For Abstract Ideas in Patent Eligibility Analysis, All Equations are NOT Equal.

Eugene Molinelli, J.D., Ph.D., Cian O'Brien, J.D.

Abstract.

The draft 2019 Revised Patent Subject Matter Eligibility Guidance ("*draft Guidance*") should be modified to treat equations that relate physical phenomena involved in a man-made object, and steps that are not routinely performed mentally, as not *per se* abstract, but instead directed to a practical application that renders them patent eligible subject matter under 35 U.S.C. §101. While the *draft Guidance* correctly parses the two-step analysis of the *Alice*/*Mayo* decisions, there are serious hazards with the overbroad classification of all "mathematical formulas or equations" and "concepts performed in the human mind" as *per se* abstract ideas. Some equations do express abstract ideas, but not all equations are equally abstract under the case law. In addition, not all "concepts performed in the human mind" are *per se* abstract ideas.

Discussion

A. Background.

The United States Constitution established patent protection by giving Congress the power "To promote the progress of science and useful arts, by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries." (U.S. Const. art. 1, § 8, cl. 8). Congress has exercised this power by passing patent statutes in 35 U.S.C. (United States Code); and, the Executive Branch Department of Commerce has implemented the statutes by way of the patent rules in 37 C.F.R. (Code of Federal Regulations), and by establishing the United States Patent and Trademark Office (USPTO) to apply the rules. Patentable subject matter is defined by Congress in 35 U.S.C. §101 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."

In interpreting the Constitution and the statutes, the Supreme Court (SC) has recognized judicial exceptions to the kinds of discoveries that can be patented even though they are enumerated in 35 U.S.C. §101.   Recently summarized in the SC decision in *Mayo Collaborative Servs. v. Prometheus Labs, Inc*., 566 U.S. 66 (2012)(*Mayo*), the SC has stated "Phenomena of nature, though just discovered, mental processes, and abstract intellectual concepts are not patentable, as they are the basic tools of scientific and technological work" *Mayo* at 71, quoting [the SC decision in] *Gottschalk v. Benson*, 409 U.S. 63, 67 (1972), (*Benson*). In a famous 2014 decision, *Alice Corp. Pty. Ltd. v. CLS Bank Int'l*, 573 U.S. 208 (2014) (*Alice*), the SC used a slightly different classification, asserting the judicial exception for "[l]aws of nature, natural phenomena, and abstract ideas," which are "the basic tools of scientific and technological work" *Alice* at 216. In *Alice*, the *Mayo* "phenomena of nature" is expanded into two classes, "laws of nature" and "natural phenomena;" and, "mental processes" and "abstract intellectual concepts" are combined into "abstract ideas" indicating the definitions are not precise with bright lines. *Alice* at 217.

Step 1 of the patent eligibility analysis is to determine if the claims are directed to one of the four categories listed in 35 U.S.C. §101 (process, machine, article of manufacture, composition of matter). If not, the claim is not eligible. If so, the process moves to the two-step Alice/Mayo process that has been implemented by the USPTO as steps 2A and 2B of the patent eligibility analysis. In step 2A it is determined whether the claim is directed to a judicial exception. If not, the claim is patent eligible and the application is examined under the other criteria (useful, new and non-obvious). If the claim is found during step 2A to be directed to a judicial exception, then in step 2B it is determined if there is something more than the judicial exception that provides the novelty.

,Software is often found to be directed to an abstract idea and therefore is frequently held ineligible at step 2A. The claim is examined to determine whether there is "significantly more" at step 2B. The *draft Guidance* provides that a claim is not directed to a judicial exception if it is directed to a practical application (*draft Guidance*, p. 18). Here it is argued that the type of equation implemented in software matters when determining whether the claim is directed to a practical application.

