively abolished its application to software patents.²²³ The *State Street* holding requires that a computer program merely produce a useful number to satisfy the subject matter requirement.²²⁴ Because any computer program produces some result, *State Street*'s test has no bite, effectively eliminating the subject matter requirement for software patents.²²⁵ Under *State Street*, inventors can patent a new mathematical formula and, therefore, prevent others from using it in computer software.²²⁶ *State Street* is, thus, a dangerous step towards allowing patent monopolies on mathematical formulas.²²⁷

A basic tenet of patent law is that Einstein could not have patented his celebrated formula for mass-energy conversion, $E=mc^2$.²²⁸ This formula is the archetypal discovery that the mathematical algorithm exception is meant to exclude.²²⁹ Commentators, arguing that *State Street* test for proper subject

their elements may be useful for understanding them).

²²⁰ See *State Street*, 149 F.3d at 1374 & n.6, 1375 (holding that whether claim is statutory subject matter depends on its "essential characteristics," not which 35 U.S.C. § 101 category of subject matter that it recites); see also *Diamond v. Diehr*, 450 U.S. 175, 187 (1981) (stating that whether claim contains subject matter which, by itself, would not be patentable is irrelevant to patentability of claim); *Parker v. Flook*, 437 U.S. 584, 590 (1978) (holding that invention is not automatically unpatentable if it contains law of nature or mathematical algorithm).

²²¹ See *Flook*, 437 U.S. 584 at 593 (condemning literal reading of patent claims as depending too much on draftsman's art, ignoring principles behind prohibition against patents for laws of nature); *Alappat*, 33 F.3d at 1554 (Archer, C.J., dissenting in part) (observing that patent law should not exalt form over substance).

²²² See Sandburg, *supra* note 15, at 1 (predicting deluge of patent applications for computer software in response to *State Street*).

²²³ See *State Street*, 149 F.3d at 1373 (holding algorithm exception inapplicable to Hub and Spoke software); see also *Hughes Aircraft Co. v. United States*, 148 F.3d 1384, 1385 (Fed. Cir. 1998) (Clevenger, J., dissenting) (observing that *State Street* rendered virtually anything patentable).

²²⁴ See *State Street*, 149 F.3d at 1373.

²²⁵ See *Hughes*, 148 F.3d at 1385 (noting that under *State Street* virtually any computer program is patentable).

²²⁶ See *id.*

²²⁷ See *Diamond v. Diehr*, 450 U.S. 175, 191 (1981) (holding that patent which seeks to preempt mathematical formula in abstract is invalid).

²²⁸ See *Diamond v. Chakrabarty*, 447 U.S. 303, 309 (1980).

²²⁹ See *Diehr*, 450 U.S. at 185 (identifying laws of nature, natural phenomena, and abstract ideas as three types of subject matter that are unpatentable); *Chakrabarty*, 447 U.S. at 308-09 (explaining that scientists

matter is too broad, warn that *State Street* contradicts this tenet and would even allow Einstein to patent his formula.²³⁰ Because of ridiculous results like this, courts should abandon *State Street* and replace it with a new test.

C. Proposal: A Nexus Requirement

In *State Street*, the court attempted to determine when computer software is patentable subject matter.²³¹ A computer program's patentability turns on whether the program lies in the field of the useful arts, or whether it is merely an abstract, unpatentable idea.²³² This Note proposes a novel approach that resolves this issue, replaces the mathematical algorithm exception, and avoids many of the problems of previous doctrines.

1. A Nexus Requirement

The *State Street* court considered the subject matter requirement without first identifying the inventive elements of Boes's patent.²³³ When considering whether a patent claims proper subject matter, a court must examine the claims as a whole to identify the invention.²³⁴ Recognizing the necessary connection between a patent's subject matter and its inventive aspects, this Note proposes a nexus requirement between these two elements.

cannot patent their discoveries of laws of nature); *Mackay Radio & Tel. Co. v. Radio Corp. of Am.*, 306 U.S. 86, 94 (1939) (holding that mathematical expressions of scientific truths are not patentable).

²³⁰ See, e.g., Jerry Ackerman, *Ruling Seen Kicking Off New Era in Accounting*, BOSTON GLOBE, Aug. 5, 1998, at F4 (reporting that some people believe that *State Street* would have allowed Einstein to patent his theory of relativity); *Could Einstein Patent Theory?*, STAR TRIB. (Minneapolis), Aug. 25, 1998, at 9E (suggesting that, under *State Street*, Einstein may have patented $E=mc^2$); Riordan, *supra* note 13, at D4 (reporting that some patent experts contend that Einstein could have patented $E=mc^2$ after *State Street*).

²³¹ See *State St. Bank & Trust Co. v. Signature Fin. Group, Inc.*, 149 F.3d 1368, 1370 (Fed. Cir. 1998).

²³² See *Diehr*, 450 U.S. at 185 (identifying laws of nature, natural phenomena, and abstract ideas as three types of subject matter that are unpatentable); *Mackay Radio*, 306 U.S. at 94 (stating that mathematical expressions of scientific truths are not patentable).

