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ABSTRACT
The ACM, the AIS, and the IEEE Computer Society have jointly defined five computing disciplines: computer engineering, computer science, information systems, information technology, and software engineering. These terms and many others are used as the names of educational programmes. Across the world, the same name may be used for quite different programmes and different names for similar programmes. This makes it difficult for potential students, employers, and educators to determine the nature of a particular programme and how it compares to others. Because computing is global, greater clarity in terminology is required.

We have surveyed academics and literature internationally to determine the scale of the nomenclature issue across the globe. A consistent naming scheme would be ideal, but the different terminologies are now entrenched in different countries, so this paper provides the next best option, a taxonomy of the principal terms and their meanings.

CCS Concepts
• Social and professional topics–Computing education

Keywords
Terminology; nomenclature; international.

1. INTRODUCTION
The profession of Computing / Information Technology / Informatics / Information and Communication Technology / Computer Science / Information Systems has many different names internationally. This has caused wide concern for potential students, employers, and the general public across the world. As a global community we should ideally be more specific and more consistent in naming the different parts of our profession, so as to avoid confusing the public, employers, educators, and potential students.

It is eminently plausible for a student to undertake her computing education by completing a degree with a computer science major, then to find employment in the IT industry. It might make more sense if she were to undertake her computing education by completing a degree with a computing major, then find employment in the computing industry; but that appears not to be the way of the world.

Some readers of this paper will see it as a paper in computing education; others in computer science education. The ‘computing education’ in the paper’s title is unlikely to unsettle readers, yet many of them are members of ACM’s Special Interest Group in Computer Science Education.

The use of different terms to mean the same thing, and of the same terms to mean different things, might be entertaining if it were solely a question of semantics. However, it goes well beyond semantics, and can have negative consequences. An IT graduate from a New Zealand university is unlikely to be considered for a programming job in the USA, where IT tends to refer to such matters as help-desk and technical support, and it will be assumed that this is all the graduate is able to do. According to one
university in the USA, “IT professionals … use the programs created by computer scientists and focus on the practical application of computers in everyday life. They may help to explain to a client how to solve a technology issue or work with businesses to implement new technology plans that meet their needs” [19]. Yet the New Zealand graduate’s IT degree is likely to have covered such topics as programming, software design, database systems, data communications, computer vision and internet programming [28].

For industry to have a common understanding of what a degree name signifies, and of the topics covered within the degree, either the terminology must be uniform across the world, or there must at least be a readily accessible means of translating terms between their different uses.

An Australian report observes that “Describing ICT careers and the skills required of ICT professionals is necessary to communicate the nature of the profession to others and also to make sense of its diversity in the context of rapid change. Finding a common nomenclature and method of categorisation is a major challenge facing the discipline. A solution would make an enormous difference in evolving the profession and establishing a common view among all stakeholders” [5]. Yet some readers will be confused, or perhaps amused, at this use of the phrases ‘ICT careers’ and ‘ICT professionals’, which is possibly unique to Australia.

Such differences in terminology are by no means confined to computing or to the academic world. Some people decorate cakes with icing, others with frosting. Some then add sprinkles, others add hundreds and thousands [16]. Even within a single country, some drink soda, some drink pop, and some drink coke (regardless of the flavour) [20]. Beyond that country the variations include fizzy drink, soft drink, selzer, mineral, and lolly water [32]. People seem well aware of such differences in everyday terminology, but appear to have difficulty accepting that they also exist in professional and educational contexts such as that of computing.

Note that right from the title this paper uses the word ‘computing’ to refer to the broad range of degree programmes that will typically include computer science, software engineering, informatics, information technology, and more. At the outset this might appear to be pre-judging the outcome of our research; however, we needed to use some word for the concept, and readers may be assured that this is the word that through our investigation emerged as the most appropriate for that academic umbrella term.

### 1.1 Working Group Goals

The ITiCSE conference attracts participants from many countries, and the associated working groups are known for producing deeply considered perspectives on their subject matter. An ITiCSE working group therefore appeared to offer an ideal opportunity to form a multinational group that could discuss terminology from a number of distinct national perspectives. At the outset of the working group meetings, the goals could be encapsulated in the following questions:

- From one country to another, are different terms used to mean the same things?
- From one country to another, are the same terms used to mean different things?
- Within some countries, are different terms used to mean the same things?
- Within some countries, are the same terms used to mean different things?
- If the answer is yes to any of the above questions, can we map the terminology differences?
- Can we propose a guideline that has some potential to lead to a unified terminology?

