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Protection of Computer Software/Algorithm

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Summary - This paper discusses the salient issues relating to the protection of computer software. The issues regarding the copyright protection of computer software have been considered and the related provisions of Indian Copyright Act have been described. The current development relating to protection of software under patent laws are reviewed and the critical aspects of software patenting, particularly, mathematical algorithms have been analyzed.

The laws of ownership of physical property have evolved over the years to include the ownership of the products of mind viz. intellectual property. Intellectual property is not owned as a natural right but the rights to own such a property are conferred by the national governments through the enactment of appropriate legal provisions. Intellectual property can be sold or mortgaged like the other physical properties.

With the advancements in the field of information technology, computers are fast becoming a household commodity. Computers have a hardware that provides 'memory' locations to store data. The operation and running of computer system is guided by the computer software that consists of a set of instructions which may be as concrete as a code or as abstract as a mathematical algorithm.

In the beginning when there were few computers, software was very expensive and most sales were done through licensing of the software under contracts. The software was bought and sold as part of the computer itself. Generally, information was kept secret for protection of the software. With the less expensive personal computers becoming available in the market and the ease with which a computer program could be copied, the issues of protection of computer software have become important.

How best can a computer software be protected? Is keeping the information confidential enough for protection? Does copyright law provide the best form of protection to

computer software ? What are the alternative positions regarding patenting of computer software ? This paper addresses some of these issues and related concepts in the protection of computer software.

In most countries the intellectual property in the computer software is protected under the copyright laws. The key international treaties in this context are:

- Berne Convention for the protection of literary and artistic works
- Universal Copyright Act
- WTO agreement on trade-related aspects of intellectual property rights

The legal systems in various countries are developing their own responses. The definitions and interpretations are varied. In some countries, patent protection is also given for computer software.

Computer Software

Definition of computer software is central to the nature of protection that is available to software under the applicable laws. Broadly defined, the term software includes anything related to the computer programs. It may be a concrete code or an algorithm that computer programs use, embody, or carry out, or it may be the documents and operating manuals which may be prepared in connection with the program. It includes programming languages, instruction sets, data structures, command sets or structures, user interfaces and application program metaphors.

The code of computer programs may include, for example, machine language, such as information in the form of encoded domains in a magnetic medium - a floppy diskette, or an optical disk, or holes (and non holes) on a paper card, which a computer may process to execute a program. Such machine language is essentially the same thing as machine-readable object code. Higher-level expressions such as those contained in macros and key stroke patterns for statements in systems such as Lotus 1-2-3 and dBase III also form part of the computer codes.

In the Indian context, the Indian Copyright Act was amended in 1994 to extend protection to computer programs as literary works. Under the Indian Act, a computer program means a set of instructions expressed in words, codes, schemes or in any other form, including a machine-readable medium, capable of causing a computer to perform a particular task or achieve a particular result. The definition of computer includes any electronic or similar device having information processing capabilities[1].

The Malasian Copyright Act defines the computer program to mean an expression in any language, code or notation, of a set of instructions (whether with or without related information) intended to cause a device having an information processing capability to perform a particular function either directly or after either or both of (i) conversion to another language, code or notation; (ii) reproduction in a different material form. One is not clear whether the definition covers the object code as well[2].

Under the European Commission (EC) directive, the term computer program includes programs in any form including those which are incorporated into hardware. This term includes preparatory design work leading to the development of a computer program provided that the nature of the preparatory work is such that a computer program can result from it at a later stage. Under the EC law, to the extent algorithms and programming languages comprise

ideas and principles, the same are not protected[3].

The most general definition is provided by the US Copyright Act which defines computer software as a set of statements or instructions to be used directly or indirectly in a computer in order to bring about a certain result[4].

Protection of Computer Software Under Copyright Laws

The central idea of copyright is to establish an instrument of property which rewards and motivates authors to create works while at the same time protecting the publisher's investments in realizing the work and bringing it to the public. The contributions of both the author and the publisher are necessary and, although their interests differ, both are included in the term copyright.

The first computer program was registered under the US Copyright Act in 1964 under the "Rule of Doubt" principle. There was uncertainty as to whether the program was copyrightable under the then applicable laws as literary expression. The computer program was registered giving the benefit of the doubt to the program proprietor with the note of caution that a court might later issue a verdict against the copyrightability of computer programs. Later the US laws were amended to explicitly include the definition of computer program as an item which could be protected under the copyright act.