²³³ See *State Street*, 149 F.3d 1368 *passim* (neglecting to consider nonobviousness when evaluating patent's subject matter); see also *In re Abele*, 684 F.2d 902, 907 (C.C.P.A. 1982) (stating that every case involving subject matter issue must begin by determining what patent applicant invented or discovered).

²³⁴ See, e.g., *Diehr*, 450 U.S. at 187 (stating that whether claim contains subject matter that, by itself, would not be patentable is irrelevant to patentability of claim); *Parker v. Flook*, 437 U.S. 584, 590 (1978) (holding that invention that contains law of nature or mathematical algorithm is not automatically unpatentable); *State Street*, 149 F.3d at 1374 & n.6, 1375 (holding that whether claim is statutory subject matter depends on its "essential characteristics," not which 35 U.S.C. § 101 category of subject matter that it recites); *In re Alappat*, 33 F.3d 1526, 1543, 1544 & n.21 (Fed. Cir. 1994) (in banc) (stating that it is irrelevant that claim may contain some subject matter that is not patentable).

To satisfy the subject matter requirement, courts should require that a nexus exist between a patent's inventive concepts and the statutory subject matter.²³⁵ Under the nexus requirement, if none of a patent's innovation overlaps with a category of statutory subject matter, the patent would fail the subject matter requirement. This test would only require that part, not all, of the inventive aspects of a patent be statutory subject matter.²³⁶ Because of the connection between computer software and mathematical algorithms,²³⁷ the nexus requirement would be most helpful for software patents.

2. Application of the Proposal to Computer Software

The nexus approach would not completely preclude patents on computer programs. Using this approach, a computer program could meet the subject matter requirement under two scenarios. First, a computer program could meet the subject matter requirement if the idea to apply the algorithm to a computer is the invention.²³⁸ For example, suppose an industry had been performing an industrial process for curing rubber without a computer for many years. The idea to use a computer to control that process could be sufficiently inventive and, thus, would be patentable.²³⁹

Second, a computer program could meet the subject matter requirement if it requires innovation in the art of computer science.²⁴⁰ For example, suppose a particularly difficult problem challenged the software industry, such as programming an artificial intelligence.²⁴¹ If a computer programmer develops an innovative software solution to this problem, the programmer should receive a patent. In this example, such a program may be so difficult that implementing it on a computer is itself an invention.

In each example, the patent's subject matter is not the abstract concept of the computer algorithm, but a practical application of the algorithm.²⁴² The

²³⁵ See 35 U.S.C. § 101 (1994); *Graham v. John Deere Co.*, 383 U.S. 1, 11-12 (1966) (describing patent law's test for invention).

²³⁶ See generally 35 U.S.C. § 101 (listing categories of patentable subject matter).

²³⁷ See *CORMEN*, *supra* note 69, at 1 (discussing relationship between algorithms and computer software).

²³⁸ See, e.g., *Diehr*, 450 U.S. at 191-93 (affirming validity of patent for using computer to control process of curing synthetic rubber when rest of industry had not thought to control that process using computer).

²³⁹ See *id.* In *Diehr*, the mathematical formulas that described the rubber curing process were well established. See *id.* at 182. *Diehr*'s innovation was to use a computer to control the curing process with these formulas. See *id.*

²⁴⁰ Cf. 35 U.S.C. § 103 (1994 & Supp. III 1997) (outlining test for nonobviousness). Like the nonobviousness requirement, the second scenario is satisfied if innovation was not obvious to one of ordinary skill in the relevant art at the time of invention. See *id.*; see also *Graham*, 383 U.S. at 14 (outlining test for obviousness).

²⁴¹ See, e.g., U.S. Patent No. 5,864,621 (describing method of scrambling television signals); U.S. Patent No. 5,729,467 (describing computer system that determines layout of electrical circuits).

²⁴² Cf. *In re Alappat*, 33 F.3d 1526, 1544 (Fed. Cir. 1994) (in banc) (holding that abstract concepts are not patentable until reduced to practical application).

invention transcends the abstract realm into the field of the useful arts.²⁴³ Software programs in either example therefore are the type of inventions that Congress intended to protect with the patent system.²⁴⁴

Neither example would have applied to Boes's patent, so it would have failed the nexus test.²⁴⁵ First, the *State Street* court noted that Boes's decision to run the accounting system using a computer was an obvious result given the amount of data involved.²⁴⁶ Because the idea to use a computer program was obvious, and, therefore, not inventive, the first scenario does not support Boes's patent.²⁴⁷ Second, Boes's patent claimed that its inventive aspects were the mathematical algorithms, not the computer programming techniques that implemented them.²⁴⁸ Because Boes did not have to use innovative programming skills to create the program, the second scenario does not support Boes's patent either.²⁴⁹

3. Application of the Nexus Requirement to Other Fields of Technology

Some may argue that the nexus approach unreasonably restricts computer software patents more than patents in other fields. By adding an additional requirement, they may argue, the nexus approach makes it more difficult to patent computer software than other types of technology. Computer software patents, after all, are subject to the same requirements for patentability as patent in any other field.²⁵⁰

²⁴³ See *Diehr*, 450 U.S. at 191-92 (recognizing that when claim involves mathematical formula, inquiry is required to determine whether claim seeks to protect formula in abstract or useful art); *Diamond v. Chakrabarty*, 447 U.S. 303, 308-09 (1980) (requiring that subject matter of patent be in useful arts).

