Patentability of Algorithms: A Review and Critical Analysis of the Current Doctrine

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THE PATENTABILITY OF ALGORITHMS: A REVIEW AND CRITICAL ANALYSIS OF THE CURRENT DOCTRINE*

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* Since the writing of this article, several cases have been decided which discuss the issues raised in this article. Mr. Minsk will be writing an update to his article discussing the impact of those cases on these issues which will be published in Volume 9 of the Santa Clara Computer and High Technology Law Journal.


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INTRODUCTION  

The protection of intellectual property is based on a Constitutional grant of power to the Congress to “promote the Progress of Science and useful Arts . . . .” The scope of protectable subject matter and the extent of such protection are specified in legislation enacted under the authority of that grant. The judicial branch is responsible for determining the statute’s applicability and interpreting the statutory language. The statute’s indeterminate language can present problems when a court attempts to apply it to an invention based on a new technology, because it is not always clear whether the invention is included within accepted categories of protectable intellectual property.  

When it is unclear whether a new technology falls within the purview of the statute, a court can adopt one of two basic approaches to resolve the protection issue. The approaches can be applied individually or in combination. The first approach is to draw an analogy between the new technology under consideration and existing technologies for which the issue of protection under the scheme has been resolved. The second approach is to consider the underlying policies and goals of the protection scheme to determine whether protection of the technology is consistent with them. Balancing of the policies may be required when a protection scheme  

1. U.S. Const. art. I, § 8, cl. 8. The complete text of the clause is, “The Congress shall have 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.”  
3. This approach can be described as: A is similar or equivalent to B (with regard to the significant criteria), B is (is not) patentable, therefore, A is (is not) patentable.  
4. The first approach presents the issue of whether the identification of A with B is valid with respect to the criteria which determine patentability. If the policy statements are considered, the issue becomes whether rationales which justified their previous application continue to apply. Both issues are implicated in the decisions which shaped the doctrine regarding the patentability of algorithms. Note that the approaches can be applied to the entire class of similarly categorized property, or to only the individual example being consid-
has multiple and potentially conflicting purposes, since a decision must be made as to which purpose will be given greater value. Even if not explicitly addressed by a court, such a balancing of policies is important to recognize in evaluating arguments allowing or denying protection to a type of technological property.

This article examines the development of the legal doctrine regarding the protection of a particular type of intellectual property, the algorithms which serve as the conceptual basis for computer software. The article focuses on the issue of whether algorithms constitute patentable subject matter. The article traces the prominent judicial decisions which are the basis of the current doctrine and critically evaluates the arguments which underlie them. The implementation of the decisions by the Patent and Trademark Office in the form of criteria to determine whether algorithms are statutory subject matter is also discussed. The intent is to explore how well the decisions reflect or fail to reflect the policies of the patent system and to identify the assumptions made by the courts in arriving at their decisions. In addition, the analysis suggests that the doctrine is founded on the Supreme Court’s implicit balancing of patent system policies, an activity reserved for Congress.

Part I of the article discusses some of the issues raised when considering protecting algorithms within the patent system. They are based on questions of statutory interpretation, and hint at some of the objections to algorithm patenting which have been expressed by the courts and commentators. Part II discusses and analyzes the Supreme Court decision regarding the patentability of algorithms which served as the foundation for the current doctrine. Part III discusses later cases which developed the present form of the doctrine. Included is a discussion of the current policy of the Patent and Trademark Office regarding its analysis of patent claims reciting algorithms. Also included is a discussion which focuses on the inefficient allocation of resources resulting from adoption of the initial Supreme Court decision.

Part IV discusses possible justifications for the patent system along with a review of judicial indications of the acceptance of some or all of the proposed justifications. This discussion assists in reconsidered in the case at hand. This presents a separate question of the appropriate scope of the judicial action.

5. The term “statutory subject matter” refers to property which falls within the scheme of patent protection by virtue of satisfying 35 U.S.C. § 101 (Inventions patentable) which states: “Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.”
nizing the flaws in the doctrine and in suggesting the foundations of a more desirable protection scheme. Part V examines the effects on prospective inventors of judicial decisions involving the patentability of algorithms. The discussion highlights the potential consequences of the existing doctrine.

Part VI attempts to reconcile the conflict between the purposes of the patent system and the current doctrine by suggesting an alternative protection scheme for algorithms. The implementation of the proposed scheme and some of the practical issues involved in an inventor's decision whether or not to seek patent protection for an invention are also discussed. The errors in the Court's resolution of the issues raised in the initial case combined with the potential obstacles created to achieving the goals of the patent system strongly suggest that the current doctrine be replaced. This can be accomplished by implementing an alternative protection scheme which better balances the public and private interests involved, and is more consistent with the manner in which other forms of property are treated. This will enable the interests of both the Constitution's authors and present day inventors to be more fully realized.

I. PATENT PROTECTION OF ALGORITHMS: STATUTORY ISSUES

The ability to protect algorithms within the patent system depends upon whether a patent application reciting an algorithm satisfies the statutory requirements of Title 35 of the U.S.Code, §§ 1-376.6 The statutory language indicates issues which may require judicial interpretation, and can serve as the basis for legal challenges to the validity of an algorithm patent. These issues also suggest some of the reasons why the courts responsible for developing the current doctrine found it difficult to reach their decisions, and why they and some commentators are of the opinion that patent protection of algorithms is undesirable.

In examining the statutory language, several important interpretational issues are presented. The resolution of these issues was an integral part of the judicial decisions which formulated the doctrine. Awareness of these issues places the judicial decisions in their proper context and is useful in analyzing the weak points of the doctrine.

The first issue of concern to this article is that the language "invents or discovers" in 35 U.S.C. § 101 (Inventions patentable)
appears to vest an equal opportunity to obtain a patent in those who create or discover something which constitutes patentable subject matter. As is discussed later the issue of characterizing an algorithm as an invention created by its author or as a discovery has posed problems for courts and is relevant to whether algorithms are considered to be within the prior art.

A second issue of importance is the language in § 101 referring to the requirement of "new and useful." The criteria of novelty, utility, and non-obviousness form the foundation of the patent system. They are implicated when discussing whether an algorithm is contained within the prior art (and hence not novel), and whether an independent algorithm (one not incorporated into a specific application) is "useful" in the sense necessary to satisfy the patent statute.

The novelty requirement of 35 U.S.C. § 102 (Conditions for patentability; novelty and loss of right to patent) presents the issue of whether algorithms are included in the prior art, and the separate issue of their proper characterization (if an algorithm is a "law of nature" it is in the public domain and is available without restriction to the public).

The language of 35 U.S.C. § 103 (Conditions for patentability; non-obvious subject matter) stating that "patentability shall not be negatived by the manner in which the invention was made," is important when discussing whether algorithms are the result of an act of creation or discovery. The language precludes judicial inquiry into what processes were occurring in an inventor's mind at the moment of invention. If this restriction is applied to the language of § 101, the § 103 language also arguably precludes any inquiry into whether an algorithm is the product of creation or discovery. The section's language also requires that the issue of whether algorithms as a class are contained in the prior art be resolved prior to its appli-

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7. 35 U.S.C. § 100(a) states: "The term 'invention' means invention or discovery." See also the language of § 103 on non-obvious subject matter which states in part: "Patentability shall not be negatived by the manner in which the invention was made."

8. "Prior art" is a term of art in the patent context and is implicated in the § 102 determination of novelty, and the § 103 determination of non-obviousness. It refers to inventions of a similar nature which are patented, published, or publicly available and are considered by the Patent and Trademark Office examiners in deciding whether a patent application discloses a patentable invention. In the computer software and algorithm context, the Acting Commissioner of Patents and Trademarks has stated, "Prior Art refers generally to the existing body of technical information against which the patentability of an invention is judged on its merits." 39 PTO Letter to Rep. Robert W. Kastenmeier on Patent Protection for Computer Processes, Pat. Trademark & Copyright J. (BNA), No. 956, at 58 (Nov. 16, 1989).
cation, in order that the relevant prior art is considered by examiners in the Patent and Trademark Office.

The seventeen-year patent term described in 35 U.S.C. § 154 (Contents and term of patent) suggests a policy issue separate from any question of statutory interpretation. A useful algorithm may be applicable to subsequent inventions, and the optimal term of protection necessary to provide a sufficient incentive to inventors, and not impede the development of the industry, may differ from that in the statute. This argument has been used by some to support the position that patent protection of software is inappropriate because of its interference with the normal development cycle within the software industry.  

II. THE FOUNDATION OF THE CURRENT DOCTRINE

The statutory subject matter requirement of 35 U.S.C. § 101 is the initial barrier that a patent application must overcome if an inventor is to obtain a patent. The issue of whether algorithms satisfied this requirement was resolved in the United States Supreme Court, in a decision which strongly influenced the development and form of the current doctrine. The impact of this decision was explored in two subsequent Supreme Court decisions.

In these three decisions, the Supreme Court considered the patentability of algorithms. The Court attempted to state the relationship between its definition of an algorithm and the statutory requirements for patentable subject matter. All three cases sought to patent methods which wholly or partially consisted of computer implementations of equations or relationships. The Court's characterization of the inventors' claims shifted the issue from one of determining the scope of the statutory term "process" as used in 35 U.S.C. § 101, to one of deciding whether the claims contained patentable subject matter notwithstanding the included algorithm.

A. The Benson Decision

The first Supreme Court case, Gottschalk v. Benson, set the tone for the entire doctrine. Benson established the judicial approach towards evaluating the statutory subject matter issues raised by algorithms. Benson involved a patent claim for a "method of converting signals from binary coded decimal form into [pure]

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binary . . .” The binary coded decimal (BCD) form of a number consists of the binary representations of each of the individual decimal digits in the number. The method sought to be patented was a procedure for converting this representation into a standard binary one of the entire number. The method was intended to be performed by a suitably programmed digital computer. The claims were rejected by the Patent Office but were held valid by the Court of Customs and Patent Appeals (C.C.P.A.). The Supreme Court reversed the C.C.P.A., thereby upholding the rejection of the patent application.

_Benson_ is a significant case, not only because it was the Supreme Court's initial discussion of the subject matter but also because of its influence on the subsequent development of the doctrine. The Court stated the issue as “whether the method described and claimed is a 'process' within the meaning of the Patent Act.” To resolve this issue, it was necessary to define the subject matter of the claimed invention in a way which would allow it to be compared with other accepted “processes.” The Court accomplished this by presenting its definition of an “algorithm” as “a procedure for solving a given type of mathematical problem.” This definition was the key to the Court's argument and was instrumental in resolving whether algorithms were statutory subject matter. However, it is both overly broad and expressed in indeterminate language.

The Court continued by describing the algorithm in _Benson_ as a “generalized formulation . . . to solve mathematical problems of converting one form of numerical representation to another.” This implies that the Court viewed the _Benson_ algorithm as one involving the change of an initial representation of a number to a different one, a characterization very similar to the definition of a statutory “process” subsequently adopted by the Court. In citing an earlier case, _Cochrane v. Deener_, the Court stated, “Transformation and reduction of an article ‘to a different state or thing’ is the clue to the patentability of a process claim that does not include

12. 409 U.S. at 73 (Claim 8 of the patent application as reported in the Appendix to Opinion of the Court).
13. For example, the number 53 would be represented in BCD form by two binary numbers, one for each digit: 0101 0011. The method Benson sought to patent would convert this to the binary representation of 53: 110101.
14. 409 U.S. at 64.
15. _Id._ at 65.
16. 409 U.S. at 65.
17. 94 U.S. 780 (1876).
particular machines." The Court then commented that the conversion of one form of the binary number to the other could be done mentally or through the use of a table. This recalls the "mental steps" doctrine which had been invoked in earlier times to deny the patentability of some processes, and was finally rejected.

The Court then invoked a classic statement of patent policy, "Phenomena of nature . . ., mental processes, and abstract intellectual concepts are not patentable, as they are the basic tools of scientific and technological work." This statement is applicable to algorithms based on the earlier, vague definition by the Court. The policy statement raised two issues which continue to plague inventors' efforts to patent algorithms: the problem of intangibility and the concern of preemption of knowledge in the public domain.