## 2. BACKGROUND

The nomenclature of computing, for education, employment, professional associations, and more, has been a matter of debate for more than 60 years.

In his excellent depiction of the emergence of ‘the science of computing’, Tedre [25] details the debates that have raged about its naming, listing many of the alternative names that have been proposed; names such as algorithmics, compology, computer sciences, computerology, computics, computing science, computology, cybernetics, datalogy, datamatics, hypology, informatics, intellectronics, synnoetics, technetronics, Turing-engineering, and turology.

Tedre continues: “In the early days of a new discipline, names can be a powerful thing. For an outsider, names give an impression of the field’s research agenda: what can be expected of research in the field, what its driving questions are, what the means of solving those questions are, and where the field is situated in the map of academic disciplines” [25].

With this in mind it is perhaps understandable that we now have a plethora of naming conventions across the globe, with different cultures using different words to define the same content. If any of the names, such as computer sciences, had taken hold as an overarching term, it might now be possible to argue that all branches of the discipline fall under that term, in the same way that a number of science disciplines fall under the banner of the natural sciences; but that did not happen, and we are left with no single encompassing term.

From the current situation, it would be good if it were possible to retrofit a nomenclature that is acceptable to all. We therefore need to begin with a clear picture of the current situation.

The term ‘computer science’ appears to have arisen in the late 1950s in the USA, at about the same time that the term ‘informatics’ (in various translations) was appearing in Europe [25]. Neither term has chronological precedence, but informatics has the advantage of being used in English as well as in numerous European languages. Louis Fein, who is credited with the first printed use of ‘computer science’, subsequently expressed concern that the term emphasises the computer rather than the intellectual activity of computing [25].

While computer science and informatics have attained reasonable currency in the USA and Europe respectively, a number of other names have become firmly established in other countries, and a number of prior projects have set out either to establish a single terminology or at least to map the terminologies in use.

### 2.1 The Computing Ontology Project

The ACM/IEEE Computing Curricula 2005 [3] specify curricula for computer engineering, computer science, information systems,
information technology, and software engineering. Although these disciplines are sufficiently different to exist independently, there is considerable overlap.

The Computing Ontology Project, starting with the assumption that we all have the same terminology for the same topics and topic mixes with our degree programmes, was initiated because the computing disciplines were seen to be diverging [18]. For example, curriculum recommendations developed by different committees contained inconsistencies such as describing a similar topic or outcome in different ways and using the same term with subtle differences in meaning.

It was argued that the computing disciplines would all benefit by identifying common goals and working collaboratively to achieve them. The Computing Ontology Project intended to enable this in curriculum development by combining the knowledge units of all curriculum recommendations, accreditation criteria, and the ACM computing classification system into a single comprehensive computing ontology.

The results are described in an ITiCSE 2005 working group report [8], an ITiCSE 2006 paper [12], an ITiCSE 2007 working group report [9], and a paper on using a computing ontology as a foundation for curriculum development [10]. The results can also be viewed in hierarchical form [21] and in visualisation form [30].

The terminology used to name computing degrees varies widely internationally, and a common understanding of how these names are related is required. Two of the potential uses identified for a general ontology are to determine [14]:

- how a computing degree at one university compares to another with the same name at a different university; and
- what distinguishes information technology degrees from information systems degrees.

However, the terminology addressed by the project is principally that of the topics within computing education programmes, whereas our principal interest is in the terminology of the degree programmes themselves.

2.2 Latin American Nomenclature Project

The language used to describe the content and naming of degree programmes is generally understood by local academics within each nation, but problems can arise from the significant differences in content between different countries using the same programme name, and from the use of different names to describe the same content.

In 2010 a group of Latin American, UK, US, and Spanish academics undertook to create a mapping tool for the Latin American educators to map their degree programmes in order for them to become internationally recognisable and transferrable [23].

The group based their classification system upon that created by Hilburn et al [15], who set out in 1999 to map the skills and competencies in software engineering. All participants listed the competencies, skills, and essential topics that they considered important in order to create one long inclusive list.

Each listed competency was then given a rating of 0 (not covered), 1 (covered a little), or 2 (covered in depth), for each module at each level of each degree programme. It was then possible to apply a formula relating module level, depth of coverage and proportion of degree to produce a percentage level for each competency for each programme.