Computer codes - both source code in assembly and higher level formats and also object code or machine language - are protected under the US copyright law. Therefore, if one person bodily appropriates the code from other person's program, that is copyright infringement. A close paraphrase of someone else's code would also be considered a copyright infringement. Operating systems and utility type programs alike have been held to constitute copyrightable subject matter. The exact scope of the protection is an issue that is still evolving. In no case does copyright protection for an original work of authorship extend to any idea, procedure, process, system, method of operation, concept, principle, or discovery, regardless of the form in which it is described, explained, illustrated, or embodied in such work.

Most national systems have gradually moved in the direction of providing protection to computer software under the copyright law. Key concepts and general principles concerning copyright are given in the Annexure - 1. These principles are as well applicable to the protection of softwares.

Protection Under Indian Copyright Act

The Indian Copyright Act defines the term 'Copyright' to mean the exclusive right to do or authorise the doing of any of the following acts in respect of a work or any substantial part thereof, namely

(a) in the case of a literary, dramatic or musical work (not being a computer program)

(i) to reproduce the work in any material form including the storing of it in any medium by electronic means

(ii) to issue copies of the work to the public not being copies already in circulation

(iii) to make any translation of the work

(iv) to make any adaptation of the work.

(b) in the case of computer program

(i) to do any of the acts specified in (a) above

(ii) to sell or give on hire or offer for sale or hire any copy of the computer program, regardless of whether such copy has been sold or given on hire on earlier occasion.

Computer programs are protected as 'literary works' under the Indian Act. The meaning of literary works also includes tables and compilations including computer databases. The work has to be original for copyright to subsist in the work. Making a work available to the public by issue of copies or by communicating the work to the public is covered under the meaning of publication.

In relation to any literary, dramatic or artistic work which is computer generated, author of a work is the owner of the copyright provided that in the case of a work made in the course of author's employment under a contract of service or apprenticeship, the employer shall, in the absence of any agreement to the contrary, be the first owner of the copyright therein.

Copyright subsists in the literary work published within the life time of the author until sixty years from the beginning of the calendar year next following the year in which the author dies.

Infringement

Copyright in a work is deemed to be infringed when any person without a license on the copyright

(i) makes for sale or hire or sells or lets for hire or by way of trade displays or offers for sale or hire, or

(ii) distributes either for the purposes of trade or to such an extent as to affect prejudicially the owner of the copyright or by way of trade exhibits in public, or imports into India any infringing copies of the work.

"Infringing copy" in relation to a literary, dramatic, musical or artistic work means a reproduction thereof other than in the form of a cinematographic film; if such reproduction or copy is made or imported in contravention of the provisions of the act.

Import of two copies of any work, other than a cinematograph film or record, for the private and domestic use of the importer is not considered an infringement. In addition, the following do not constitute an infringement:

(a) a fair dealing with a literary work (not being a computer program) for the purposes of private use and research and criticism or review of that or any other work.

(b) the making of copies or adaptation of a computer program by the lawful possessor of a copy of such computer program from such copy

(i) in order to utilize the computer program for the purpose for which it was supplied; or

(ii) to make back-up copies purely as a temporary protection against loss, destruction or damage in order only to utilize the computer program for the purpose for which it was supplied.

Independent of the author's copyright and even after the assignment either wholly or partially of the copyright the author has a right to claim the authorship of the work and to restrain or claim damages in respect of any distortion in relation to the said work which could be prejudicial to his honour or reputation. However, such right is not available in respect of any adaptation of a computer program as in (b) above.

The reproduction of a literary work by a teacher or a pupil in the course of instruction or as part of the questions or their answers

in an examination is not considered an infringement. License to produce and publish translation of a literary or dramatic work can be obtained under certain conditions stipulated in the act.

Under the Indian Act, knowing use of infringing copy of a computer program is an offence. Any person who knowingly makes use on a computer of an infringing copy of a computer program shall be punishable with imprisonment for a term which shall not be less than seven days but may extend to three years and with a fine not less than Rs 50,000 which may extend to Rs 2 lakh. In circumstances, where the computer program has not been used for gain or in the course of trade or business, the court may for adequate and special reasons not impose any sentence of imprisonment and only a fine upto Rs 50,000 may be imposed.

Assignment and Licensing

There are provisions under the Act to assign the copyrights to another person or grant a license in respect of the copyrights owned by an author. An exclusive license means a license which confers on the licensee or on the licensee and the persons authorized by him, to the exclusion of all other persons (including the owner of the copyright) any right comprised in the copyright in a work, and "exclusive licensee" shall be construed accordingly.