The Court brought the preemption issue to a head by stating: "[h]ere the 'process' claim is so abstract and sweeping as to cover both known and unknown uses of the . . . conversion." This comment reflects a concern with preemption because it refers to the expansive scope of the claims (which, if valid, might include knowledge in the public domain). However, it is based on the scope of the specific claims in the Benson application rather than an inherent feature of all algorithms. The denial of a patent to the al-

18. 409 U.S. at 70, citing Deener at 787-788.
19. See 409 U.S. at 67. The Court appears to be setting up the argument that algorithms are abstract. Note that this comment focuses on the individual algorithm at issue in the case, not the category of subject matter.
20. See In re Prater, 415 F.2d 1378 (C.C.P.A. 1969), and In re Musgrave, 431 F.2d 882 (C.C.P.A. 1970). Musgrave states, "[w]e cannot agree with the [patent office] board [of appeals] that these claims . . . are directed to non-statutory processes merely because some or all the steps therein can also be carried out in or with the aid of the human mind or because it may be necessary for one performing the processes to think. All that is necessary, in our view, to make a sequence of operational steps a statutory 'process' within 35 U.S.C. § 101 is that it be in the technological arts . . . ." 431 F.2d at 893.
21. 409 U.S. at 67. The Court also cited an earlier case, Funk Bros. Seed Co. v. Kalo Co., 333 U.S. 127, 130 (1948), "He who discovers a hitherto unknown phenomena of nature has no claim to a monopoly of it . . . ." This relates to the issue of whether algorithms are created (man-made) or discovered (naturally occurring). The Court's statement in Benson is dissected and strongly criticized as "dogmatic" and unable to "bear up fully under analysis." See Donald S. Chisum, The Patentability of Algorithms, 47 U. PITt. L. REV. 959, 980-84 (1986) [hereinafter Chisum]. Chisum criticizes the comparison of algorithms to natural laws and abstract concepts and refers to the "basic tools of scientific and technological work" in commenting, "[a]ny process or structure within that body of knowledge cannot be patented, not because it does not qualify as patentable subject matter, but simply because it is not new and unobvious." Id.
22. See supra note 15.
23. 409 U.S. at 68. This raises the issue of the claims being overbroad because their scope is broader than the scope of the enabling teaching of the specification contained in the patent application. See infra note 151 and accompanying text for a discussion of the overbreadth doctrine.
algorithm at issue (and to all similarly characterized algorithms) follows by inference from the quoted statements.\textsuperscript{24}

As a final justification for denying a patent, the Court resorted to an administrability argument and noted that the incentive purpose of the patent laws had not been compromised in the absence of patent protection for algorithms.\textsuperscript{25} These statements serve as a secondary justification for the Court's decision and suggest an underlying policy of denial of patent protection for algorithms.

**B. Analysis of the Benson Decision**

As indicated by the Court's approach in *Benson*, the lack of specific reference to algorithms in the patent statute required that their patentability be determined by judicial interpretation of the underlying policies and previous case law. While developing the doctrine, the courts encountered fundamental issues which required resolution prior to reaching a decision on the merits of the cases before them. These resolutions determined the current state of the law regarding the protection of this form of property. An analysis of these issues and their resolution indicates problems with the doctrine and suggests aspects of the law which should be modified to make the doctrine more compatible with the policies of the patent system.

The effect of the Court's decision in *Benson* was to establish a

\begin{quote}
\textsuperscript{24} The Court drove the point home by stating, "[i]t is conceded that one may not patent an idea ... [T]hat would be the result if the formula ... were patented in this case." 409 U.S. at 71 (emphasis added). This again raises the specter of preemption and removal of knowledge from the public domain. The Court followed with, "[i]f the judgment below is affirmed, the patent would wholly pre-empt the mathematical formula ..." Id. at 72 (emphasis added). Note that *Benson* did not claim a formula as that term is usually understood, that is, an equation or the notational representation of a chemical structure.

\textsuperscript{25} 409 U.S. at 72. The Court quoted the report of The President's Commission on the Patent System in saying, "[t]he Patent Office now cannot examine applications for programs because of a lack of a classification technique and the requisite search files. Even if these were available, reliable searches would not be feasible or economic because of the tremendous volume of prior art being generated. ... It is noted that the creation of programs has undergone substantial and satisfactory growth in the absence of patent protection ..." Id. at 72.

The Court's analysis thus recognizes two primary policies of the patent system: 1) provision of an incentive to inventors, and 2) protection of the public interest in access to knowledge in the public domain. The argument in *Benson* can be described as:

1) An algorithm is equivalent to $A$, where $A$ is a procedure for solving a given type of mathematical problem;
2) $A$ is equivalent to $B$, where $B$ is a law of nature, etc.; and
3) $B$ is not patentable, therefore $A$ is not patentable.

In addition, administrability and the policy of protecting public interest in access to knowledge in the public domain are potential problems in this case, and the incentive policy is not compromised.
per se rule denying patentability to the category of subject matter which fit the adopted definition of an algorithm. The approach adopted by the Court in Benson can be characterized as a per se rule because it stated that an isolated algorithm is unpatentable regardless of its content or structure. Once a "mathematical algorithm" is identified, if it is claimed independently of a statutory "process," it is unpatentable.

To reach this result, the Court began by considering the category of subject matter, rather than the specific algorithm for which the applicant in Benson sought a patent. The Court then presented a four-part argument which allowed it to conclude that algorithms as a category were not patentable. Determining whether the algorithm in Benson (and by implication all similarly characterized algorithms) was statutory subject matter by considering the entire category of subject matter necessarily led to a per se acceptance or denial of patentability. This approach is questionable, since the Court posed the initial issue as "whether the method described and claimed is a 'process' within the meaning of the Patent Act."

Answering this question does not a priori require addressing the issue of whether algorithms as a category are statutory subject

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26. An analogy of patent law to antitrust law is helpful. A per se rule in antitrust law refers to a rule which is invoked to decide issues in cases and is based on precedent and judicial familiarity with the issue in other contexts. The rule is applied without the necessity of an involved investigation into the specific facts of the case at hand because once the issue or behavior is characterized as one with which the courts are familiar, the policy analysis of previous cases is invoked to reach a decision. The countervailing approach is a case-by-case analysis and is termed a "rule of reason." This is not to say that a holding that "mathematical algorithms" do not constitute statutory subject matter is the same as invoking a per se rule in the antitrust context. Rather, I maintain that because the consequences are similar, the same justifications should be considered prior to adopting such a rule. It is in this sense that the analogy should be viewed. A distinction between the antitrust and patent contexts is recognized in the case law. See American Hoist & Derrick Co. v. Sowa & Sons, Inc., 725 F.2d 1350, 1367 (Fed. Cir. 1984) cert. denied, 469 U.S. 821 (1984) ("patent rights are not legal monopolies in the antitrust sense of [the] word. . .").

27. The characterization of the Court as adopting a per se rule is in agreement with the comments of Chisum, where he stated, "the issue in a case such as Benson was whether a whole broad category of inventions, those relating to computer software technology, should be excluded per se from the patent system." See Chisum, supra note 21, at 971 n.44.

28. See supra note 25 and accompanying text.

29. This is the result of the application of the specific decision in Benson (that the algorithm sought to be patented was not patentable) to a broad scope of other potentially patentable inventions. The use of terminology which causes a category to encompass a broad range of subject matter necessarily precludes a case-by-case determination of the patentability of any subject matter which could be included in the category. The issue becomes whether the characteristics used to place the Benson algorithm into the unpatentable category dictate the same conclusion when applied to other algorithms which have some characteristics which are similar and some which are different from those present in the Benson algorithm.

30. 409 U.S. at 64.
The Court's approach also demonstrates two aspects of a per se rule which can be evaluated separately: the argument used to reach the decision with regard to the individual algorithm at issue in the case, and the scope or breadth of application of the decision which is based on the manner in which the category is defined.

Separate from the details of the argument used to establish a per se rule, the statement of such a rule of decision can be questioned because of the significance of per se rules as precedent. This problem, in addition to the structure of the argument used to reach the per se rule and the implicit policy judgment reflected in the Court's argument, raises serious questions about the validity of the Benson holding and its application to other algorithms. Such problems with the Court's analysis give rise to an argument for a case-by-case evaluation of sought-to-be-patented algorithms which would effectively incorporate the underlying policies and values of the patent system.

1. The Adoption of a Per se Rule of Decision.

The adoption of a per se rule of decision by the Court in Benson presents a problem which arises from the influence of per se rules as precedent and the usual justifications for adopting them. Such a rule is usually based on extensive case law and a judicial assessment of the implications of a particular course of behavior or policy position. This requires sufficient experience and familiarity with the subject matter to ascertain the implications of adopting the doctrinal position. The alternative to a per se type of rule is a case-by-case evaluation of the expected costs and benefits of permitting or denying a course of behavior. This is characterized as a "rule of reason." The usual justifications for adopting a per se rule are not found

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31. From a procedural point of view, it is recognized that if the Court had not wished to address the general issue, it could have refused to review the lower court decision.

32. The characteristics and justifications for per se rules and "rules of reason" are discussed in Phillip Areeda, The "Rule of Reason" in Antitrust Analysis: General Issues (Federal Judicial Center 1981) [hereinafter Areeda].

33. See id. at 24. Areeda states that "per se rules ... are a species of (1) stare decisis and of (2) presumptions of varying strengths." Id. This indicates the value of finding ways to determine the effect of denying a patent in order to test the presumptions, such as an empirical study or modeling of the factors which affect an inventor's decision to seek a patent. A discussion of such a model is found in Robert P. Merges, Commercial Success and Patent Standards: Economic Perspectives on Innovation, 76 Cal. L. Rev. 803 (1988) (discussing the incentives which influence a firm's decision whether or not to innovate).

34. Note that where a case-by-case analysis is difficult to implement or is inconclusive, administrative convenience is a viable criterion to consider and may support the adoption of a per se rule. See Areeda, supra note 32, at 3.
in the Court's discussion of the patentability of algorithms. The Court did not have sufficient experience with the costs and benefits of allowing algorithms to be patented, and incorrectly assumed that all algorithms presented the same preemption concerns as would be raised by the patenting of a natural law. This indicates that the premises required for adopting a per se rule were not satisfied. The error is compounded by the significance of per se rules as precedent, because they are prone to being adopted in later cases without sufficient consideration of their applicability.

The Court's error in adopting a per se rule necessitates replacing it with a "rule of reason" analysis. Permitting the patenting of some algorithms assists in correcting distortions (which could result from the denial of patents to all algorithms) in the amount of innovative software produced as a result of the incentive structure of a free market based economic system. Furthermore, a "rule of reason" analysis allows a detailed balancing of the potential harms and expected benefits of issuing a particular patent. This does not require choosing between competing policy values, as the Court did in the final step of the argument justifying its result. Irrespective of criticisms of the Court's adoption of a per se rule, the structure of

35. See id. at 21-22. Areeda states that "the presence or absence of redeeming virtues is the critical inquiry" and lists the primary justifications for categorical condemnation of a business practice as being: 1) "the conduct is highly pernicious," and 2) "[t]he conceivable social benefits are few in principle, small in magnitude, [and] speculative in occurrence." Id. These statements indicate the necessity of a judicial inquiry into the nature and potential benefits of a practice prior to its condemnation, or in this context, its disallowance. Areeda further states that "the per se characterization usually emerges only after courts have had some considerable experience in appraising a particular practice." Id. at 29. Note that even though the Court might maintain that such an analysis did occur in the earlier cases, no empirical study or analysis of the premises in the context of the specific subject matter at issue in the case occurred.

36. See id. at 39. Areeda states that "when the court does use per se language, the presumption against legality [of the practice considered] is probably stronger in subsequent cases." Id. He further explains that "although categorical language does not prevent later qualification, it tends to . . . steer [judges] into sterile definitional inquiries and away from purposive analysis of the object[ives] of the . . . laws." Id. at 43. This is exemplified by the cases citing Benson and adopting a per se rule of decision.

37. This would require that criteria be defined to permit distinguishing between algorithms which it is "reasonable" to allow a patent for, and those for which it is not. Such criteria would introduce the policies of the patent system into the determination of whether a specific patent should be granted.

38. See the comments regarding the effects of a denial of patentability on an inventor's behavior infra section 5. See also Areeda, supra note 32, at 8 (discussing the use of "public interest" justifications for correcting market failures). In this case, the "public interest" is the social welfare resulting from the issue of a patent.

39. This assertion is demonstrated later in the analysis of the Benson decision.
the argument suggests that it is sufficiently flawed to render the final conclusion open to question.

2. Structural Problems With the Court’s Argument in Benson.

The Court’s argument in Benson contains structural flaws which invalidate its conclusions. The flaws relate to the definition of an algorithm adopted and the analogy used by the Court to justify the policy statement regarding phenomena of nature and abstract processes.

The definition of the subject matter was addressed in Benson for the first time. This definition of an “algorithm” is not one generally cited by those familiar with the concept. This may be due to the Court’s misunderstanding of the terminology, or confusion between its use in different disciplines. The Court’s definition can be challenged on two grounds: (1) it is overly inclusive, as not all algorithms are used to solve “mathematical problems,” and (2) it is indeterminate, because it does not provide a definition of what constitutes a “mathematical problem.” As previously noted, the definition treats the subject matter in terms of a category, which is

40. See supra note 15 and accompanying text.

41. As examples of other definitions, see Chisum, supra note 21, at 974-77. See also the definition in Charles J. Sippl and Roger J. Sippl, Computer Dictionary (1982): Algorithm - 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 steps to calculate or determine a given task; processing rules.

42. In Paine, Webber, the court states, “[I]n mathematics, the word algorithm has attained the meaning of recursive computational procedure and appears in notational language, defining a computational course of events which is self contained, . . . In contrast, the computer algorithm is a procedure consisting of operation[s] to combine data, mathematical principles and equipment for the purpose of interpreting and/or acting upon a certain data input.” 564 F. Supp. at 1366-67. Note that the definition of a mathematical algorithm depends on its being in the form of an equation.