The initial goal of the Latin American project was to create a common nomenclature for courses containing the same content. In fact what they achieved was to create a set of guidelines for mapping a computing-related degree programme to the categories defined by the IEEE [17]. While not managing to create a common naming scheme for all to follow, the group observe that they have managed to create a methodology by which “employers and other organizations will recognize that graduates have demonstrated their professional competencies, independent from the name of their academic program, in a format documented and approved by IEEE” [23].

3. A SAMPLING OF COUNTRIES

The members of our ITiCSE 2015 working group come from seven countries on three continents, so we begin by providing an impression of the terminology used in the seven countries.

3.1 Australia

In Australia the industries in which computing graduates seek employment are generally called the IT industries, although the term ICT industries has recently been gaining some traction. The peak professional association, the Australian Computer Society, maintains The ICT Profession Body of Knowledge.

The degrees are generally explicitly named: rather than a Bachelor of Science with a major in computer science, students will enrol in a Bachelor of Computer Science. However, there are a few broader degree names with added specialisations: for example, Bachelor of Science in Computing, Bachelor of Commerce in Business Information Systems. Information Technology is frequently used as one of these broader degree names: examples are Bachelor of Information Technology (Computer Science and Software Development), Bachelor of Information Technology (IT Security), Bachelor of Information Technology (Mobile and Apps Development), Bachelor of Information Technology (Computer Games and Digital Media), and Bachelor of Information Technology (Network and Cybersecurity Systems).

The terms and explanations below give some idea of the terminology that is used. However, there is substantial variation within the country.

Computer science: fairly hard-edged, programming-oriented. A computer science degree will typically involve a good deal of programming and data structures, extending into such areas as computer graphics, artificial intelligence, compiler design, implementation of operating systems, etc. Most CS degrees require students to have done a reasonable level of mathematics on entry, and to do more mathematics in the course of their degree.

Software engineering: somewhat like computer science, but with more emphasis on teamwork, project management, formal modelling, etc.

Information systems, information science: these are more business-oriented degrees. They will often involve several programming courses, but not at the intensity of those in computer science or software engineering. They will tend to involve business-related material such as system analysis and design, user interface design, management information systems, user productivity tools, and more. Mathematics is seldom a
requirement either of entry or of completion. Information science will sometimes, but not always, overlap with library science.

Information technology: as can be seen from the examples given above, this is often the generic computing degree. It will seldom require the same level of mathematics as an Australian computer science degree, and will perhaps in some respects be somewhat less rigorous. However, IT degrees range from those that are fairly similar to computer science, with the same level of rigour, to those that are fairly similar to information systems. The School of Information Technology at one Australian university has the following text emblazoned on the wall at its entry: “Information technology: algorithm, distributed systems, database, software engineering, network, information systems, computation, knowledge management, analysis, mobile computing, design, e-business, model, data mining, interface, business decision support.”

3.2 Canada

Most bachelor degree computing programmes at English-speaking universities are a Bachelor of Science in Computer Science or a Bachelor of Computer Science. A few programmes are offered as a Bachelor of Arts, and the term computing science is occasionally used in place of computer science. The generic content is similar to that described above for computing science degrees in Australia. There is often a specialisation, which is added to the name of the degree.

There are substantially fewer degrees in software engineering and in information systems, and these names both also appear as specialisations in computer science degrees.

The standard name for a computer science degree at French-speaking universities is Baccalauréat en Informatique (Bachelor of Informatics).

Two-year college diploma programmes, which focus on job training, typically use generic names such as computer information systems, computer systems technology, or information technology. A job title such as programmer analyst is sometimes used in the programme name.

IT is the term most commonly used in business. The Canadian Information Processing Society (CIPS) [11] is a professional association that accredits educational programmes and certifies professionals working in business organisations. Their documentation routinely refers to IT professionals and provides a definition of an IT professional based on knowledge, skills, and ethical behaviour.

3.3 Estonia

The Estonian Standard of Higher Education establishes among other things the study programme groups, one of which is informatics and information technology. This group includes six bachelor programmes from three universities: from Tallinn University, informaatika (computer science); from Tallinn University of Technology, informaatika (informatics), arvutisüsteemid (computer and systems engineering), and ärinfotehnoloogia (business information technology); and from the University of Tartu, informaatika (computer science) and arvutitehnika (computer engineering). All six degrees are officially called Tehnikateaduse Bakalaureus (Bachelor of Science in Engineering (BSc)), so the individual study programme names are somewhat akin to the names of majors in the USA.