In general, the case law on software claims since the *Alice* decision indicates that the following concepts should be considered together. In *Trading Technologies Int'l Inc. v CQG, Inc*, 675 Fed. Appx. 1001 (Fed. Cir. , 2017) (*Trading Technologies*), the Court stated, "Precedent has recognized that specific technologic modifications to solve a problem or improve the functioning of a known system generally produce patent-eligible subject matter" *Trading Technologies* at 1004-1005 (emphasis added). Software claims were found ineligible as abstract whenever such *specifics were missing* from the claims. *Trading Technologies* at 1005. The specifics distinguish a recited process from the "data analysis" and "correlation" performed by a generic computer in claims found abstract and thus ineligible. In other cases, claims that were specific but merely implemented known steps routinely performed outside a computer (such as the financial algorithm in *Alice*) were found abstract and thus ineligible as mental steps. In *SmartGene, Inc., v. Advanced Biological Labs. SA*, 55 Fed. Appx 950 (Fed. Cir. 2014)(*SmartGene*), the District Court described the mental steps exception to patent eligibility as computer steps that "can and *routinely are*" carried out by humans. *Smartgene, Inc. v. Advanced Biological Labs*, SA 852 F. Supp 2d 42 at 64 (emphasis added). While non-precedential, this is an important distinction, otherwise every software program consisting of instructions conceived of mentally by a human is *per se* ineligible. In still other cases, claims that were specific with non-mental steps but *usurped all uses* of the process were found ineligible (e.g., *Benson*). In addition, processes that are specific, non-mental steps and non-usurping are nonetheless abstract if directed to a *result previously found by the courts to be abstract* (e.g., *Alice*).

In the *draft Guidance* recently published for public comment, the USPTO asserts "that abstract ideas can be grouped as, e.g., mathematical concepts, certain methods of organizing human activity, and mental processes." The *draft Guidance* further asserts mathematical concepts include "mathematical relationships, mathematical formulas or equations, mathematical calculations" citing several cases that have addressed mathematical claims (*draft Guidance*, p. 9-

10). The *draft Guidance* further asserts mental steps include "concepts performed in the human mind" (*draft Guidance*, p. 11).

This grouping is too broad because it sweeps into abstract ideas many useful software inventions that do not fit the factual patterns of the cited cases finding ineligible software claims. In fact, this grouping has the potential to be a *per se* prohibition on pure software inventions that is eschewed by the *Alice* decision; and explicitly rejected in the Federal Circuit (*Enfish, LLC v. Microsoft Corp.*, 822 F.3d 1327 (Fed. Cir. 2016)) which states claims directed to software are not "inherently abstract" and too broad a grouping "otherwise risks . . . creating a categorical ban on software patents." *Enfish* at 1335, 1339.

While the *draft Guidance* goes on to parse the two-step analysis of the *Alice/Mayo*, there are built-in hazards in the overbroad classification of all "mathematical formulas or equations" and "concepts performed in the human mind" as *per se* abstract ideas. Some equations are in fact abstract ideas, but not all equations are equally abstract under the case law. In addition, not all "concepts performed in the human mind" are *per se* abstract ideas.

B. Mathematical Equations.

For purposes of discussion it is assumed that equations are written y = mathematical expression of (x1, x2,…) where x1, x2, … indicates variables for which a value can be substituted and y indicates a resultant value or set of values. The equation can be evaluated in one or more steps of an algorithm, each step implemented by one or more computer instructions. In many claims, a mathematical equation expresses the *specificity* that distinguishes the claimed process from generic computer processes such as "data analysis" and "correlation." To automatically classify such an equation as abstract is to institute a catch 22 for the Applicant. The specificity and novelty are in the equation; and so, both are ignored in the examination of claims.

There are at least five situations of equations that patent examiners should distinguish, and which appear to have led to different decisions by the courts. To isolate the issue of equations from equations in claims judged to be eligible as "significantly more" in the step 2B of the *Alice/Mayo* analysis, it is assumed that the equations operate on information input, e.g., information previously collected or stored; and, produce information output, e.g., the value(s) for some physical property that are not used to control a machine or transform a substance or article of manufacture or treat a patient. As proposed here, patent eligible software claims recite implementation on a computer/processor, with some output based on the result exported from the processor, either as data presented on a display or transmitted as a signal to a different component or device. In such claims, certain types of equation should be patent eligible under step 2A.

The new distinction that the USPTO, and judges, should consider under step 2A is whether the equation in the software is a mathematical identity or not. A mathematical identity is true, that is, the equality expressed by the equation holds, regardless of any physical phenomenon that might be represented by the variables x1, x2,… in the equation. An example is the trigonometric identity

$1 = \sin^2 x + \cos^2 x.$

It does not matter what physical phenomenon x represents, whether time, distance, mass, temperature, etc.. With this definition of a mathematical identity, there are two classes of equations that are used in software claims that influence whether the equation itself is an abstract idea.