Any assignment of the copyrights is to be made in writing. No assignment of the copyright in a work shall be valid unless it is in writing and signed by the assignor or by his duly authorised agent. The assignment of copyright in any work shall

(i) identify such work

(ii) specify the rights assigned, the duration, territorial extent of such assignment and the amount of royalty payable, and

(iii) be in writing signed by the assignor or by his duly authorised agent.

Government Work

"Government work" in the Indian Copyright Act means a work which is made or published by or under the direction or control of the government or any department of the government; any legislature in India; and any court, tribunal or other judicial authority in India. In case of a government work, government is the first owner of the copyright provided there is no agreement to the contrary.

In the case of a work made or first published by or under the direction or control of any public undertaking such public undertaking shall in the absence of any agreement to the contrary be the first owner of the copyright therein. Public undertaking means an undertaking owned or controlled by government or a government company under the Companies Act, or a body corporate established by or under any Central, Provincial or State Act.

For such works, the term of the copyright is until sixty years from the beginning of the calendar year next following the year in which the record is first published.

Limitation under the Indian Act

On the conceptual side, difficulties are pointed out regarding the definition of the computer software in the Indian Act. It is argued that the meaning of computer program as a set of instructions expressed in words, codes, schemes or in any other form, including machine readable forms, capable of causing a computer to perform a particular task or achieve a particular result is erroneous as the words, codes or schemes

cannot by itself cause a computer to perform a task unless it is incorporated into a machine readable form. The machine readable medium alone without the set of instructions expressed in words or codes being incorporated into it cannot cause a computer to work. The correct version required the definition to state words, codes, schemes incorporated into the machine readable forms[5].

International Treaties

Two important international treaties to provide protection to computer programs through copyright are:

- Berne Convention for the protection of literary and artistic works
- Universal Copyright Convention (UCC)

India is a member of the Berne Convention. Under this Convention, there is no requirement of registration of copyright. It provides an automatic protection for a work as soon as it is created. It also prohibits discrimination against particular kinds of literary works implying that a national copyright law must not give computer programs less favoured treatment than other kinds of literary works, for example, by not allowing injunction in case of infringement of computer program copyright while allowing injunction in book copyright cases. Copyright protection automatically extends to all Berne or UCC member countries.

Deliberations have been made under the aegis of WIPO to incorporate amendments to the provisions of the Berne Convention in the context of changes taking place in the field of copyright protection of computer software and works like databases[6]. A committee of experts was established to deal with the possible Protocol to the Berne Convention. Of the ten issues identified for consideration by the Protocol Committee, two related to computer programs, and databases.

The conclusion of the GATT negotiations have lead to the agreement on trade related aspects of intellectual property rights which include provisions relating to protection of computer software and databases under copyright law. Under the agreement, to be operated by the World Trade Organisation, the computer software, in source code or object code is protected as literary works under the Berne Convention.

Copyright Protection - Some Critical Issues

The key problems with copyright protection are:

(i) The period of protection of computer programs under copyright is too long. Computer programs do not need to be protected for such a long period.

(ii) The copyright protection does not protect the idea. When a computer programmer looks at the program made by another and he himself prepares his own computer program, he is stealing the idea, or the form of expression. If he is stealing the form of expression of other computer programs then he is liable for copyright infringement. Many times it is very difficult to draw a clear line of distinction.

(iii) It is not clear to what extent the copyright law protection applies to software as there are no claims defining the scope like the one in patent laws.

(iv) The kind of protection available to non-literal and non- verbatim imitation of copyrighted works, for example, imitation of user interfaces and command languages for application programmes, is not generally clearly defined.

One of the reasons for copyright to be preferred for protection of computer software by most of the countries was that it required no examination of novelty and technical merit to obtain a copyright. The protection was available even if there was a little less inventiveness than required by patents. However, from the point of view of the author or owner of a copyright, it is a weak right as it is not available against a person who independently develops his computer program even though the program might be identical to that of the owner. The use of infringing software (e.g. execution of an illegally copied program) was not a copyright infringement unless the use involved the making of a copy.

Protection of Computer Software under Patent Laws

In some countries, there are provisions for patenting of computer software although the degree might vary. Initially, for most of the time when computer programming was getting developed during the period 1940s to 1980s, there was a general feeling that the computer programs were not covered by patents. Both in UK and USA patent protection to computer software was doubted.

Report of the Banks Committee on British Patent system in UK recommended that a computer program, that is a set of instructions for controlling the sequence of operations of a data processing system should not be patentable. The UK patent laws excluded computer software from patent protection. A software that controlled the timing of an electronic engine was patentable whereas software that detected the contextual homophone errors was not.