It is interesting that the name informaatika is officially translated into English as computer science at two of the universities and informatics at the third.

Besides the degrees, the informatics and information technology study programme group includes a number of professional higher education programmes:

- IT süsteemide arendus (IT systems development);
- IT süsteemide administreerimine (IT systems administration);
- infosüsteemide analüüs (information systems analysis);
- cyber security engineering;
- rakendusinfofoteknoloogia (applied information technology);
- rakendusinformaatika (applied computer science);
- infotehnoloogia (information technology).

The term IT (infotehnoloogia, information technology) is commonly used in referring to the industry – IT tööstus (IT industry), IT sektor (IT sector). However, IKT (ICT) is also sometimes used.

Informaatika (informatics) is also the name of a school subject that especially in the lower grades deals mainly with basic uses of computers such as word processing and spreadsheets.

3.4 New Zealand

In New Zealand 22 higher education institutions (20 government-funded and two private) offer degree programmes in the field of computing or information technology. Computing, computer science, and information technology are regularly used to convey the field of study. The nomenclature for undergraduate degrees varies between institutions and sometime within institutions. The most common names would be Bachelor of Computer Science, Bachelor of Computer Systems, Bachelor of Information Technology, Bachelor of Information and Communication Technologies, Bachelor of Computing Systems, Bachelor of Computer and Information Sciences, and Bachelor of Arts or Science majoring in Computer Science. Students graduating with these degrees will enter the information technology industry.

Information technology (IT) is the general term for the industry, and as a consequence the professional association has changed its name from New Zealand Computer Society to Institute of Information Technology Professionals (IITP – http://iitp.nz/). The IITP advocates “on behalf of the computing and ICT profession, as well as the ICT sector overall.” In IITP’s documentation the terms information technology (IT) and information and communications technology (ICT) appear to be used more or less interchangeably. However, in the education sector ICT is used primarily for high-school courses and for one- or two-year undergraduate diplomas.

A new curriculum for high schools was recently introduced into years 11-13. When developing the curriculum there was discussion on the names of the courses to be introduced. Information and communications technology was discussed, but it was observed that as “MS Office is taught in ICT classes, therefore ICT is about productivity software” [6]. The final decision was to call the new curriculum digital technologies, as this was “a broad term that encompasses all aspects of society including business, industry and education” [6].
3.5 Romania

In Romania, students apply directly to the institution they wish to attend for the degree programme they wish to study. Within the broad area of computing, students can apply to study either theoretical or applied studies (applied to areas such as engineering or economics). After three or four years of study, graduates can progress to a masters degree or a doctorate.

Before the Bologna programme was adopted in 1999, Romanian universities had the following features.

- Undergraduate studies lasted four or five years, depending on majors. For example, high school or university teachers (in mathematics or computer science) graduated after four years, with a fifth year available on request and considered as a specialisation; economists, engineers, and students in IT, cybernatics, and computer automation graduated after five years.
- There were no masters degrees.
- Doctoral programmes lasted six years if studied on campus or eight years if studied externally.

In 2015, the Romanian IT curricula fit into the general pattern established by the Bologna programme:

- Bachelor's degrees of three years (teachers or programmers) or four years (engineers in computing or mathematics).
- Masters degrees of three or four semesters.
- PhD of three years.

For theoretical studies the term informatics is used, and is generally translated into English as computer science. For example, in a theoretical research-based faculty, the curriculum will specify areas such as mathematics or mathematics / computer science. Graduates in informatics will be able to conduct research, elaborate algorithms and programs, use databases, create web applications and administer networks.

For applied studies there are many engineering fields such as systems engineering (automatics) and computers and information technology; and economic specialisations such as cybernatics, statistics, and computer science (here meaning economic informatics). In some areas of study students can undertake bachelors degrees, two-year masters degrees, and three-year PhD degrees.

3.6 United Kingdom

Students wishing to enter higher education in the UK apply via a centralised system to a named degree programme. They may nominate several choices of institution on the application form. Offers are made on the basis of a point score that reflects different grades of entry qualifications.