43. Is such a problem one that involves expressions containing mathematical symbols, one concerned with deriving a result through application of mathematical rules, or one whose goal is to prove some rule of a mathematical system? The Court’s characterization of an algorithm effectively decided that a “naked” algorithm (one not claimed as part of a specific application) is not patentable. The Patent and Trademark Office has adopted the view that the term “algorithm” in Benson means a “mathematical algorithm.” This follows from the decision by the C.C.P.A. in In re Pardo, 684 F.2d 912 (C.C.P.A. 1982). Note that the invention in Benson was not a mathematical formula or expression, but a method of converting one numerical representation to another.
in opposition to the stated inquiry in the case. The definition also serves to preclude the establishment of a case-by-case analysis for any algorithm which can be similarly characterized.

The use of the mathematical problem definition renders algorithms subject to the preemption, intangibility, and discoverer issues cited by the Court in its discussion of the policies denying protection to the "basic tools of scientific and technological work." This characterization obscures the determination of whether a particular algorithm is man-made, and hence the result of an act of creation by the patent applicant which is the appropriate inquiry when determining the patentability of a new invention or technology. This problem arises because of the abstract nature of mathematics and the public's claim to "methods for solving a given type of mathematical problem." Even though the Court of Customs and Patent Appeals later limited the application of the doctrine to "mathematical algorithms," the denial of patentability remains over-inclusive and leads to results contrary to the policies of the patent system.

The definition of an algorithm adopted by the Court in Benson was used to analogize the subject matter to a law of nature. This analogy highlights the discoverer versus creator issue, and asserts that all algorithms are in the public domain and hence are prior art. The analogy is inappropriate and can be criticized on the following grounds.

The analogy is over-inclusive, because not every "mathematical algorithm" is a representation of a natural law or of a relationship between physical variables which occur in nature. An algorithm may be a means of solving a problem or completing a task and may contain variables which do not represent physical quantities or an abstract mathematical concept. In addition, a mathematical algorithm can have constituent parts, only some of which raise the preemption issue. This suggests that granting a

44. Recall that the Court stated the issue before it as "whether the method described and claimed is a 'process' within the meaning of the Patent Act." 409 U.S. at 64 (emphasis added). Note that this focuses on the particular method involved in Benson, not the entire class of all algorithms.

45. 409 U.S. at 67. See supra note 21 and accompanying discussion.


47. This is demonstrated by the PTO policy of not making a distinction between man-made and naturally occurring mathematical algorithms. See infra note 140 and accompanying text. See also infra section 5 and the comments on the potential effects of a denial of patentability in Patentability and the Goals of the Patent System.

48. A mathematical algorithm may consist of defined quantities, elements (combin
patent to an algorithm would not raise preemption concerns if the subject matter is man-made.\textsuperscript{49} If concerns regarding preemption of knowledge in the public domain are not raised, the subsequent policy invocation is inappropriate, and its effect on the final doctrine leaves the entire doctrine open to criticism.

Based on the analogy, the Benson Court invoked an accepted policy statement to deny the patentability of the algorithm in question.\textsuperscript{50} The policy statement presents the fundamental issues of preemption and abstractness (intangibility), and the related issue of discovery versus creation. The concern with preemption of knowledge in the public domain arises because procedures for solving mathematical problems are presumed to refer to such things as operations to simplify equations, methods of calculation, and techniques which are applicable to a wide variety of problems. The intangibility issue arises because of the similarity of such procedures to mental processes and ideas, and the wide range of applicability. The discoverer versus creator issue arises because it can be argued that such procedures exist by virtue of the relationships between numbers and mathematical concepts or are present in nature, and hence are not created, but discovered, by an inventor.

The concerns raised can be addressed without the use of a blanket denial of the patentability of the subject matter, particularly when their applicability is open to question and the values of the patent system are of such importance. This further supports the adoption of a case-by-case analysis, as opposed to a \textit{per se} rule of decision. In addition to the structural problems, the Court's argument also contained an implicit policy choice which is more appropriately left to the discretion of the legislature.


As a final justification for its decision, the Court stated an administrability objection to the patenting of algorithms and commented on the policy issues present. There is no \textit{a priori} reason why the specter of potential administrative problems should be determinative in this situation. Although ease of administration is an important value, efficiency considerations are more properly invoked when choosing between approaches that achieve similar goals. The

\textsuperscript{49} Note the Court's statement in Diamond v. Chakrabarty, \textit{infra} note 89. (concerning the patentability of "anything under the sun made by man").

\textsuperscript{50} See \textit{supra} note 21.
administrability objection supports the Court's consideration of the category of subject matter and furthers its implicit argument against a case-by-case evaluation of claims reciting algorithms.\textsuperscript{51}

The Court's reference to the incentive policy of the patent system serves as a post-argument justification for the result reached. As indicated, the \textit{Benson} decision can be viewed as a four-step argument. I have asserted that the first and second steps are flawed, making the policy invocation in step three inapplicable. The role of step four is not clear. If, as the Court believed, steps one and two are valid, the inclusion of step four is unnecessary. The Court says, in effect, that even if its preceding argument is flawed, the potential administrative difficulties combined with a lack of apparent need for patent protection supports the denial of patents. This is a minimalization-of-harm argument, because the preemption of knowledge in the public domain being a problem (as a result of the Court's algorithm definition and analogy), and there is no need to provide a further incentive to inventors, it is better to deny patents rather than take the risk of some algorithms being patented. The argument is founded on an implicit balancing of patent policies, a process which should be left to the legislature.

The policies underlying the patent system (in terms of its various purposes and justifications) can be ascertained by referring to comments made by the authors of the Constitutional clause, the legislative history of the statute, and statements of the Court interpreting the statute.\textsuperscript{52} Although the policies of the system have been identified, no definitive statement as to their relative priority has been made.\textsuperscript{53} The lack of a hierarchy creates problems, because some of the policies are interrelated or in opposition, and a determination of their relative priorities may be required to reach a decision. If such a situation arises, a court is faced with the choice of either imposing its view as to the hierarchy of the policies or restricting its analysis to the facts of the case at hand and declining to engage in judicial legislation.

The policy choice in \textit{Benson} is exemplified by the breadth of

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\begin{itemize}
\item \textsuperscript{51} In this situation the denial of patentability effectively relegates inventors to the use of the market to protect their property interests, which contradicts the intent of Congress and can frustrate achieving the goals of the Patent System.
\item \textsuperscript{52} See infra note 87.
\item \textsuperscript{53} This is not surprising as the relative importance of the policies may depend on the situation considered, and broader public policy goals. But see the statement of the Court in \textit{Bonito Boats, Inc. v. Thunder Craft Boats, Inc.}, 489 U.S. 141 (1989) (discussing the "ultimate" aim or goal of the system). This statement appears to be the converse of the Court's approach in \textit{Benson}.
\end{itemize}
\end{footnotesize}
the holding, and the allowance of only a restrictive form of patenting for algorithms. This form requires confining the claimed invention to the accepted definitions of a statutory "process." The Court implicitly chose between competing policy values by preferring the reduction of the threat of monopolistic exploitation and preemption of knowledge in the public domain to the potential reduction in inventor's incentives and social welfare resulting from dissemination of the inventor's knowledge. This is in contrast to the approach of encouraging inventors by allowing algorithms to be statutous subject matter, and relying on the other criteria in the patent system to determine if a patent for a particular algorithm is justified.

The latter approach is supported by an examination of the basis and structure of the patent system. The Constitutional grant of power to Congress to establish a patent system is of a discretionary nature. Congressional enactment of the patent statute indicates a desire to support patents in at least some situations, rather than keep all knowledge in the public domain. The structure of the patent statute is that of a possibility of a patent grant based on broadly worded categories, combined with the elimination of that possibility by application of specific criteria or factors. Specifically, an invention which fits the broad categories of § 101 is patentable, unless it is not novel, not of utility, or obvious. Nowhere is mentioned a policy concern for keeping knowledge in the public domain, except by implication, i.e., such a patent would be based on knowledge which was not novel. Congress, by enacting the statute and listing specific criteria for denying patents indicates that it has balanced the policies and values involved, and that the Court has no authority to do so.

The Court could have avoided making a policy choice by focusing on whether the algorithm in Benson was entitled to a patent,

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54. See supra note 17 and accompanying discussion. The accepted definitions of a statutory process emphasized the tangible nature of the items operated on.

55. These and other values of the patent system are discussed infra Section IV on Purposes of the Patent System.

56. By other criteria are meant those of novelty, utility, and non-obviousness. This further supports a case-by-case or rule of reason approach.

57. Recall that the constitutional clause states that "Congress shall have the power..." not that Congress is required to afford protection to the listed items. U.S. CONST. art. I, § 8, cl. 8 (emphasis added). See supra note 1 for the text of the clause.

58. The Court has recognized this approach as proper in the environmental context. See TVA v. Hill, 437 U.S. 153, 194 (1978), where the Court stated in discussing the Endangered Species Act, "It is... emphatically the exclusive province of the Congress not only to formulate legislative policies and mandate programs and projects, but also to establish their relative priority for the Nation."
absent any attempt to reach a decision on the wisdom of allowing patents for the category of subject matter. When confronted with conflicting policies, judicial restraint is preferable until legislative intent can be determined. Therefore, a decision on the patentability of the category of subject matter should be deferred, until Congress has considered the issues involved.

The problems with the Court's analysis in *Benson* can be eliminated by adopting an approach which supports inventors' incentives while guarding against preemption of knowledge in the public domain. This is preferable to a *per se* rule which, even if valid with regard to the facts at issue, is prone to being adopted in later cases without sufficient consideration of the particular facts. Utilizing a rule of reason is further supported by the potential difficulties in achieving the goals of the patent system which result from adoption of a policy denying patents to algorithms.

My criticisms of the judicial doctrine concerning the patentability of algorithms primarily center on the *Benson* decision. Emphasis should have been on developing criteria to distinguish patentable from unpatentable algorithms using some form of a rule of reason. This is not to suggest that *Benson* be overturned. Instead, *Benson* can be confined to the facts of the case and clarified, by interpreting it as being semantically incorrect, but recognizing and attempting to implement a correct public policy, that of protecting access to knowledge in the public domain.

The problem then becomes one of utilizing language which allows distinguishing between created (man-made) and discovered (naturally occurring) algorithms which reside in the public domain. Viewed this way, *Benson* can be seen as lacking an adequate means of expressing the distinction between algorithms and mathematical representations of natural laws leading to a decision.

59. The question is not as simple as this, owing to the need to consider administrability and judicial competence issues. However, note that the adoption of a rule of reason analysis does not always require the expenditure of vast amounts of judicial resources. See Areeda, supra note 32, at 38. (stating "'the rule of reason' can sometimes be applied in the twinkling of an eye.").

60. These difficulties are discussed infra Section V, in Patent Availability and the Goals of the Patent System.

61. This interpretation is recognized in *Diehr*, 450 U.S. at 185: "[o]ur recent holdings in *Gottschalk v. Benson*, . . . and *Parker v. Flook*, . . . stand for no more than these long-established principles [that laws of nature, natural phenomena, and abstract ideas reside in the public domain]." Note that the decisions in *Flook* and *Diehr* are means of confining *Benson* to isolated mathematical algorithms, and are the origin of the focus on applications of algorithms as patentable subject matter.

62. See infra note 87; See also the comments regarding the constituents of an algorithm, supra note 48.
by the Court to protect the public interest, rather than risking pre-empting knowledge in the public domain. This reflects a judgment as to which of the patent system policies is of greater importance when some or all of them conflict. The combination of the policy choice, the structural flaws, and the significance of a per se rule as precedent, requires restricting the interpretation of Benson and adopting a different means (instead of a complete denial of patentability) of deciding whether applications reciting algorithms should be granted patents.

III. THE INFLUENCE OF BENSON ON THE DOCTRINAL DEVELOPMENT

A. The Later Supreme Court Cases

The next case after Benson concerning the patentability of algorithms to reach the Supreme Court, Parker v. Flook, involved a patent claim for a “method for updating the value of at least one alarm limit on at least one process variable involved in a process comprising the catalytic chemical conversion of hydrocarbons.” The process variables were measurements of the operating conditions in the catalytic conversion, such as temperature and pressure. The alarm limit represented a value of the process variable such that if exceeded during the conversion, an alarm signal would sound to notify the operator that there was a potential problem. The “method” consisted of measuring the value of the process variable, calculating an updated alarm limit value using a computer programmed to implement a particular weighting formula, and adjusting the actual alarm limit to the updated value. The Patent Office denial of a patent was sustained by the Board of Appeals of the Patent and Trademark Office. This action was reversed by the C.C.P.A. The Supreme Court reversed the C.C.P.A., thereby upholding the original denial.