B1. Mathematical identities.

B1.1 (Not eligible) Mathematical identities simply evaluated on a computer. Examples are various transform operations, such as the Fourier transform, Bessel functions, properties of various theoretical probability distributions, such as Gamma functions, using textbook techniques. Allowing claims to equations to evaluate these mathematical expressions will usurp all uses in research. Therefore, it is just and proper to classify such equations as abstract ideas, even if implemented on a computer. This is the kind of equation found ineligible in *Benson,* which was implemented as an algorithm involving a series of steps, and simply converted a binary value (of zeros and ones) to a decimal value (of the digits 0 through 9) indicating the same numerical value. Such a conversion is true no matter what physical phenomenon the binary value or decimal value represents; it is a mathematical identity. There was no requirement, in claim 13 adjudicated by the SC in *Benson*, that the mathematical identity be confined to a particular computer operation, e.g., to retrieve digital data from a memory location and convert that value to decimal before storing on computer readable media, or presenting on a display, or sending to another component or device. *Benson* at 74.

B1.2. (Eligible) <u>Mathematical identities evaluated to cause computer operation</u>. It is inherent in the design of a general-purpose computer processor to perform operations that are agnostic as to the physical phenomenon being represented by the data. Such computer technologies rely on some mathematical identities. .Examples of such identities are the equations used in digital data compression, digital data transmission, digital data encryption, different digital implementation of a mathematical operation rather than used manually, e.g., Fast Fourier Transform for digital data, among others. The equations used in these processes are technically mathematical identities because it does not matter what physical phenomenon the data represent. The process (e.g., compression or encryption) works for data representing any physical phenomena. However, unlike the claim in *Benson*, claims reciting these equations do not usurp all uses of the underlying mathematical identity. They are limited to how the computer operates during the process that has utility to the computer or computer system, e.g., the application of the process to compression, encryption, carrying out the evaluation, etc. This is the type of mathematical concept that should be patent eligible. For example, as recited in the *draft Guidance,*

> Software based innovations can [also] make 'non-abstract improvements to
> computer technology' and be deemed patent eligible subject matter at step 1 [of
> the *Mayo/Alice* test]," Finjan, 879 F.3d at 1304 (quoting *Enfish*, 822 F.3d at
> 1335). Indeed, the Federal Circuit has held that "improvements in computer-

related technology" are patent eligible, see also Visual Memory, 867 F.3d at 1258. (*draft Guidance*, p. 9 n. 11)

B2. Equalities among particular properties (not mathematical identities).

B2.1. (Eligible) <u>Equations for physical phenomena.</u>

These equations are only true if the variables in the equations relate to particular physical phenomena. By definition, these are not mathematical identities. Example equations are employed for: inferring a value of a physical quantity from measurements of different physical quantities; changing a contour in a computer animation image based on a change in sounds, providing a segmentation boundary for a particular organ based on medical image data. These equations inherently involve a practical application and should be eligible and not be considered abstract under step 2A. It is noted that there are at least two subcategories of equations of this type that the courts have found not eligible. But in each case, these exceptions were found ineligible not because they were equations, but for other reasons. These sub-categories are described in section 2.2 and 2.3.

B2.2 (Not eligible) <u>Equations that evaluate a natural law.</u>

These equations are only true if the variables in the equations relate to physical phenomena (thus not mathematical identities) but do express a natural law alone (e.g., correlation of physical phenomena in nature, such as, $e=mc^2$). These are recognizable and distinguished from equatiosn of type 2.1 because these equations are claimed as unrelated to whether a man-made object is involved, e.g., unrelated to whether a man-made device makes a measurement or not, or unrelated to whether a man-made device perturbs the environment or not. Each is ineligible, not as an abstract idea, but as directed to a natural law. Note that the Arrhenius equation adjudicated in *Diamond v. Diehr*, 450 U.S. 175, 188 (*Diamond*) is of this type. The *draft Guidance* states

> *Diamond v. Diehr*, 450 U.S. 175, 191 (1981) ("A mathematical formula as such is not accorded the protection of our patent laws") (citing Benson, 409 U.S. 63); *Parker v. Flook* , 437 U.S. 584, 594 (1978) ("[T]he discovery of [a mathematical formula] cannot support a patent unless there is some other inventive concept in its application."