According to the QAA benchmarking statement [22] there are over 3000 different computing-based degree programmes available from over 160 different institutions. The predominant titles appear to be computer science and computing. There is a general feeling that computer science involves the more technical subject matter, including algorithms, while computing is less technical; both are assumed to include programming content.

According to a typical university website [29]:

- The computer science degree covers “the core subjects of program design and implementation using Java, and software engineering, as well as offering a broad range of computer science topics including operating systems, computer architectures, computer security, databases and the web.”
- The computing degree “looks at software applications and how they might be used within an information system. Students learn both object-oriented and web programming as well as how to design and use database systems and electronic communication systems.”

The usual length of an undergraduate degree is three years, but students may opt to add an extra year to their BSc by means of a year in industry or by adding a fourth year of academic study to gain an MEng rather than BSc degree at institutions that offer such things.

Upon graduation most students seek work within the IT industry. There are IT career opportunities that suit graduates from all disciplines, but more specialised and technical roles require appropriate subject knowledge.

The Higher Education Careers Service Unit tracks the destinations of graduates six months after graduation. According to the published data from the 2012/13 survey, “over half (56.7%) of computer science and IT graduates in employment in the UK were working as information technology (IT) professionals. Popular occupations included programmers and software development professionals (25.8%), web design and development professionals (8.1%) and IT user support technicians (6.5%)” [14].

3.7 United States

Within the USA, most degree programmes fall under just a small number of titles. Common undergraduate computing degrees in the USA that are listed in the ABET accreditation criteria include computer science, information systems, information technology, and also degrees with similar names, such as computer information systems. Most universities offer Bachelor of Science (BS) degrees in computing but some offer Bachelor of Arts (BA) and some offer both. A science and engineering academic unit will probably offer a BS degree, while an arts and sciences academic unit may choose to offer a BA degree as well.

According to a US Department of Labor classification, computing occupations that require a bachelor's degree comprise the occupational group of computer and information technology. As of 2014, specific occupations within this group include computer network architect, computer programmer, computer systems analyst, database administrator, information security analyst, network and computer systems administrator, software developer, and web developer [27].

As defined by the North American Industry Classification System (NAICS), computing-related business establishments belong to the information sector. The information sector comprises establishments engaged in (i) producing and distributing information and cultural products, (ii) providing the means to transmit or distribute these products as well as data or communications, and (iii) processing data [26]. The information sector comprises five sub-sectors, from which data processing, hosting, and related services (NAICS 518) is directly related to computing and comprises the following occupations: computer programmer, computer support specialist, computer systems analyst, software developer (applications), software developer (systems software).
4. STANDARDS AND CONSISTENCY
Within and between countries there are different forms of accreditation to ensure that the degrees our students study are at an appropriate level and contain appropriate content. There are also accords aimed at providing international consistency.

4.1 International Accords
An international accord facilitates international mobility by providing a mechanism to compare different degree programmes and levels of study between countries. The two most widely known are the Bologna and Seoul accords.

4.1.1 Bologna Accord
The Bologna accord is an agreement between European countries that is designed to ensure comparability in the standards and quality of higher education qualifications. The Bologna Declaration, which has been applied in European countries since 2000, has objectives that include the development of European higher education and the removal of differences between national systems of education.

Since the Bologna Accord has been applied across Europe, mobility opportunities have increased, with a full year of study anywhere recognised as comprising 60 ECTS (European Credit Transfer System) points, and the European dimension of universities has been strengthened.

4.1.2 Seoul Accord
The Seoul Accord, established in 2008, is an international accreditation agreement for professional computing and information technology academic degrees, between the bodies responsible for accreditation in its signatory countries. The agreement mutually recognises tertiary level computing and IT qualifications between the signatories. “Graduates of accredited programs in any of the signatory countries are recognized by the other signatory countries as having met the academic requirements as IT professionals”[24].

4.2 Accreditation
Within each of the authors’ countries there is a form of accreditation to ensure standards within the degree programmes, and in some cases common naming criteria. In some countries the name of the degree or major is important, while in others accreditation depends on the content, regardless of the name. Although in the latter countries the name is not important for accreditation, university bureaucratic processes may make it difficult to change the name of an existing programme. It might also be detrimental for an institution to change a degree name from something that is commonly understood in its country to something that might be better understood abroad.