Benson had resolved the issue of the patentability of an isolated algorithm. The remaining question was: under what, if any, circumstances could an algorithm be patented as part of a method or process? The Supreme Court in Flook made an initial attempt to

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63. This is similar to the justification for the copyright doctrines of “merger” and “scenes a faire” where a denial of intellectual property protection is premised on the avoidance of a risk of preemption of a limited or necessary means of expression.
64. 437 U.S. 584 (1978).
65. 437 U.S. at 596 (Claim 1 of the patent application as reported in the Appendix to Opinion of the Court).
66. Id.
address this issue. The Court began by stating that "[t]he only novel feature of the method is a mathematical formula."67 The Court posed the issue in Flook as whether "the identification of a limited category of useful, though conventional, post-solution applications of such a formula makes respondent's method eligible for patent protection."68

An important issue in Flook, as in Benson, was the proper interpretation of the term "process" in the statute.69 Although the Court acknowledged previous cases which stated definitions of the term, it emphasized that it would not be bound by such interpretations.70 The Court then succinctly stated the position of Benson in the doctrinal development.71 The Court continued by stating the doctrinal significance of Flook, as evidenced by its later incorporation in Diehr. "A process is not unpatentable simply because it contains a law of nature or a mathematical algorithm."72 The focus of the analysis had shifted, as the concern was no longer whether algorithms were patentable, but rather, whether the presence of an algorithm would prevent the patentability of a process.

The Court commented on the proper approach to be followed in evaluating patent applications containing an algorithm by stating, "[w]hether the algorithm was in fact known or unknown at the time of the claimed invention, . . . , it is treated as though it were a familiar part of the prior art."73 This statement illustrated a contin-

67. 437 U.S. at 585. The use of the term "mathematical formula" brings to mind the Benson holding and its application to the present case. Note that in Flook the algorithm really is a mathematical formula as opposed to a sequence of instructions for converting one representation to another as in Benson.
68. Id. One question regarding this statement is whether the "identification" serves to resolve the tangibility and preemption issues by isolating a specific, concrete use of the algorithm. Note that the Court also describes the Flook subject matter as a "mathematical algorithm or formula." 437 U.S. at 586.
70. "As in Benson, we assume that a valid process patent may issue even if it does not meet one of these [earlier definitions of 'process'] . . . ." 437 U.S. at 588 n.9, citing Benson and Deener, 94 U.S. 780 (1876). This statement appears to reject any need to demonstrate that the invention satisfies the Deener definition, yet the Court returned to it in the subsequent case, Diamond v. Diehr, 450 U.S. 175 (1981).
71. "Benson applied the established rule that a law of nature cannot be the subject of a patent" and that an algorithm is like a law of nature. 437 U.S. at 589. This could be interpreted as confining the holding of Benson as suggested supra note 61 and accompanying text.
72. 437 U.S. at 590. The Court added that the proper analysis for the case involved the requirement that, "[t]he process itself, not merely the mathematical algorithm, must be new and useful." Id. at 591. This is an interesting comment in light of the decision in Diehr conferring patentability on a previously known and practiced process which had been modified by using an algorithm. See infra note 78 and the accompanying discussion.
73. 437 U.S. at 592-93. This statement effectively closes the door on the patenting of an isolated (naked) algorithm. This view has been criticized by commentators. See Jeffrey A.
using difficulty with how courts characterize algorithms. It main-
tained that all algorithms existed previously and may have been
discovered by inventors, but were not created by them. In other
words, they are similar to natural laws and not a man-made
product.

The Court also touched on the preemption issue by saying that
"law[s] of nature . . . are not the kind of 'discoveries' that the [pat-
ent] statute was enacted to protect."74 The Court summarized the
holding of Flook and reemphasized the prior art issue by stating,
"[r]espondent's process is unpatentable under § 101, . . . because
once [the] algorithm [it contains] is assumed to be within the prior
art, the application, . . . contains no patentable invention."75 This
emphasizes the problems facing those seeking to patent an al-
gorithm; once an algorithm is equated to a law of nature, concerns
with novelty and the preemption of knowledge in the public domain
effectively doom the patent application. The Court finished by re-
ferring to the underlying policies of the patent system and denying
that it had made a final judgment as to the efficacy of allowing the
patenting of algorithms.76 The Court also urged caution when ex-
expanding the realm of patent protection, raising the issue of its insti-
tutional competence to reach such a decision.77

Simenauer, Note, Patentability of Computer-Related Inventions: A Criticism of the PTO's
View on Algorithms, 54 GEO. WASH. L. REV. 871 (1986). (arguing that the assumption of
algorithms being in the prior art is skewing patentability determinations). See also Chisum,
supra note 21, at 995. (referring to this statement by the Court as an "aberration, . . . basi-
cally antithetical to patent law principles.") See also the comments of the PTO on what is
"prior art," supra note 8.

74. 437 U.S. at 593. See id. at n.15. (discussing the novelty objection to allowing the
patenting of discoveries of existing scientific principles). This confirms the Court's conclusion
in Benson that all algorithms are similar to laws of nature.

75. Id. at 594.

76. "[T]his decision should [not] be interpreted as reflecting a judgment that patent
protection for certain novel and useful computer programs will not promote the progress of
science and useful arts, or that such protection is undesirable as a matter of policy." 437 U.S.
at 595. This appears to leave the question open, but note that if algorithms are presumptively
considered to be within the prior art, the novelty question is resolved at the outset to the
detriment of the inventor. A similar statement is found in In re Bradley, 600 F.2d 807
(C.C.P.A. 1979), cert. denied, 450 U.S. 381 (1981), where the court states, "[t]he examiner's
basis for the rejection is grounded on the erroneous interpretation of . . . Benson, that all
computer program or program-related inventions are nonstatutory under § 101." The appar-
et inconsistency between these statements and the decisions may be resolved by differentiat-
ing between "mathematical algorithms" and "computer algorithms" (or programs). For an
attempt at such a resolution, see Paine, Webber 564 F. Supp. 1358.

77. "[W]e should not expand patent rights . . . unless the argument for expansion of
privilege is based on more than mere inference from ambiguous statutory language." 437
U.S. at 596, quoting the Court in Deepsouth Packing Co. v. Laitram Corp., 406 U.S. 518, 531
(1972). Deepsouth involved the desire of a combination patent holder to expand their right
and enable them to prevent the making of the constituent parts of a machine, not just the
The most recent Supreme Court case on the subject, *Diamond v. Diehr*, involved a patent claim for a "method of operating a rubber-molding press for precision molded compounds with the aid of a digital computer, comprising: . . . repetitively calculating in the computer, at frequent intervals during each cure, the Arrhenius equation for reaction time during the cure." The Arrhenius equation itself had been known for some time prior to the filing of the patent application. The Board of Appeals of the Patent and Trademark Office action had sustained the Patent Office denial of a patent. This decision was reversed by the C.C.P.A. The Supreme Court affirmed the C.C.P.A. reversal, upholding the grant of a patent.

*Diehr* completed the trilogy of Supreme Court cases and established the foundation for the later Court of Customs and Patent Appeals and Federal Circuit cases on this subject. The Court stated the issue as whether "a process for curing synthetic rubber which includes in several of its steps the use of a mathematical formula and a programmed digital computer is patentable subject matter." This statement represents a different inquiry than that in *Benson*, and indicates the influence of that decision. The issue was no longer whether an algorithm is patentable, but rather, whether the presence of an algorithm would prevent the patenting of a more traditional process or method. The emphasis on applications of algorithms as the basis of a patent was formalized in the two-step test developed in the C.C.P.A. cases described in the next section.

The Court in *Diehr* continued by referring to the historical purposes of the patent laws and to the task at hand of interpreting § 101. As before, the statutory definition of "process" was considered, with the Court quoting the *Cochrane v. Deener* language assembly of the whole device. The quoted language evidences a deference to the legislature, and suggests interpreting *Benson* as denying patentability on a judicial competence basis, not the policy one cited in the case. This would effectively restrict the *Benson* holding and allow its replacement by a more appropriate doctrine.

79. 450 U.S. at 180 n.5. The Arrhenius equation relates the cure time to the activation energy constant of the material being molded, the geometry of the mold, and the temperature of the mold during the process.
80. *Id.* at 177. Note that what was involved in *Diehr* was a formula or equation, not a series of steps used to achieve a final state as in *Benson*.
81. The Court described the invention as "a process for molding raw, uncured synthetic rubber into cured precision products." 450 U.S. at 177.
82. "As in *Chakrabarty*, we must here construe 35 U.S.C. § 101 . . ." *Id.* at 181. A point of interest is that *Chakrabarty* contained language which supported an expansive reading of the patent grant, apparently rendering the Court's concerns with institutional competence moot. *See infra* note 87 and accompanying text.
whose significance it had apparently limited in Benson and Flook.\textsuperscript{83} The Court also characterized the claimed invention as a “process” and emphasized that the respondents did not seek to patent a mathematical formula or preempt its use by others.\textsuperscript{84} The Court then stated an effective summary of its holding which would be incorporated in later cases and Patent and Trademark Office policy. “[A] claim drawn to subject matter otherwise statutory does not become nonstatutory simply because it uses a mathematical formula, computer program, or digital computer.”\textsuperscript{85} The Court concluded by upholding the decision of the C.C.P.A. granting a patent, and provided guidance as to the proper inquiry when the patentability of an invention containing a mathematical formula was at issue.\textsuperscript{86}

\textit{Benson} can be seen as a guiding force to the Court in \textit{Flook} and \textit{Diehr}. \textit{Benson} did not allow the grant of a patent to an isolated, unapplied algorithm. Thus, the focus became determining under what situations an invention containing an algorithm could be patented. This directed judicial resources away from the statutory subject matter determination and raised the possibility of the doctrine impeding the goals of the patent system.

Although not concerned with the patentability of algorithms, the Supreme Court case of \textit{Diamond v. Chakrabarty}\textsuperscript{87} is significant because of its discussion of the policies underlying 35 U.S.C. § 101. \textit{Chakrabarty} addressed the issue of whether a created (man-made) bacteria constituted statutory subject matter. As with algorithms, the subject matter of the case was not envisioned at the time Congress enacted the patent statute then in force.

The Court in \textit{Chakrabarty} recited comments from previous cases describing the purpose of the patent laws, and the method by which that purpose is sought to be achieved. The Court then con-

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\textsuperscript{83} 450 U.S. at 182-84. The quote and comments regarding its significance are found supra notes 17, 54, and 70 and accompanying discussions.

\textsuperscript{84} “[R]espondents' claims [cite] ... a physical and chemical process for molding precision synthetic rubber products ...” 450 U.S. at 184. “[T]he respondents here do not seek to patent a mathematical formula. [T]hey seek only to foreclose from others the use of that equation in conjunction with all of the other steps in their claimed process.” 450 U.S. at 187. \textit{See also id.} at 191: “We view respondents' claims as ... a process for molding rubber products and not as an attempt to patent a mathematical formula.”

\textsuperscript{85} 450 U.S. at 187. Note the requirement of determining what is “otherwise statutory.”

\textsuperscript{86} “[W]hen a claim containing a mathematical formula implements or applies that formula in a structure or process which, when considered as a whole, is performing a function which the patent laws were designed to protect (e.g., transforming or reducing an article to a different state or thing), then the claim satisfies the requirements of § 101.” 450 U.S. at 192. Note the incorporation of the Deener definition of a statutory “process.”

\textsuperscript{87} 447 U.S. 303 (1980).
sidered the intent of Congress as manifested in the statutory language. The Court concluded that "[i]n choosing such expansive terms as 'manufacture' and 'composition of matter' [in the statute], modified by the comprehensive 'any,' Congress plainly contemplated that the patent laws would be given wide scope." The expansive view of the scope of statutory subject matter presented in Chakrabarty is in sharp contrast to the cautionary statements of the Court in the algorithm cases. The opposing views highlight the significance of the definition and characterization of algorithms in Benson which allowed the policy invocation effectively settling the issue.

B. The Court of Customs and Patent Appeals Cases

The holdings of the Supreme Court in the three algorithm cases were applied and more fully developed in subsequent cases. The culmination was a two-step test applied to patent claims reciting an algorithm, and the codification of that test in Patent And Trademark Office policy. The C.C.P.A. cases of importance to the issues discussed in this paper are presented in this section.

In re Abele concerned an "invention directed to an improvement in CAT (computerized axial tomography) scan imaging." In stating "[w]e agree . . . that a two part analysis is the proper vehicle for resolution of issues here presented under 35 U.S.C. § 101," the court adopted a test to resolve the statutory subject matter issues raised by inventions containing an algorithm.

The first part of the test was stated in In re Freeman where it was described as, "[f]irst, it must be determined whether the claim directly or indirectly recites an 'algorithm' in the Benson sense of

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88. "In cases of statutory construction, we begin, of course, with the language of the statute." Id. at 308, quoting Southeastern Community College v. Davis, 442 U.S. 397 (1979). "And 'unless otherwise defined, words will be interpreted as taking their ordinary, contemporary, common meaning.'" 447 U.S. at 308 (quoting Perrin v. United States, 444 U.S. 37 (1979)).

89. 447 U.S. at 308. The Court followed by stating that "[t]he Act [of 1793] embodied Jefferson's philosophy that 'ingenuity should receive liberal encouragement.'" Id. The Court also quoted from the Congressional reports accompanying the 1952 Act in saying that "Congress intended statutory subject matter to 'include anything under the sun that is made by man.'" Id.