The statement in *Diamond* appears to require an inventive step other than an equation. *Diamond* at 191. It should be noted that this is dictum because the claims were found to be eligible for reciting something more (under what is now known as step 2B), by operating a rubber molding device. *Diamond* at 191. The Court correctly noted that the Arrhenius equation is not patent eligible; but gave an overbroad statement, lumping all equations of different types into the same barrel. This overbroad statement need not be followed blindly; but, instead, should be confined to the facts of that case, which involve an equation citing a law of nature. *Benson* has already been discussed as directed to a mathematical identity of type 1.1.

In *O'Reilly v. Morse*, 15 U.S. 62 (1854)(*Morse*), the SC rejected Samuel Morse's broad claim covering any use of electromagnetism for printing intelligible signs, characters, or letters at a distance, regardless of any device. *Morse* at 112-121. Also see *Mackay Radio & Tel. Co. v.*

Radio Corp. of America, 306 U.S. 86, 94 (1939) ("[A] scientific truth, or the mathematical expression of it, is not patentable invention[.]") Allowing claims to equations to evaluate these natural laws, or to use generically the law expressed by the equation, will usurp all uses of the natural law in research.

B2.3. (Not eligible) <u>Equations involving only mental steps</u>.

The equations in this category are equations that describe one or more mental steps that are typically/routinely/easily performed without a computer. *Flook* found an equation for an alarm limit to be patent ineligible. *Flook* at 594. The facts of *Flook* are consistent with ineligibility based on implementing mental step. *Flook* states "the computations can be made by pencil and paper calculations" and the adjudicated claim does not recite a processor or situation in which it is impractical to perform the steps mentally; thus, *Flook* should be limited to the mental steps exception and not stand for the proposition that all equations should be considered in the prior art; thus, making all claims directed to the use of equations on a computer ineligible. *Flook* at 586. The cases cited by *Flook* (*Benson* and *Morse*) do not support that conclusion; rather, those cases are related to citing a mathematical identity for equations of type 1.2 (*Benson*), and a natural law as described above for equation type 2.2 (*Morse*), respectively.

B2.4. (Not eligible) <u>Equations relating ineligible variables</u>.

Equations that recite ineligible variables are only true if a variable in the equation relates to a particular property (thus not mathematical identities); but the particular property is not a physical phenomenon, and instead has been found by the courts to be abstract. Examples of properties found to be abstract by the courts, as listed in the *draft Guidance*, include certain methods of organizing human activity. These are:

> fundamental economic principles or practices (including hedging, insurance, mitigating risk); commercial or legal interactions (including agreements in the form of contracts; legal obligations; advertising, marketing or sales activities or behaviors; business relations); managing personal behavior or relationships or interactions between people (including social activities, teaching, and following rules or instructions.) (*draft Guidance*, p. 10)

These equations should not be eligible for patent protection because they involve variables or results that are specifically found to be abstract ideas. These are abstract, not because the equation is abstract; but, because of the other factors that render a claim abstract, namely, the variables $x1$, $x2$ … or result y, refer to abstract concepts. The organizing human activity portion of abstract ideas is the reason for unpatentable subject matter in many famous cases. As cited in footnote 13 of the *draft Guidance*, among other cases,

> *Alice*, 573 U.S. at 219-20 (concluding that use of a third party to mediate settlement risk is a "fundamental economic practice" and thus an abstract idea); id. (describing the concept of risk hedging identified as an abstract idea in *Bilski* as "a method of organizing human activity"); *Bilski*, 561 U.S. at 611-612 (concluding that hedging is a "fundamental economic practice" and therefore an abstract idea); *Bancorp*, 687 F.3d at 1280 (concluding that "managing a stable

value protected life insurance policy by performing calculations and manipulating the results" is an abstract idea); (*draft Guidance*, p. 10 n. 13)

Another example is *SAP Am. Inc. v. InvestPic LLC*, 898 F. 3d 1161 (Fed. Cir. 2018) cited in the *draft Guidance*, where the focus of the claims is analyzing data pertaining to investment. *SAP* at 1164-1165.

Figure 1 summarizes the above analysis of equations.