In the beginning, the US Patent Office took the position that computer programs were not patentable subject matter. Just as the question whether living manmade microorganisms were subject matter of patentable inventions or not was considered first in the US courts and was held that such organisms were patentable subject matter paving the way for patent protection in the field of biotechnology (Diamond versus Chakrabarty case), in a similar way, the issue of patent protection for computer software had long been under consideration of the US courts. The principal issue was the same — whether computer software was the subject matter under the US patent laws.

In the 1950s through the early 1970s, the issue was not quite settled. In 1972, a case was decided in the US courts (Gottschalk v. Benson) which appeared to state that a mathematical formula — an algorithm — though implemented on a digital computer was not a patentable subject matter. No decision was, however, made for programs using such formulas or algorithms. Again in 1978, in another case, the issue was taken up wherein the courts appeared to support the proposition that generally software could be patented but held that the software as issue in the case could not be patented as claimed (Parker v. Flook). In 1981, the issue was considered again in the Diamond v. Diehr case wherein it was decided in a 5 to 4 decision that computer software could constitute patentable subject matter, and thus opened the door for software patents. Thus, a procedure for solving a mathematical problem may not be patentable but if it was an industrial process of which the software was one element then the simple presence of the software would not destroy the patentability. The rules governing patenting of software are still in the preliminary stage and evolving. Some, but not all, software is subject to patent protection[7].

In Japan, the computer programs that simply perform mathematical calculations are not patentable. If the software is linked to appropriate hardware elements it may be patentable. For example a microcomputer embedded in a fishing rod to control operation of the reel.

In France, the patent law excludes programs for computers from patentability. In exceptional cases, computer programs involved in the operating process of a patentable device may be patented as such. The scope of protection granted to a computer program should normally be limited to the very function ascribed to it in the claims. Under the European Patent Convention, although computer programs are excluded from patentability, the theory of technical effects has been affected in some cases implying that a machine or a process of manufacturing or of operating, driven by a computer program is patentable.

There is no patent granted to a software in India. Since the Indian Patents Act excludes the mere discovery of a scientific principle from patentability, a pure mathematical algorithm would also be excluded from patentability. However, the claims incorporating a software into a machine system or hardware may be considered and the patent granted to the machine i.e. vendible products but not to the software[8]. For example, the following claim may be patentable:

Data processing apparatus comprising: a first processor under the control of a first means operating under a first operating system; a second processor under the control of a second means operating under a second operating system. The second operating system providing the resource device services for the data processing apparatus characterised in that; an information transfer device is coupled between the processors enabling the direct transfer of information between the first and second means without using the services of the second operating system. The first processor and the second processor are all physical elements.

Software Patents — some examples

Two important software patents have been granted in United States. Encyclopedia Britannica Inc, holds rights to a US patent on 'Multimedia search system using a plurality of entry path means that indicate interrelatedness of information'. The patented software aims to provide an interactive CD-ROM search system in which graphical and textual information can be accessed with equal ease. Lotus Development Corporation holds two important patents that relate to improvements in the spreadsheet program. One of these relate to object - oriented database technology. One of the objectives of the software patented in 1992 by Lotus is to make database systems easier to use by allowing data to be entered or modified while in the data viewing mode.

Protection of Mathematical Algorithms — the Emerging Issue

Mathematical algorithms are the abstract component of the computer software. Instruction sets, computer programing languages, command sets and structures, data structures, and advanced programing concepts are other abstract concepts incorporated into computer software. Such abstract aspects of software are becoming increasingly recognised as the most important and valuable contributions to software progress. The writing of code, the specific implementation of particular algorithms in particular hardware and other concrete aspects of software technology are becoming less important in terms of their economic value

compared to the contributions of software and algorithms. Increasingly, the economic value in software is in the higher levels of abstraction relating to it. As such the business and industry are attempting to change the traditional concepts of intellectual property to gain protection for such abstract ideas.

The intellectual property laws do not grant protection to abstract ideas but they are designed to deal with very concrete application of ideas. The underlying concern is that protection of abstract ideas may hinder the progress of software technology. As a result, protection of abstract aspects of computer software present unparalleled difficulties and a debate has ensued on the appropriateness of seeking the protection of such aspects under the patent laws.