90. Note that the views represent the opposing poles of the discovered versus created (man-made), prior art, and preemption issues.

91. 684 F.2d 902 (C.C.P.A. 1982).

92. Id. at 904.

93. Id. at 905 (citing Benson and In re Freeman, 573 F.2d 1237 (C.C.P.A. 1978)).
that term . . ." The court modified the second part of the test as presented earlier in *In re Walter*, stating its own interpretation of the required analysis: *"Walter should be read as requiring no more than that the algorithm be 'applied in any manner to physical elements or process steps,' provided that its application is circumscribed by more than a field of use limitation or non-essential postsolution activity."* This completed the development of the two-step test. Application of the test requires identifying the type of algorithm presented, followed by an evaluation of how it is used in the claimed process or method. The court also approvingly cited the *Benson* and *Flook* holdings as providing some limits on the patentability of algorithms.

A subsequent C.C.P.A. case, *In re Pardo,* concerned claims for "a method for controlling the internal operations of a computer [by which it is] convert[ed] . . . from a sequential processor . . . to a processor which is not dependent on the order in which it receives program steps." The case is important because of its recognition of the overly broad definition of an algorithm adopted in *Benson.* In *Pardo,* the court addressed two issues: (1) whether the claimed invention constituted statutory subject matter, and (2) whether the invention was non-obvious as required by 35 U.S.C. § 103.

The court in *Pardo* recognized the two-step test developed in the preceding cases as the appropriate mode of analysis, and then attempted to dispel some of the confusion regarding which algorithms were considered nonstatutory subject matter. The court limited the class of nonstatutory algorithms to "mathematical algorithms" as defined in *Benson.* The court indirectly provided examples of what constitutes a "mathematical algorithm" by stat-

94. 573 F.2d 1237, 1245. This refers to the *Benson* definition of an algorithm. See supra note 15 and accompanying text.
95. 618 F.2d 758 (C.C.P.A. 1980).
96. 684 F.2d at 907 (quoting *Walter,* 618 F.2d 758). This completed the two-step test as begun in *Freeman,* 573 F.2d 1237. Note the incorporation of the *Flook* holding in the second part of the test.
97. "[A] claim does not present patentable subject matter if it would wholly preempt an algorithm, *Benson,* or if it would preempt the algorithm but for limiting its use to a particular technological environment, *Flook.*" 684 F.2d at 906.
98. 684 F.2d 912 (C.C.P.A. 1982).
99. *Id.* at 913. Note that the claims in *Pardo* do not depend on any specified mathematical calculations or variables which the computer is utilizing.
100. 684 F.2d at 915.
101. "The method adopted by this court for analyzing mathematical algorithm-statutory subject matter cases . . . comprises a two part test." 684 F.2d at 915. The court then stated the *Freeman-Walter* test as modified by *Abele.* *Id.*
102. *Id.* Note that this still leaves open the issue of what is a "mathematical problem."
ing, "we are unable to find any mathematical formula, calculation, or algorithm . . . recited in the claimed steps of examining, compiling, storing, and executing."\textsuperscript{103} This suggests that protection of public access to mathematical operations is what is important. The court also addressed the scope of patentable subject matter, saying "[s]ection 101 encompasses a broad range of subject matter."\textsuperscript{104} The court held that the claims at issue recited statutory subject matter, and proceeded to discuss the obviousness issue.\textsuperscript{105} \textit{Pardo} reflects a concern with the impact of the definition of an algorithm adopted in \textit{Benson} and the apparent conflict between the approaches to resolving subject matter issues found in \textit{Chakrabarty} and \textit{Benson}.

\textit{In re Meyer}\textsuperscript{106} concerned "a process and an apparatus for carrying out the process of testing a complex system and analyzing the results of these tests."\textsuperscript{107} The specification described as part of the invention "a rather simple algorithm to locate elements of probable function and malfunction in a complex system."\textsuperscript{108} The court addressed the intended scope of patentable subject matter, recalling similar statements made in \textit{Pardo}.\textsuperscript{109} The court recognized that "some mathematical algorithms and formulae do not represent scientific principles or laws of nature; they represent ideas or mental processes and are simply logical vehicles for communicating possible solutions to complex problems."\textsuperscript{110} This decision further questions the broad approach adopted in \textit{Benson} which denied patentability to all isolated algorithms.

The court in \textit{Meyer} cited to the Supreme Court in discussing the rationale for not allowing scientific principles and laws of nature

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103. 684 F.2d at 916. This is based on a similar statement in \textit{Walter}, 618 F.2d at 764-65 n.4, and provides a possible, but not exclusive, definition of the term.

104. 684 F.2d at 916. The court cited \textit{Chakrabarty}, 447 U.S. 303, for this proposition. \textit{See supra} note 87 and accompanying discussion. The comment is based on Congressional reports accompanying the bill which became the 1952 Patent Act.

105. 684 F.2d at 917.

106. 688 F.2d 789 (C.C.P.A. 1982).

107. \textit{Id.} at 790.

108. \textit{Id.} at 791.

109. The court cited the Congressional reports accompanying the bill which became the 1952 Patent Act "indicating that 35 U.S.C. § 101 was intended to encompass a broad range of subject matter." 688 F.2d at 794.

110. \textit{Id.} at 794-95. This statement suggests that some interpretation of the nature of the algorithm involved is required to implement the first step of the two step test. Otherwise the definition in \textit{Benson} and the subsequent application of the policy involving natural laws invoked there will be overly inclusive. Such an interpretation requires differentiating between "mathematical algorithms" which purport to solve equations, calculate formulae containing physical quantities, or represent a statement of a natural law, and those which do not. \textit{See also} the PTO policy on this issue infra note 141 and accompanying text.
\end{flushleft}
to be patented, and in doing so, suggested a method for differentiating between discovered and created algorithms. The court stated that discovered principles or laws of nature "have existed throughout time [and] define the relationship of man to his environment." This emphasizes that one aspect of natural laws is that they contain variables describing physically measurable quantities. The court summarized the proper approach for determining if a claim complied with the statute:

it must be determined whether a scientific principle, law of nature, idea, or mental process, which may be represented by a mathematical algorithm, is included in the subject matter of the claim. If it is, it must then be determined whether [it] is applied in an invention of a type set forth in 35 U.S.C. § 101.

The court held that the claims in Meyer recited a mathematical algorithm and failed the second part of the two-step test.

Taken together, the C.C.P.A. cases indicate an acceptance of the Supreme Court decisions and their incorporation into the two-step test for determining if inventions containing an algorithm are patentable. The C.C.P.A. cases recognized problems due to the breadth of the doctrine and attempted to interpret it in a manner which would alleviate its shortcomings.

C. The Federal Circuit Cases

The decisions of the Federal Circuit involving inventions containing algorithms are significant for two reasons. The Federal Circuit has adopted the decisions of the C.C.P.A., so that the earlier cases serve as precedents. The Federal Circuit decisions also indicate areas in which the court may differ with the interpretation of the Supreme Court, and earlier C.C.P.A. decisions.

111. This supports a case-by-case determination of patentability rather than the per se approach adopted in Benson.

112. 688 F.2d at 795 (citing Leroy v. Tatham, 55 U.S. (14 How.) 155, 175 (1852).

113. 688 F.2d at 795. Note the tangibility requirement imposed by this statement.

114. Id. at 796.

115. See South Corp. v. United States, 690 F.2d 1368 (Fed. Cir. 1982) (adopting the body of law represented by the holdings of the Court of Claims and the Court of Customs and Patent Appeals as precedent for the decisions of the Federal Circuit).

116. As an example, in In re Durden, 763 F.2d 1406 (Fed. Cir. 1985), the court stated its own interpretation of what constituted a "process" for the purposes of the patent laws: "A process, after all, is a manipulation according to an algorithm, as we have learned in recent years - doing something to or with something according to a schema." Id. at 1410. This definition stresses the operational nature of a process, not the transformational one, as earlier cases did.
In re Grams\textsuperscript{117} involved "a method of testing a complex system to determine whether the system condition is normal or abnormal and, if it is abnormal, to determine the cause of the abnormality."\textsuperscript{118} The court stated the accepted doctrine regarding the nonstatutory nature of a claim, which consisted of preempting a mathematical algorithm.\textsuperscript{119} The court followed by stating the issue of the case as "[w]hether the algorithm-containing claims at issue are drawn to statutory subject matter."\textsuperscript{120}

Indicating a divergence from the existing Benson-based doctrine, the court noted the apparent contradiction between the expansive statements concerning statutory subject matter in Chakrabarty, and the cautionary ones in Flook.\textsuperscript{121} However, the court took no action and instead acknowledged the current state of the doctrine as evidenced by Benson.\textsuperscript{122} The court resolved the issue in Grams by characterizing the claims as a mathematical algorithm containing a single physical process step that "merely provides data for the algorithm."\textsuperscript{123} This supported the holding

\begin{itemize}
\item \textsuperscript{117} 888 F.2d 835 (Fed. Cir. 1989).
\item \textsuperscript{118} Id. at 836.
\item \textsuperscript{119} Id. at 837. "[T]he inclusion of a mathematical algorithm in a claim can render it nonstatutory if the claim in essence covers only the algorithm." Id.
\item \textsuperscript{120} Id.
\item \textsuperscript{121} Construing section 101 as excluding mathematical algorithms seems somewhat at odds with the liberal view of that section expressed in . . . Chakrabarty." Id. at 837-38. "Chakrabarty expressly rejects the argument that patentability in a new area . . . cannot qualify as patentable subject matter until Congress expressly authorizes such protection." Id. at 838.
\item \textsuperscript{122} "Notwithstanding those statements in Diehr and Chakrabarty, Benson remains the law." 888 F.2d at 838. This points out the contradictory nature of the Benson, Flook, and Diehr decisions when compared to Chakrabarty, and also focuses the analysis on the issue of whether algorithms are discovered or created. Note also the interpretation of Chakrabarty by Chisum suggesting that the case altered the burden of proof on why something should be included or excluded from the patent system, leaving it to the opponents of patent protection for algorithms to show that such protection should be denied. See Chisum, supra note 21, at 1011.
\item \textsuperscript{123} 888 F.2d at 840. The court referred to In re Meyer, 688 F.2d 789, as reciting a similar type of unpatentable claim. Id. The court did not hold that an algorithm can never be patented where the only significant physical step was the provision of data, saying "[w]hether section 101 precludes patentability in every case where the physical step of obtaining data for the algorithm is the only other significant element in mathematical algorithm-containing claims is a question we need not answer. Analysis in that area depends on the claims as a whole and the circumstances of each case." Id. This suggests a case-by-case or "rule of reason" approach.
\end{itemize}

One commentator has stated, "the reasoning recited by the panel leaves very little room for data gathering steps to be found sufficient [to allow patentability]. Perhaps if the data gathering steps were themselves independently patentable, they could be sufficient." 3 SOFTWARE L. BULL. 5 (1990). The same commentator asserts that the Federal Circuit panel imposed another layer on the Freeman-Walter test by applying a three part test consisting of: 1) Does the claim recite a "mathematical algorithm;" 2) Does the claim contain other patent-
that the claims were unpatentable under § 101.\textsuperscript{124} Even so, the decision recognized the tension between the prior cases and focused attention on their underlying policy assumptions.

\textit{In re Iwahashi}\textsuperscript{125} involved an improvement to “an auto-correlation unit for use in pattern recognition to obtain auto-correlation coefficients as for stored signal samples.”\textsuperscript{126} The court stated the issue as “whether the claim as a whole is, . . . directed to nonstatutory subject matter.”\textsuperscript{127} The court recited the \textit{Freeman-Walter} test and discussed the various definitions of “algorithm” which had been offered by the courts.\textsuperscript{128} The court said the “proscription against patenting has been limited to mathematical algorithms and abstract mathematical formulae, which, like the laws of nature, are not patentable subject matter.”\textsuperscript{129} The court characterized the claim as directed to an “apparatus in the form of a combination of interrelated means,” and held that the invention should be deemed “statutory subject matter as either a machine or a manufacture as specified in § 101.”\textsuperscript{130}

The court’s interpretation of the claim as an apparatus and statements that “the claim is a combination of means all but one of which is a means-plus function limitation” and “the claim is therefore subject to the limitation stated in 35 U.S.C. § 112, ¶6, “may reflect a more liberal approach to evaluating claims containing algo-

\textsuperscript{124} 888 F.2d at 841. Note the significance of the second part of the \textit{Walter} test as refined in \textit{Abele}. The emphasis is on the application of the algorithm to an otherwise statutory process, not simply its solution. As before, the preemption of knowledge in the public domain is an issue, as would be the case if only the algorithm were cited in the claims. This approach to preemption recalls the copyright law doctrines which limit the scope of protectable expression such as “merger” (no protection of expression which is the only means, or one of only a few means of expressing an idea), “scenes a faire” (no protection of expression which is necessary or required to express an idea), and “blank forms” (no protection of “blank forms” or those having only minimal expressive content).

\textsuperscript{125} 888 F.2d 1370 (Fed. Cir. 1989).