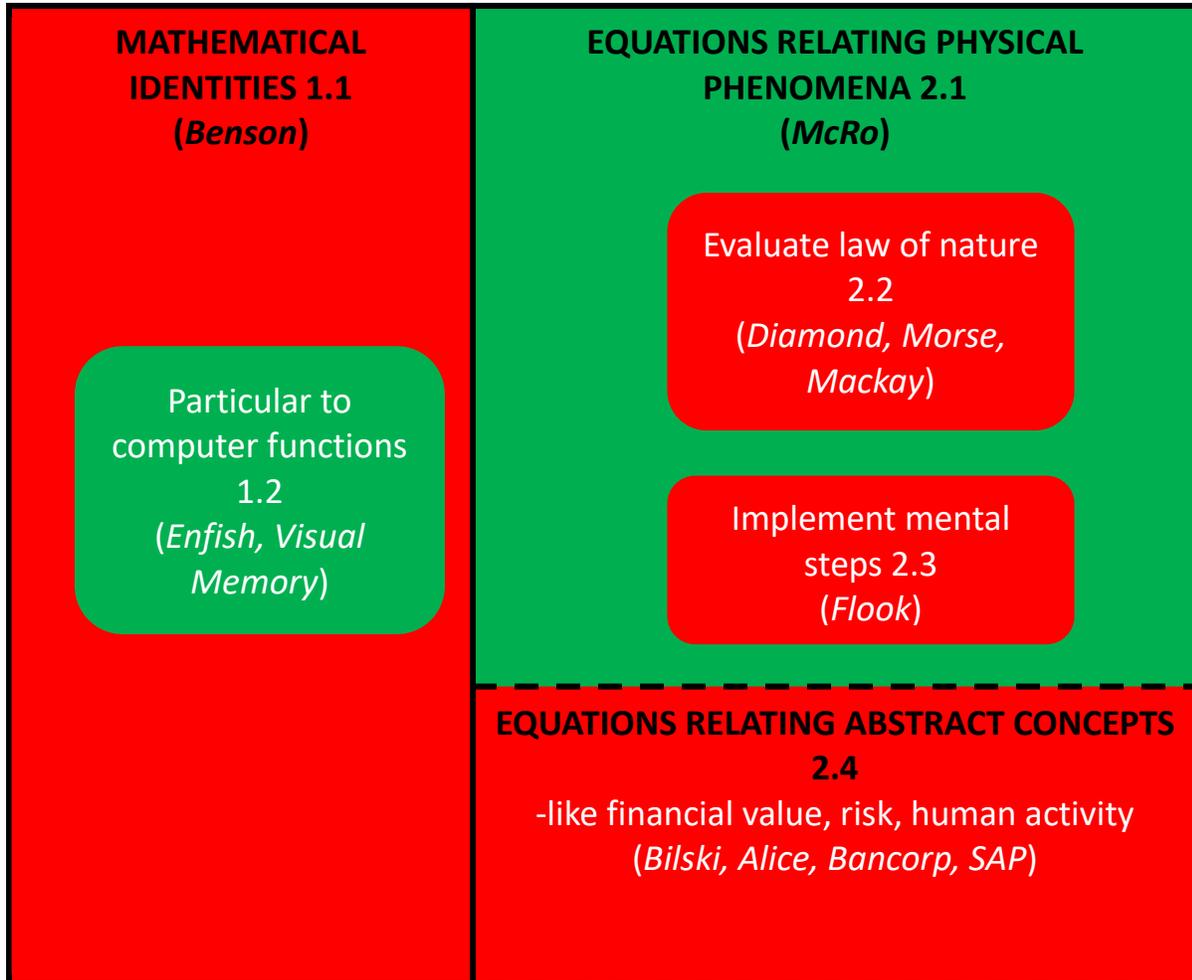| MATHEMATICAL IDENTITIES 1.1 (*Benson*)	EQUATIONS RELATING PHYSICAL PHENOMENA 2.1 (*McRo*)
Particular to computer functions 1.2 (*Enfish, Visual Memory*)	Evaluate law of nature 2.2 (*Diamond, Morse, Mackay*)
	Implement mental steps 2.3 (*Flook*)
	EQUATIONS RELATING ABSTRACT CONCEPTS 2.4 -like financial value, risk, human activity (*Bilski, Alice, Bancorp, SAP*)

Figure 1. Venn diagram of mathematical equations. Red areas have been found patent ineligible in various cases. Green areas should be patent eligible as practical applications that are not abstract ideas.