²⁴⁴ See S. REP. NO. 82-1979, at 5 (1952), reprinted in 1952 U.S.C.C.A.N. 2394, 2396; H.R. REP. NO. 82-1923, at 6 (1952), reprinted in 1952 U.S.C.C.A.N. 2394, 2396.

²⁴⁵ See U.S. Patent No. 5,193,056 (Mar. 9, 1993).

²⁴⁶ See *State St. Bank & Trust Co. v. Signature Fin. Group*, 149 F.3d 1368, 1371 (Fed. Cir. 1998) (observing that complexity of method and amount of data involved necessitated computer, or equivalent device, to perform task).

²⁴⁷ See *id.*

²⁴⁸ See U.S. Patent No. 5,193,056. Boes's patent merely claimed to find a method to reduce costs associated with managing mutual fund portfolios. See *id.*

²⁴⁹ See *State Street*, 149 F.3d at 1371 (stating that Boes's mathematical formulas were inventive, but mentioning no novel techniques in Boes's program).

²⁵⁰ See 35 U.S.C. §§ 101-03 (1994 & Supp. III 1997) (providing subject matter, utility, novelty, and nonobviousness requirements for patents). The Supreme Court in *Gottschalk v. Benson* refused to recognize patents that included computer algorithms without specific authorization from Congress. See *Gottschalk v. Benson*, 409 U.S. 63, 73 (1972). However, in *Diehr*, the Court narrowly construed *Benson*'s holding to say merely that algorithms in the abstract were unpatentable. See *Diamond v. Diehr*, 450 U.S. 175, 185-86 (1981).

But the nexus approach does not add additional restrictions for computer software patents because it would apply equally to inventions in any field. For example, an engineer could design an electrical circuit that merely implements a novel mathematical formula.²⁵¹ Because an electrical circuit, like a computer program, implements mathematical formulas, the circuit would be equivalent to a computer program that merely implements a formula.²⁵² As a machine, this circuit would meet the literal requirements of statutory subject matter.²⁵³ Under the nexus test, however, the electrical circuit would be unpatentable, as would the computer program.²⁵⁴

Devices that use mechanical components to merely implement a mathematical formula would likewise be unpatentable under the nexus test. A mechanical device could implement a mathematical formula in various ways. One example is a mechanical device that could be physically manipulated to reveal the answer to a mathematical formula. The nexus test would not allow a patent for this invention because the device's inventive aspect is exclusively the mathematical formula, not the machine.²⁵⁵ Unlike the holding in *State Street*, the nexus test affects the intent behind the statutory subject matter requirement and ensures that only inventions in the useful arts are patentable, as the Constitution mandates.²⁵⁶

CONCLUSION

This Note proposes a new test to determine whether a patent applicant claims patentable subject matter. By excluding unpatentable subject matter, the proposed approach preserves these abstract ideas for the public to use freely. The nexus test would not deny patents for computer software in all cases. The test would simply ensure that these types of inventions conform to the goals of the patent system.²⁵⁷ Without the nexus requirement, the subject matter requirement is merely a procedural obstacle.

The proposed approach would also clear up the confusing, conflicting precedent on this issue.²⁵⁸ Apart from making the patent laws more predictable,

²⁵¹ See *In re Alappat*, 33 F.3d 1526, 1563-65 (Fed. Cir. 1994) (in banc) (Archer, C.J., dissenting in part) (stating that electrical circuit is nonstatutory subject matter when it is merely direct translation of mathematical formula into electrical circuitry).

²⁵² See *id.* at 1564 (Archer, C.J., dissenting in part) (arguing that any distinction between implementing process in software or electrical circuitry is “exalting form over substance”).

²⁵³ See 35 U.S.C. § 101 (requiring that patents fit into one of four categories of subject matter). In this case, the circuit would be a patentable “machine.” See *id.*; *Alappat*, 33 F.3d at 1564 (Archer, C.J., dissenting in part).

²⁵⁴ See *supra* Parts III.C.1-2 (outlining nexus test and its application to computer software).

²⁵⁵ See *supra* Part III.C.1 (outlining nexus test).

²⁵⁶ See *Alappat*, 33 F.3d at 1564 (Archer, C.J., dissenting in part) (observing that patent law should not exalt form over substance).

²⁵⁷ See generally AREEDA & KAPLOW, *supra* note 18, at 150-55 (discussing premises of patent system); Doerfer, *supra* note 18, at 1440-41 (explaining policy justifications of patent system).

²⁵⁸ See *supra* Part I.C.2 (chronicling history of mathematical algorithm exception).

the approach would advance the purpose behind the Patent Act and its constitutional underpinnings. The approach would also allow protection for new inventions in the technological arts but would prevent unintended patent monopolies in other areas.