\textsuperscript{126} \textit{Id.} at 1371.

\textsuperscript{127} \textit{Id.} at 1373.

\textsuperscript{128} \textit{Id.} at 1374.

\textsuperscript{129} \textit{Id.} at 1374. Note that a distinction exists between algorithms and formulas, so that both of the assertions in the statement must be substantiated.

\textsuperscript{130} 888 F.2d at 1375. Note that the “means” referred to are expressed in the form of an algorithm, and that the potential preemption problem of step 2 of the \textit{Freeman-Walter} test is resolved by the claiming of “means plus function limitation[s],” and is “therefore subject to the limitation stated in 35 U.S.C. § 112 ¶ 6.” \textit{Id.} Paragraph 6 of § 112 states that each means plus function definition “shall be construed to cover the corresponding structure, material, or acts described in the specification and equivalents thereof.” 35 U.S.C. § 112.
rithms. The claim in Iwahashi recited a series of operations on data for a particular purpose, with the only explicit physical limitation being a read-only memory (ROM) programmed to carry out one of the operations. While this distinguishes the claim from one which solely recites an algorithm, it is not that different from the numerical conversion claims sought to be patented in Benson, which the Court recognized were only of use in conjunction with a digital computer.\(^{131}\)

The panel's dicta regarding the application of the limitation in 35 U.S.C. § 112 to the claim has generated comments from the Patent and Trademark Office (PTO) and the possibility of a difference in interpretation between the Federal Circuit and the PTO.\(^{132}\) At the least, the dicta provides some practical advice to claim drafters and an indication of the court's views on what does or does not constitute preemption of public domain knowledge.

D. The Policy of the Patent and Trademark Office

The policy of the U.S. Patent and Trademark Office regarding the patentability of algorithms is based on its interpretation of the case law.\(^{133}\) The PTO recognizes the broad interpretation of § 101 as stated in Chakrabarty, but refers to Benson for the definition of and policy regarding mathematical algorithms.\(^{134}\) The PTO accepts the Supreme Court characterization of mathematical algorithms as "the basic tools of scientific and technological work,"\(^{135}\) and recognizes the policy issues in stating, "[mathematical algorithms] should not be the subject of exclusive rights, whereas technological application of scientific principles and mathematical algorithms furthers

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131. See 409 U.S. at 71. This recalls the merger doctrine in copyright law.

132. The current view of the PTO is summarized in an article entitled Patentable Subject Matter, Mathematical Algorithms and Computer Programs, 1106 Off. Gaz. Pat. Office (Sept. 5, 1989) [hereinafter PTO paper]. In the PTO paper on patentable subject matter, the PTO stated that attempts to draft mathematical algorithms as "machine" claims by using "means for" language will not avoid the algorithm's process feature and the patentability determination based on it since the form of the claim does not control the subject matter determination. Id. at 8. If a claim recited only means plus function language, even though the specification contained language describing a particular apparatus or equivalent, it appears that the court and the PTO would disagree on the proper analysis. The PTO asserts that the Iwahashi decision is not contrary to its policy due to the recitation of an apparatus in the claim, but does take issue with the court's dicta. See PTO Interpretation of In Re Iwahashi, 39 Pat. Trademark & Copyright J. (BNA), No. 972, at 399 (Mar. 15, 1990).

133. See PTO paper, id.

134. See PTO paper, id. at 6. Note that Benson only referred to the definition of an algorithm. The article cites Walter and Pardo for the proposition that only mathematical algorithms are non-statutory. Id.

135. Id. (quoting Benson, 409 U.S. at 67).
the constitutional purpose[s]."

In evaluating patent claims, the PTO has formally adopted the two-step test as formulated in Freeman, Walter, and Abele. The PTO accepts the Benson definition of a mathematical algorithm, and the examples listed in Walter. The PTO's concern with the preemption of knowledge in the public domain is evidenced by the statement that "[n]o distinction is made between mathematical algorithms invented by man, and mathematical algorithms representing discoveries of scientific principles and laws of nature." This statement conflicts with Chakrabarty and places all such knowledge in the public domain. The PTO policy statement recites the two-step test and documents its application by the courts. As a final comment, the PTO reinforces the earlier decisions overturning the strict application of the "mental steps" doctrine.

The PTO's approach to evaluating inventions containing algorithms is formalized in the Manual of Patent Examining Procedure (MPEP). The chapter on patentability reviews the Chakrabarty decision, and comments on the decisions involving mathematical algorithms. The PTO approach to determining whether a set of claims recites statutory subject matter is stated as follows:

The Office will decide the questions as to patentable subject matter under 35 U.S.C. § 101 on a case-by-case basis following the tests set forth in Chakrabarty, e.g., that "a nonnaturally occurring manufacture or composition of matter" is patentable.

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136. Id. This focuses the preemption issue on the patenting of "naked" algorithms, leaving open the possibility that an application of such may be statutory subject matter. This recognizes the Diehr decision.

137. "The proper legal analysis of mathematical algorithm-statutory subject matter cases is the two-part test of In re Freeman, . . . as modified by Walter and Abele." Id.


139. Id. This implicates the discovery versus creation issue, as the PTO is grouping together both man-made and discovered mathematical algorithms.

140. Id. at 7-10.

141. "[M]achine or computer implementation of "mental steps" is statutory subject matter." Id. at 11.

142. MANUAL OF PATENT EXAMINING PROCEDURE (5th ed. 1989) [hereinafter MPEP]. This document is published by the United States Government Printing Office and is used by examiners in the PTO as a guide to ruling on the acceptance or rejection of patent applications.

143. See MPEP, id. at 2100-1 (Chapter 2100 (Patentability)). In particular note §§ 2105 (Living Subject Matter) and 2106 (Mathematical Algorithms or Computer Programs).

144. See MPEP, id. at 2100-2.
This statement supports a “rule of reason” analysis and a determination of whether a particular algorithm was man-made or discovered.

The MPEP states that the statutory categories under which an algorithm would fall are those of processes, machines, or manufactures. With regard to preemption, the manual states,

Even though a claim contains an application limiting preamble, even though it does not cover every conceivable application of a formula, or even though it does not totally preempt the formula, such a claim would be nonstatutory, if, when considered as a whole, it merely recites a mathematical algorithm or method of calculation.

This formalizes the denial of a patent to an isolated algorithm.

E. A Resource Misallocation Criticism of the Doctrine

The doctrinal development begun in Benson culminated in a patent policy which denies patentability to isolated “mathematical algorithms,” while providing the possibility that proper applications of algorithms can be patented. Benson itself can be criticized as being based on an improper decision to choose between competing patent system policies, a faulty argument structure, and a holding which is insufficiently supported by experience to serve as precedent. The subsequent cases can be criticized for contributing to the present inefficient system under which some algorithms may be patented. The result is a body of law which does not properly reflect the goals of the patent system and displaces the legislature’s role in making policy choices.

Benson was adopted in subsequent cases as the definitive statement of the law regarding the patenting of isolated algorithms. With this out of the way, these later cases explored the scope of the Benson doctrine (what in addition to an algorithm would be patentable?), developed an analytical structure for evaluating claims containing algorithms (the Freeman-Walter-Abele test), and reasserted the administrability and institutional competence arguments.

145. “Inventions involving mathematical equations, mathematical algorithms or computer programs, if statutory at all, would fall into the categories of statutory subject matter as processes, machines, or manufactures.” Id.

146. Id. at 2100-4. This adopts the Flook holding.

147. The Court in Benson recognized that the extension of the patent laws to cover the types of programs considered was “a policy matter to which we are not competent to speak,” and that “considered action by Congress is needed.” 409 U.S. at 72-73. This seems inconsistent with a categorical denial of patentability as opposed to a case-by-case evaluation.

148. If Benson is overturned or confined, the later cases can be viewed as discussing the
By following Benson, later courts contributed to an inefficient use of judicial resources and ended up focusing their efforts on secondary issues. The courts developed a confusing and indeterminate test stressing the application of an algorithm, not the algorithm itself. The doctrine emphasizes tangibility rather than the inventive concept, and places undue importance on administrability arguments. One commentator has attempted to rationalize the trilogy of Supreme Court cases by suggesting that they apply the "overbreadth doctrine" to the subject matter of mathematically claimed inventions. The overbreadth doctrine is based on the requirement of 35 U.S.C. § 112 that the specification "enable" the reader to "make and use" the invention. An overbroad claim is one whose scope is not supported by the content of the specification, and would be rejected by a patent examiner on a basis independent of any 35 U.S.C. § 101 rejection. The enablement rejection (if that is in fact the basis for the Court's decisions in the algorithm cases) is a justification for denying a specific patent application, not for denying patents to a category of subject matter.

In addition to these conceptual problems, the current doctrine...
is unduly and unnecessarily influenced by claim drafting techniques. This is indicated by applicants' use of "means for" language and attempts to draft "process" patents as "apparatus" ones.\textsuperscript{151} The drafting of patent claims in these forms enables the intangibility objection to patents on algorithms to be overcome by providing a physical embodiment of the invention. This approach also addresses the preemption and claim scope concerns by limiting the inventor's rights to those delineated by a specific application of the algorithm. Application of the current doctrine has the effect of emphasizing form over function, in apparent conflict with the stated policy of the PTO.\textsuperscript{152} This is a philosophical flaw and one which results in an inefficient use of claim drafter's and patent examiner's time. These effects of the doctrine are the basis for a resource misallocation criticism of its present form.

The continued vitality of the doctrine, even in the face of decisions such as Chakrabarty, suggests an inconsistency in the approach to different types of subject matter and emphasizes the error in the Benson Court's definition and characterization of algorithms.

\textsuperscript{151} For a discussion of the "unnecessary or even unhelpful gyrations" utilized to characterize software within the scope of patentable subject matter, see CARY H. SHERMAN, ET AL., COMPUTER SOFTWARE PROTECTION L. § 403.4(b) (1989) [hereinafter SHERMAN]. The treatise suggests "avoiding the types of claims that trigger the two-part Freeman-Walter-Abele test," "avoid reciting mathematical algorithms or formulas, whether directly or indirectly," and that "the term 'calculate' should be avoided wherever possible." It goes on to say, "If a mathematical algorithm is recited, or even if one could possibly be found to be recited, the invention should be structured and claimed as part of a larger process or apparatus which effects physical changes or produces a physical product." \textit{Id.} at 403-47. "With respect to the form of the claims, it may also be advisable to draft them as means-plus-function claims. In such a way, each claim can be for an undescribed 'means for' accomplishing each step . . . ." \textit{Id.} at 403-48.

As an example, consider a search algorithm designed to find the closest member of a defined group to a given test sample (as in a spell checker for a word processing program). The group's members must be indexed, and a metric allowing an evaluation of the closeness between the member and the test case must be decided upon. Heuristics for searching the group may also be required. The algorithm applies the metric to pairs of samples, one the test sample and one from the defined group.

If an inventor sought to patent this "algorithm" as a "method for determining the closest member of a defined group to a test sample," the issuance of a patent would hinge more on the application of the algorithm than on the inventive concept. If the claims contained the components of a "mathematical algorithm" the standard two-step test would be applied, necessitating the restriction of the algorithm to a particular application and its use as "applied in any manner to physical elements or process steps." These efforts would be required even though the algorithm was comprised of man-made elements and relationships so that no public domain knowledge would be preempted by its patenting. If the claims were written in "means plus function" form, it is more likely that a patent would be granted, as in the case of the patent in Iwahashi.

\textsuperscript{152} See MPEP, supra note 142, at 8 (commenting on "process" versus "apparatus" claims).
The initial assumptions and the administrability argument prevent an approach to the subject matter which could more fully realize the goals of the patent system. These goals, and the purposes of the patent system are discussed in the next section. The following section discusses how the present state of the law can impede achieving those goals.

IV. PURPOSES OF THE PATENT SYSTEM

In this section, various purposes and justifications for the existence of a patent system will be discussed. The current doctrine's effect on achievement of those goals will then be considered. This will also emphasize the values and policies which should form the basis of a more desirable protection system.  