The trends in the United States are most liberal in granting patent protection for computer software and mathematical algorithms. Some of the patents relating to mathematical algorithm granted in the US are given in Annexure-2. Although the US Patent Office has taken a position that an algorithm cannot be patented as *per se* while a patent is possible on a machine that merely uses an algorithm. Making such a distinction is of crucial importance as one needs considerable efforts to establish the requirements of patentability even in cases obtaining patents on algorithms and computer programs by claiming them as part of the "machine systems" or other products.

Karmarkar's Patent

In May 1988, the US Patent Office granted three patents on interior point algorithms filed by N Karmarkar and AT & T Bell Laboratories. The patents covered the projective transformation algorithm as well as the affine transformation method. The scope of the patent is restricted to practical technologies and industrial systems while academic use of these algorithms is excluded. The patent referred to some of the standard applications of the algorithm such as optimal use of telecommunication network system, optimization of p.oduction process of factories, optimal product mix, oil refinery, optimal allocation of computer resources to multiple users, optimal routing of aircraft and real time control of various processes. Such descriptions in the application are considered superficial and are made only to satisfy the guidelines of Patent Office that a mathematical algorithm has to be sufficiently applied to the physical system to be patentable[9].

Karmarkar's patent is stunning to the experts in mathematical programming since they considered it a mathematics patent inspite of the claims made by Karmarkar and AT&T to the contrary. Expert opinions vary on what essentially is the subject matter of patenting as the claims which are made by Karmarkar's patent are considered to be essentially mathematical algorithms which are excluded from patentability.

Protection of mathematical algorithms as software patents has indeed been one of the unsettled issues. The concerns regarding the application of patent system for the protection of software-related inventions range from claims that the patent system is incompatible with the software developments to the ones that state that the Patent Offices do not have the ability to accurately gauge innovations in this field of technology. There are difficulties in categorising algorithms that have multiple uses and as such it is often difficult to check for real originality as well as inventiveness. Most of the software industry has structured itself in the realm of no patents for software. Allowing the patenting

of the software at this stage of the development of the industry may impede its progress.

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Annexure - 1

Key Concepts Relating to Copyright Protection

Copyright Protection

Copyright is available to literary, artistic and dramatic works. The literary works include the works such as database and computer software. Copyright protects only the material form, or manner of expression, of information and not the idea or information itself. The creativity is in the choice and arrangement of words, shapes, colours etc.

If a particular joke is recorded in a cartoon, copyright will protect that cartoon, so that others cannot reproduce it without permission. However, any one is free to use the same joke in a different way.

The works have to be original works for getting protection under the copyright. No other condition applies. It is not essential for the works to be of very high quality for being protected under the copyright.

Ownership

The copyright in literary, dramatic, musical and artistic works belongs to the author of the work. This means the person whose skill and effort produced the work - the writer of the book, not the secretary who types it out.

If two or more people jointly create a work and their contributions are indivisible then copyright is jointly owned.

Where a work is produced with the aid of or is generated by computers, the person who

undertakes the arrangements necessary for the creation of the work is considered as the author.

Where a work is produced by someone in the course of their employment then the normal rule is that the copyright is owned by the employers. Copyright will belong to the employer only if it is part of the employee's duties to produce the work.

Infringement

Copying or making adaptations, of a work or verbatim reproduction of a substantial part of it done without the permission of copyright owner, is a breach of copyright.

For computer programs, translating a program from one language to another is considered an infringement.

The copyright owner can give a license to use the work for one purpose or generally. Any assignment of copyright must be in writing.

No formalities such as registration to protect a copyright work are essential.

Copyright can be transferred from one person to another, like another property. Copyright can pass as part of an estate on death.

Annexure - 2

Selected Titles of US Patents Relating to Mathematical Algorithms

Asynchronous switching node distributing cells dynamically to outputs constituting an irregular group (5461615)

Method for use in designing an arbitrarily shaped object (5453934)

Satellite location and pointing system for use with global positioning system (5446465)

Method for resource allocation in a radio system (5442804)

Neurocontrolled adaptive process control system (5426720)

Method of generating partial differential equations for simulation, simulation method, and method of generating simulation programs (5406310)

Method and system for process control with complex inference mechanism using qualitative and quantitative reasoning (5377308)

Neurocontrolled adaptive process control system (5367612)

Method and apparatus for mapping surface texture (5333245)

Method and apparatus for validating authorization to access information in an information processing system (5313637)

Digital nonalgorithmic method of compressing data which represents addresses and values (5271071)

Method for selecting distinctive pattern information from a pixel generated image (5267328)

Method of transferring burst data in a microprocessor (5255378)

Reactant concentration control method and apparatus for creation for achieving the results desired by human beings (5248577).