C. Mental steps.

The mental steps exception has also been used to sweep away all pure software invention even when an equation is not recited. Because any method or algorithm implemented as computer instructions involves a series of understandable steps, indeed that is how the instructions are

composed by a software engineer, some examiners say all programs can be implemented manually by one or more persons with paper and a pencil. This would not change under the *draft Guidance*, because those examiners will still argue each instruction is a "concept performed in the human mind."

In *Intellectual Ventures LLC v. Symantec Corp*, 838 F. 3d 1307 (Fed. Cir. 2016) cited in the *draft Guidance*, the Court holds that a process of receiving and filtering emails is ineligible since it corresponds with "fundamental practices long prevalent" such as "people receiving paper mail to look at an envelope and discard certain letters without opening them". *Intellectual Ventures* at 1313-1314. This raises consideration of a "long prevalent" requirement for the mental step exception to be used to render a claim abstract as a mental step and thus ineligible.

Thus, it is wise to include the stipulation in the *draft Guidance* that software steps recited in a claim are not "concepts performed in the human mind" unless the combination of recited steps: do not include implementation on a processor; or, are all routinely (e.g., long prevalent) performed by a human without a computer; or, both. Otherwise, such software steps should be patent eligible and should not be classified as "concepts performed in the human mind," and thus should not be "abstract ideas" under current jurisprudence regarding mental steps.

D. Examples of Examiner analysis.

These examples are based on real experiences at the USPTO during prosecution. Assume a sequence of mathematical manipulations of equations representing physical phenomenon under type 2.1. Further assume the claimed novelty is in a combination of mathematical equations, or algorithms implementing the equations. The examiner reasons each is an abstract idea. Therefore, the combination is abstract and directed to an abstract idea under step 2A. In some cases, the examiner says the equation is written and understood by a human and is therefore merely a mental step and therefore also directed to an abstract idea under step 2A. The examiner will then look for "significantly more" under step 2B; but, not find it. The novelty cannot be in the judicial exception, e.g., cannot be in the abstract idea represented by the equations recited. The additional limitation are directed to input information about the physical information collected using conventional means; or output information about a physical phenomenon. Information *per se* is not patentable; so, the examiner typically does not find "significantly more." If the examiner considers information input to be a physical measurement and not disembodied information, the examiner still does not find significantly more because the measurements are conventional and information output is trivial post solution activity. Therefore, the claim is directed to unpatentable subject matter without significantly more; and rejected under 35 U.S.C. §101.

More specific real examples of examiner rejections of technological software claims under step 2A include: deducing haplotype from DNA sequencing data; reducing variance in measurements from a particular known sensor; predicting the physical characteristics of a structure not yet built based on the design data.

Consider the example of deriving the physic characteristics of a particular kind of structure (e.g., DNA engineered molecule) based on numerical modeling and input design data (e.g., sequences of various strands), then outputting the predicted physical characteristics (e.g., mechanical strength or vibrational modes) to a device (e.g., a display or fabrication device). In this example, the Examiner has said information in (design data) is *per se* an abstract idea, a series of mathematical steps (modeling interaction among physical characteristics of design components in a novel way) is *per se* an abstract idea, information out (predicted physical characteristic of built structure) is *per se* abstract, display is insignificant post solution conventional activity. There is no other limitation. The claim was found ineligible for patent protection. Allowance was obtained by adding a step for fabricating an improved structure; but the claim should have been found eligible as a practical application under step 2A because the equations were of type 2.1. Adding the fabrication step is disadvantageous to the inventor because the entity determining the physical characteristic of the structure is often not the entity that fabricates. Thus, proving infringement is much more challenging.

E. How to clarify the *draft Guidance*.

Consider equations of type 1.2 and type 2.1 implemented on a processor as practical applications that are not *per se* an abstract idea. Also consider steps that are not routinely performed mentally as not "concepts <u>performed</u> in the human mind" (emphasis added) and therefore not *per se* an abstract idea. In each case, the claim is not directed to an abstract idea under step 2A, and is therefore patent eligible without addressing whether there is significantly more, such as an improvement or novel post solution activity, under step 2B. Otherwise, the USPTO and the courts risk a *de facto* "categorial ban" on software inventions as "inherently abstract."