A. The Constitutional Basis and its Interpretation

The language of the constitutional grant of power to Congress in Article 1, Section 8, Clause 8 stresses the purpose of promoting the progress of science as the foundation for the patent system.154 This indicates the need to consider the effects of any policy judgment in the patent realm with regard to the overall encouragement of inventions by offering protection, as balanced against the potential inhibition of later inventions by erecting a temporary barrier to the free availability and dissemination of information.155 The clause also mentions that the exclusive right secured for inventors is to be of limited duration. This indicates that the founders desired that an inventor possess a property right in his or her invention for only a limited period of time.156

The Supreme Court has had occasion to comment on the pur-
poses of the patent system in cases involving the interpretation of the statutes based on the constitutional grant of power. The cases present an indication of what the Court sees as the goal of the system and the method by which it is to be achieved. In *Mazer v. Stein*, a case involving the scope of the copyright statute, the Court stated:

> [t]he economic philosophy behind the clause empowering Congress to grant *patents and copyrights* is the conviction that encouragement of individual effort by personal gain is the best way to advance public welfare through the talents of authors and inventors in 'Science and useful Arts'. Sacrificial days devoted to such creative activities deserve rewards commensurate with the services rendered (emphasis added).\(^{157}\)

This statement addresses both the means and the ends of the patent system. The means are based on the provision of a reward as an incentive to authors and inventors to create works, and the goal is the advancement of social welfare by the stimulation of invention. Presumably, both the end product (the invention) and the enabling disclosure will benefit society by making available an invention and the knowledge of the inventor. The last sentence in the quote also touches on a possible justification for the patent system, the concept of an inventor's natural right to the product of his efforts. This justification is based on equity and has been discussed in depth by other authors.\(^ {158}\)

In *Kewanee Oil Co. v. Bicron Corp.*, a case involving the issue of whether state trade secret law is preempted by federal patent law, the Court commented on the objectives and justifications of the patent system:

> The patent laws promote [the progress of science and the useful arts] by offering a right of exclusion ... as an incentive to inventors to risk the often enormous costs in terms of time, research, and development. [The result] will have a positive effect on society through the introduction of new products and processes of manufacture into the economy .... In return for the right of exclusion - this 'reward for inventions' ... the patent laws impose upon the inventor a requirement of disclosure. When a patent is

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158. See Justin Hughes, *The Philosophy of Intellectual Property*, 77 Geo. L.J. 287 (1988) [hereinafter Hughes] for a discussion of the philosophical roots of intellectual property. The article focuses on the labor theory of Locke (similar to the natural rights theory expressed by the Court in *Mazer*), and the personality theory of Hegel, which is similar to a moral rights theory of property ownership. Note that the moral rights theory of property is not recognized by the existing patent laws.
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granted and the information contained in it is circulated to the
general public . . . such additions to the general store of knowl-
edge are of such importance to the public weal that the Federal
Government is willing to pay the high price of 17 years of exclu-
sive use for its disclosure, which . . . will stimulate ideas and the
 eventual development of further significant advances in the art.
The Court has also articulated another policy of the patent law:
that which is in the public domain cannot be removed therefrom
by action of the States.159

This statement indicates how the patent laws achieve the goal of
providing an incentive to inventors through the grant of a limited
property right. The Court refers to the reward theory of the patent
system as a means by which inventors are compensated for their
efforts. The Court stresses the social welfare goal of the system
achieved by the introduction of new products and knowledge into
society. The Court's statement regarding the policy of maintaining
knowledge in the public domain recalls the preemption issue al-
dready discussed. If algorithms are "natural laws" as the Court has
characterized them, then they reside in the public domain and are
presumptively not patentable as the public is entitled to that knowl-
gedge.160 The balancing of these competing policies (providing an
incentive to invent and protection of the public interest) is always
present in any determination of whether a category of inventions
constitute statutory subject

Finally, in a recent case which also involved the issue of federal
preemption of state protection of intellectual property, the Court
presented a summary of the suggested purposes and justifications of
the patent system. In Bonito Boats, Inc. v. Thunder Craft Boats,
Inc., the Court stated:

The Patent Clause itself reflects a balance between the need to
courage innovation and the avoidance of monopolies which sti-
fle competition without any concomitant advance . . . . Sections

160. See the Court's statements in Diamond v. Diehr, 450 U.S. at 186 (1980). See also
Graham, 383 U.S. at 6, where the Court makes a similar statement: "[Congress may not]
authorize the issuance of patents whose effects are to remove existent knowledge from the
public domain." The statement in Kewanee refers to the actions of the States because the
issue in that case was the preemption of State intellectual property laws by Federal laws. The
removal of knowledge from the public domain is prevented by Federal patent law because
such knowledge is not novel.
161. The balancing aspect inherent in the structure of the patent and copyright laws was
noted by the Court in Sony Corp. of Am. v. Universal Studios, Inc., 464 U.S. 417 (1983), a
case involving the fair use clause of the copyright laws, where the Court stated, "The [scope
of the copyright law] reflects a balance of competing claims upon the public interest . . . ." Id.
at 431.
102(a) and (b) [of the patent statute] operate in tandem to exclude from consideration for patent protection knowledge which is already available to the public. . . . The federal patent system thus embodies a carefully crafted bargain for encouraging the creation and disclosure of new, useful, and nonobvious advances in technology and design in return for the exclusive right to practice the invention for a period of years. [T]he ultimate goal of the patent system is to bring new designs and technologies into the public domain through disclosure.\textsuperscript{162}

This implies that the goal of providing incentives to investors by issuing patents is dominant.

B. The Suggestions of Commentators

As might be expected, the language of the patent clause has been interpreted by the Court and by commentators, as well. Some have focused on the justifications for the system as being a natural right in property as expressed in the works of Locke or Hegel.\textsuperscript{163} Others have addressed the economic consequences of the patent system by exploring the incentives it provides to inventors.

These incentives have been described as that of encouraging disclosure of the invention, rewarding the inventor, fostering the development and marketing of inventions by manufacturers, and increasing social welfare.\textsuperscript{164} It has also been suggested that the patent system provides an incentive to more efficiently allocate resources by encouraging inventors and manufacturers to expend resources on fully developing those inventions and ideas which have been granted protection.\textsuperscript{165} Another commentator has suggested that the patent system provides a means of quality control by enabling inventors to maintain the integrity of their invention through their right of assignment.\textsuperscript{166} This is analogous to a "moral rights" property right such as is found in some state statutes.

\textsuperscript{163} See Hughes, supra note 158.
\textsuperscript{164} These arguments are summarized in Floyd Lamar Vaughan, Economics of Our Patent System 27-33 (1925). See also Joseph A. Franco, Note, Limiting the Anticompetitive Prerogative of Patent Owners: Predatory Standards in Patent Licensing, 92 Yale L.J. 831, 834 (1983) discussing the economic justification for a patent system as "the belief that competitive markets will yield inadequate investment in innovation." The note goes on to discuss the attendant social costs of the patent system owing to the patent owner's exclusive property right.
\textsuperscript{166} See Charles Weiner, Patenting and Academic Research: Historical Case Studies, in Owning Scientific and Technical Information: Value and Ethical Issues (Vivien Weil and John Snapper eds. 1989). This collection of essays discusses proposed justifications
The suggested purposes of the patent system can be characterized as being concerned with the interests of the inventor (reward, natural rights, quality control, equity), the interests of the public (incentives to create, increased social welfare, efficient resource allocation), or some mixture of both (reward for disclosure). This again reflects the balancing of the public and private interests, a primary concern of the patent system.

This concern is evidenced by the mechanics of the patent laws themselves. The requirements on patentable subject matter (§ 101) represent an attempt to balance the inventor's ability to receive a reward with the public's interest in maintaining access to knowledge in the public domain. The novelty requirement (§ 102) similarly supports the disclosure goal of the patent system by protecting the public interest in access to information and inventions already in the public domain.

The specification (or disclosure) requirement (§ 112) represents a means of achieving the goal of increased social welfare and efficient resource allocation in subsequent inventions, in exchange for the promise of a reward to the inventor. This goal of the patent system is implemented by making available to the public the information required to practice the invention after the term of the patent expires. In this way social welfare is increased through the transfer of the inventor's knowledge to the public in exchange for the limited period of protection allowed by the grant of a patent.

The granting of a seventeen-year period of exclusive property rights (§ 154) is a means of balancing the potential reward available to an inventor and the desire to provide a sufficient incentive to inventors, while recognizing the public's interest in utilizing the products of inventors' efforts in a timely manner. The term thus reflects a judgment as to the proper balance between the benefits of a patent grant and the associated costs. The term balances the

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of the patent and copyright laws and comments on some of the present philosophical and ethical issues confronting inventors.

167. The following comments expand on those made in the Appendix discussing the structure of the patent laws.

168. This goal is realized by the specification requirement in § 112.

desire to provide an incentive to inventors with the traditional dislike of monopolistic practices, based on a fear of the public being exploited.

V. Patent Availability and the Goals of the Patent System

Consideration of the compatibility between the stated goals of the patent system and the current doctrine is an effective way to evaluate its ability to achieve those goals. Such an analysis assists in pointing out conflicts between the patentability determination by the courts in the algorithm cases and the asserted policy goals, thus indicating issues which may benefit from further legislation or judicial clarification.

In evaluating the effect on a prospective inventor of the judicial exclusion of their efforts from protection by the patent laws, his or her motivations must be considered. The motivation to produce inventive products is primarily internally or externally based. Internal motivations, such as intellectual curiosity, will not be affected as much by socially provided rewards as may external motivations, such as recognition and financial reward. In addition to the inventor's own motivations, the availability of other motivating factors, such as reward through the operation of market forces, will affect his or her behavior.

If the inventor's motivations are primarily internal, the unavailability of a patent may have little effect on inventive production, particularly if he or she is employed in a situation in which compensation is received regardless of the patentability. If the inventor's motivations are primarily external, the unavailability of a patent must be considered in light of other opportunities to obtain a reward in order to determine the net effect on incentives to produce inventions. The availability of the market as a means for merchandising inventions can act to offset the disincentive resulting from the denial of protection through the patent system. In addition, other forms of legal protection, such as contract law, copyright, trade secret law, trademarks, and the tort of misappropriation, can provide the basis for sufficient protection, so that the inventor's incentives are not diminished. 170

The effects of the unavailability of a patent on an inventor's incentives will depend on the balance between the individual inventor's motivations, the forms of rewards available, and the alternate forms of legal protection which are applicable to the invention. This suggests that at least in some situations, the denial of patent protection may reduce incentives, although the net effect is uncertain, because inventions which might have been protected by a patent may be at least partially protected or exploited by other means. When considering alternate forms of legal protection, the effects of transaction costs, administrative costs, and the potential decrease in disclosure of knowledge to the public must be included.

As a means of investigating the effects of the unavailability of a patent on a prospective inventor's behavior, it is helpful to consider the possible responses. In general terms these are:

1. The inventor has a decreased incentive to produce that type of product (assuming internal motivations are insufficient in the absence of a patent, and that market benefits are insufficient or unobtainable). The immediate effect of this behavior is a reduction in social welfare, because no knowledge would be disclosed; however, the net effect on social welfare depends on whether the inventor redirected his or her efforts to another, protectable invention.

2. The inventor produces the invention, but does not disclose its workings. This results in decreased social welfare from the lack of disclosure, a reduction in allocative efficiency (less concern with the use of resources), and a decrease in social welfare from the lack of subsequent improvements by other inventors (at least in the short term). The reward and natural right concerns of the patent system may still be addressed through the use of the market.

3. The inventor produces the invention but is forced to seek additional support to produce a patentable product. This can reduce the reward benefits to the inventor (as compared to the situation in which a patent is obtained and licensed or marketed by the inventor), and it can interfere with the recognition of the natural right to the product of the inventor's labor, and the control of the personality aspects of the invention.171

Jensen, Comment, Softright: A Legislative Solution to the Problem of Users' and Producers' Rights in Computer Software, 44 LA. L. REV. 1413 (1984) (discussing an original form of protection called "softright").

171. This refers, respectively, to the theories of Locke and Hegel. See Hughes, supra note 158.
4. The inventor produces the invention but seeks to protect and exploit it through other forms of intellectual property protection. This approach has the drawback that the methods chosen may be a less effective form of protection. Copyright may be too limited a form of protection (because only the expressive content is protected), and there is presently concern over the scope of protection afforded to software.\textsuperscript{172} Trade secret protection reduces the dissemination of the inventor's knowledge and interferes with the licensing potential. It may require inventors to combine their efforts with those of another party as in (3), above. The tort of misappropriation generally protects the labor invested in a product, not the inventive concept. This form of protection may not be expansive enough to provide inventors with a legal claim to the benefits they sought to obtain.\textsuperscript{173}

The use of alternate forms of protection presents problems relating to transaction costs in policing and litigation, and difficulties in the proof of protectable material. Also, the other forms of protection may not enable the inventor to realize the benefits of the inventive concept (the equity issue).\textsuperscript{174} These difficulties can impede the reward and natural rights functions of the patent system.

5. The inventor produces the invention but does not seek legal protection, instead choosing only to exploit it through the market.

This approach may enable the inventor to realize the reward goal of the patent system, and it can assist the disclosure goal if the workings of the invention are made available to the public. The lack of the exclusivity aspect of a property right challenges the concept of the patent system as expressed in the Constitution.

A recurring issue in any discussion of the patent system is that of social welfare which is realized through the process of invention,
protection, licensing, and disclosure motivating subsequent inventions. The increase in social welfare is one characteristic used to evaluate the propriety of granting patents to a category of subject matter. The ability to protect one's inventive product may also influence the economic competitiveness of industries based on such inventions. Without an appropriate form of protection, others can create and market competing products without the necessity of investing money to develop the ideas on which they are based.

The denying of the availability of a patent to the developer of an algorithm should be critically analyzed, particularly where it conflicts with the stated policies of the patent system and may result in inhibiting the realization of the system's goals. When these potential difficulties are combined with the flaws in the doctrine's development and structure, its reformulation is strongly suggested.

VI. AN ALTERNATIVE PROTECTION SCHEME FOR ALGORITHMS

A review of the doctrine regarding the patentability of algorithms reveals errors in the Court's analysis in Benson, and its impact on the doctrinal development. The problems arise from the Court's policy choice and errors in characterizing the subject matter, leading to a per se rule of decision based on insufficient experience with the subject matter. This necessitates examining the negative consequences of the doctrine to ascertain its impact on achieving the goals of the patent system. The conflict between the doctrine and the goals of the patent system suggests replacing the current doctrine with a protection scheme designed to support the goals, without denying the availability of a patent to an entire category of inventions which appear to fall within the statutory requirements. The policy and administrative objections raised to patenting algorithms can be addressed by incorporating specific elements into the protection scheme.

To replace the current doctrine by an alternative protection

175. As a means of discussing the social welfare impact of a patent, define:
Social Welfare = immediate utility of invention + discounted value of future utility of invention, where immediate utility = (utility from disclosed knowledge + utility from the actual product), and discounted value of future utility = (current value of investment in potential future benefits).
Each of these factors must be considered in evaluating the impact of denying a patent to an inventor. In the present context, in order to realize the optimal social welfare benefits of the patent system, it is worthwhile to attempt to develop criteria by which to separate those algorithms which reside in the public domain from those that do not. This will allow the possibility of patenting some algorithms and thus obtaining the benefits flowing from disclosure of the invention.

176. This is referred to as the "free rider" problem.
scheme, it is necessary first to identify the underlying principles upon which the scheme is to be based. These can be stated as:

- Support of the incentive structure and social welfare goals of the patent system,
- Support of the public interest in preventing preemption of knowledge in the public domain, and
- Addressing the administrability and institutional competence issues arising from the examination by the PTO of applications claiming algorithms.

The precise characteristics of the scheme are the responsibility of Congress and/or the courts; however, the following suggestions will assist both in meeting the objections raised in the cases, and in implementing the scheme.

- Adopt a more general definition of an “algorithm” which focuses on its operational or functional character.
- Restrict Benson to its specific fact pattern and the general policy statement regarding the protection of knowledge in the public domain.
- Provide a framework for distinguishing the constituent elements of an algorithm. This will assist in identifying which, if any, elements of a particular algorithm are protectable by the patent system.
- Postulate tests to isolate the public domain content of the algorithm from protectable subject matter, allowing the separation of unpatentable from potentially patentable algorithms. The tests are designed to identify mathematical statements of natural laws, expressions containing physical variables, expressions containing mathematical operations, and the like. Enumerating such tests will resolve the discovered versus created issue, and focus the patentability determination on the claimed invention.
- Evaluate the patentability of the claimed algorithm on a case-by-case basis. This implements a rule of reason analysis rather than a per se rule as results from Benson.
- Adopt procedures to alleviate the administrability concerns. This addresses the administrability and institutional competence (of the PTO) issues raised in the cases.\textsuperscript{177} The primary administrative

\textsuperscript{177} See supra note 25 for some comments of the Court in Benson. See also Diehr, 450 U.S. at 197 (stating, “[a]fter studying the question of computer program patentability, the [President’s] Commission recommended that computer programs be expressly excluded from the coverage of the patent laws; this recommendation was based primarily upon the Patent Office’s inability to deal with the administrative burden of examining program applications.”).
difficulties mentioned in the cases relate to the lack of a classification technique which would serve as a means of categorizing the claimed algorithms, the unavailability of the required library of existing algorithms for purposes of prior art searches, the volume of prior art generated, and the specialized training required to evaluate claims containing algorithms. Some or all of these obstacles appear to have been overcome, as the PTO is currently issuing patents for algorithms when claimed in conjunction with a specific application.

- Alleviate concerns regarding the availability of the tools of science by compulsory licensing of algorithms for non-profit use by researchers and educational institutions. This would protect the public interest and eliminate the concerns of scientists that technological progress would be impeded. Site licenses of a library of algorithms could be made available for educational institutions. An alternative is to adopt some type of “fair use” exemption for institutions using patented algorithms.

- Resolve the tangibility concerns by adopting the approach utilized in property law for recognizing rights in intangible property.178

Even if an alternative protection scheme is adopted, this does not mean that the PTO will be inundated with applications for algorithm patents. Inventors will carefully weigh the attendant costs and difficulties prior to seeking a patent.179 They might seek to protect their inventions by a combination of other forms of intellectual property protection, or rely on the market to reward them for their efforts. In addition, the application must still satisfy the other requirements of the patent laws in order for a patent to be granted. This will limit the number of applications filed, as well as the number of patents granted.

178. This approach is suggested in Note, Computer Intellectual Property and Conceptual Severance, 103 HARV. L. REV. 1046 (1990) (urging adoption of the bundle-of-rights and market-based conceptions of property to protect abstract inventions). The author maintains that “the current law results in high transaction costs and uncertain protection.” Id. at 1060.

179. These include considering whether their inventions are included in the definition of patentable software (as data bases and other computer related inventions may not be), the amount of time it takes to prepare a patent application and prosecute it through the Patent Office (which may take several years and render the patent obtained of little value in a changing marketplace), the high cost of obtaining a patent, costs involved in policing the rights secured by a patent (since a patent is a public document, it can result in disclosure and loss of trade secret protection), and enforcement costs should a patent infringement charge be brought (litigation costs are very high). A discussion of various advantages and disadvantages to seeking a patent on algorithms is found in D. BENDER, COMPUTER LAW: SOFTWARE PROTECTION, §§ 3A.10, 3A.11 (1989). See also SHERMAN, supra note 151, at §§ 401.5-401.6.
CONCLUSION

The legal doctrine regarding the patentability of algorithms is founded on the analysis performed in one case, *Gottschalk v. Benson*. The adoption of its conclusions in later cases determined the course of doctrine's development. The errors in the Supreme Court's approach to resolving the issues raised in *Benson* combined with the obstacles created to achieving the goals of the patent system, strongly suggest that the current doctrine be replaced. This can be accomplished by implementing an alternative protection scheme which is designed to better balance the public and private interests involved, and which is more consistent with the manner in which other forms of property are treated.

APPENDIX

*The Basis and Structure of the Patent System*

As mentioned in the introduction, the patent system is based on a specific constitutional grant of power to the Congress. The patent statute (35 U.S.C.) is the response of Congress to that grant. This appendix provides a brief overview of the operation of the patent system, focussing on those aspects of importance to the issues discussed in this article. The topics covered include the definition of statutory subject matter, the disclosure required in the patent application, the terms of the patent grant, and the property rights conferred by the grant (and from these, the actions which constitute infringement of a valid patent).

*An Overview of the Structure of the Patent System*

1. Patentable Subject Matter.

The general statement of what qualifies as a patentable invention is found in 35 U.S.C. § 101.¹⁸⁰ This statement specifies four categories of patentable subject matter. The implication of the statement is that an invention must fall into one of the enumerated categories or be denied protection under the patent system.¹⁸¹ As demonstrated by the judicial decisions discussed in this article, this

¹⁸⁰ “Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.” 35 U.S.C. § 101.

¹⁸¹ This interpretation is supported by judicial statements such as that found in *Kewanee Oil Co. v. Bicron Corp.*, 416 U.S. 470, 483 (1974): “[N]o patent is available for a discovery, . . . unless it falls within one of the express categories of patentable subject matter of 35 U.S.C. § 101 . . . .”
created the necessity of referring to legislative or judicial definitions of the categories to determine whether a claimed invention was patentable. The requirement in § 101 that an invention be "new and useful" to be eligible for patent protection refers to two of the three fundamental criteria which determine patentability; novelty, utility, and non-obviousness.

2. The Requirement of Novelty.

35 U.S.C. § 102 describes the novelty requirement which an invention must satisfy to be patentable. The purpose of this requirement is to ensure that a patent is granted only to inventors whose inventions were not previously patented or available to the public. The requirement of novelty is applied in conjunction with that relating to non-obvious subject matter (§ 103).

3. The Requirement of Non-Obvious Subject Matter.

35 U.S.C. § 103 describes the requirement that an invention be

182. See, e.g., 35 U.S.C. § 100(b) defining "process" stating, "[t]he term 'process' means process, art or method, and includes a new use of a known process, machine, manufacture, composition of matter, or material." See also the annotation, Patentable Subject Matter, 65 L.Ed.2d 1197 (discussing cases interpreting the meanings of the words used to define the categories of patentable subject matter).

183. A person shall be entitled to a patent unless -
(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for the patent, or
(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of the application for patent in the United States, or
(c) he has abandoned the invention, or
(d) the invention was first patented or caused to be patented, or was the subject of an inventor's certificate, by the applicant or his legal representatives or assigns in a foreign country prior to the date of the application for patent in this country on an application for patent or inventor's certificate filed more than twelve months before the filing of the application in the United States, or
(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, . . . or
(f) he did not himself invent the subject matter sought to be patented, or
(g) before the applicant's invention thereof the invention was made in this country by another who had not abandoned, suppressed, or concealed it. In determining priority of invention there shall be considered not only the respective dates of conception and reduction to practice of the invention, but also the reasonable diligence of one who was first to conceive and last to reduce to practice, from a time prior to conception by the other.

35 U.S.C. § 102. These limitations constitute what are termed the "statutory bars" to obtaining a patent.
non-obvious in order to be awarded a patent. It limits patentability to inventions which represent "non-obvious" improvements to the art of which they are examples. In order to apply this requirement a determination must be made as to the scope and content of the prior art, the differences between the prior art and the patent application claims being considered, and the ordinary level of skill of practitioners in the art.

A non-obvious improvement to the art would be one neither taught nor suggested by the prior art. A non-obvious improvement can also consist of one which is the result of a combination of existing prior art, unless an explicit suggestion to combine is found in an existing reference. Note that if algorithms as a class do not reside in the prior art, they must be collected and categorized so that the Patent and Trademark Office can conduct the required searches of prior art when deciding whether to grant a patent on an invention disclosed in a patent application.


35 U.S.C. § 112 describes the specification of the invention which must be contained in a patent application. The specifica-

184. "A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made . . . ." 35 U.S.C. § 103. Note that this section explicitly states that it is to be applied in addition to the requirements of section 102, not as an alternative to it. This demonstrates the difficulty of obtaining a patent; the invention must not only pass the threshold of § 101, but the subsequent conditions expressed in § 102 and § 103.


186. This touches on the possible responses to a PTO Examiner's rejection of a patent application's claim(s) based on 35 U.S.C. § 103. Another response to this type of rejection is to assert that if the existing prior art references were combined as the Examiner proposes, the operation of the invention would be detrimentally affected, or altered in a fundamental manner.

187. The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor of carrying out his invention. The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.


Note the requirement that a specification provide an enabling disclosure of how to practice the invention and that the inventor set forth the best mode of carrying out the invention. The enablement requirement serves as the basis for an examiner's rejection of some or all of
tion consists of a description of the nature and process of practicing the invention, in sufficient detail to enable a person skilled in the art to make and use it.

5. The Contents and Term of the Patent.

35 U.S.C. § 154 describes the contents of the patent grant and its term of seventeen years. The language of the section also sets out the property rights conferred by a patent: the right to prevent others from making, using, or selling the invention throughout the United States. This “right to exclude” is similar to the traditional characterization of other property rights, such as those granted to tangible forms of property.


35 U.S.C. § 271 specifies the conditions necessary to create a cause of action for infringement for the holder of a valid patent. As mentioned in § 154, infringement is based upon the unauthorized making, using, or selling of a patented invention within the United States during its term. Section 271 also discusses those acts which constitute contributory infringement, as well as acts of the patentee which will not serve to prevent recovery for infringement.


Section 281 specifies the remedy available to the holder of a patent application where the information in the application is insufficient to permit one skilled in the art to practice the invention. The best mode requirement can become an issue in litigation if a party challenging the validity of a patent asserts that the patentee failed to disclose knowledge they possessed at the time of filing the application which constituted an improved means of practicing the invention.

188. Every patent shall contain a short title of the invention and a grant to the patentee, his heirs or assigns, for the term of seventeen years, subject to the payment of fees as provided for in this title, of the right to exclude others from making, using, or selling the invention throughout the United States and, if the invention is a process, of the right to exclude others from using or selling throughout the United States, or importing into the United States, products made by that process, referring to the specification for the particulars thereof.


189. This is supported by the comments of the Federal Circuit in Patlex Corp. v. Mosser, 758 F.2d 594 (Fed. Cir. 1985). See supra note 156.

190. "(a) Except as otherwise provided in this title, whoever without authority makes, uses or sells any patented invention, within the United States during the term of the patent therefor, infringes the patent.

(b) Whoever actively induces infringement of a patent shall be liable as an infringer." 35 U.S.C. § 271.

191. See, respectively, 35 U.S.C. § 271 (e) and (d).
valid patent in the event that it is infringed. The remedy is of a civil nature and can include an injunction, recovery of monetary damages, and in some cases, attorney fees.

192. "A patentee shall have remedy by civil action for infringement of his patent." 35 U.S.C. § 281. Specific remedies are discussed in § 283 (Injunction), § 284 (Damages), and § 285 (Attorney fees).