4.2.1 Australia – ACS
Computing degree programmes in Australia are accredited by the Australian Computer Society, which also accredits secondary and other post-secondary computing courses. The accreditation criteria include the course content, proportion of the course that is unequivocally computing, and qualifications and experience of the academic and other teaching staff. Graduates of accredited degrees “should be able to apply their knowledge to complex computing problems as defined by the Seoul Accord”, of which the Australian Computer Society is a founding member [4].

4.2.2 Canada - CIPS
The Canadian Information Processing Society makes the following statement on accredited programmes:

“Currently accredited programs are recognized under the Seoul Accord, a multi-lateral agreement among global agencies responsible for accreditation and recognition of tertiary-level computing education. Because of the universally essential nature of computer applications and the mobility of professionals across jurisdictional boundaries, there is a need to identify academic programs that adequately prepare graduates for entry into a computing profession based on generally recognized knowledge and abilities across countries and other jurisdictional boundaries. Toward this end, the Seoul Accord has established a mechanism for recognizing the equivalence of accredited educational qualifications in the development of computing professionals. The Seoul Accord provides for mutual recognition of graduates of accredited programs among the signatories of the accord”[11].

4.2.3 New Zealand – IITP
In New Zealand it is mandatory that all degree programmes must be approved and the institutions accredited to teach the degrees before they can be offered to students. In the university sector this approval and accreditation is done by the combined universities quality assurance group QAP. In the sector covering institutes of technology, polytechnics, and private providers this approval and accreditation is overseen by the New Zealand Qualifications Authority (NZQA). This is a rigorous process that includes input from peer institutions. The New Zealand professional society, IITP, is a new provisional signatory to the Seoul Accord and is planning to introduce an accreditation process.

4.2.4 UK – BCS
The BCS (formerly the British Computer Society) is now The Chartered Institute for IT, which “champions the global IT profession and the interests of individuals engaged in that profession for the benefit of all” [7]. The BCS is a signatory of the Seoul accord [24].

The BCS fosters links between experts from industry, business and academia; supports practitioners through qualifications and chartered status; and sets standards and frameworks for industry and academic qualifications. One of the major roles is to “develop and maintain standards in educational qualifications that provide an appropriate foundation for those who wish to follow a career in computing or information systems” [7].

Accreditation of different academic programmes can be partial or full, depending upon the amount of computing in the programme and the level of the course, from foundation degree to integrated masters.

The framework that supports the accreditation is the computing subject benchmark statement from the QAA (Quality Assurance Agency). There are statements relating to subject-related cognitive and practical abilities along with transferable skills. The list of topic areas is “seen as defining the scope of the broad area of computing. It is not intended to define curricula or syllabi, it is merely provided as a set of knowledge areas indicative of the technical areas within computing” [22].
4.2.5 USA – ABET
ABET, formerly known as the Accreditation Board for Engineering and Technology, is a non-profit, non-government, organisation that accredits "college and university programs in the disciplines of applied science, computing, engineering, and engineering technology at the associate, bachelors, and masters degree levels" [1]. While ABET is widely known for accreditation of programmes in the US, it also accredits programmes internationally, applying the same process that it uses for programmes within the US [2].

In terms of computing programmes, ABET’s criteria distinguish between the following programmes with specific content [2]:

- Computer science and similarly named programmes, whose fundamental curriculum terms are "algorithms, data structures, software design, concepts of programming languages, and computer organisation and architecture"

- Information systems and similarly named programmes, whose fundamental curriculum terms are “application development, data management, networking and data communications, security of information systems, systems analysis and design and the role of information systems in organizations”

- Information technology and similarly named programmes, whose fundamental curriculum terms are “the core information technologies of human computer interaction, information management, programming, networking, web systems and technologies”

ABET does not cover software engineering programmes, which have been placed into the scope of the Engineering Accreditation Commission.

5. REVIEW OF CURRENT TERMINOLOGY
It is apparent from the preceding sections that nomenclature varies between countries. We set out to summarise the names used in a number of countries both for the academic area and for the industrial sector, which are not necessarily the same.

Each country has a range of computing degree programmes across the computing spectrum. Each degree programme may have a different name, but the academic sector to which it belongs is generally consistent within the chosen country. For example, in the USA, computer science degrees, information systems degrees, and others are all considered to be computing degrees. In that sense, computing is the name of the academic sector in the USA.

The industry sector is the general area in which graduates are expected to find employment. For example, medical graduates might expect to work in the health industry, and commerce graduates in the finance industry. Again taking the USA as an example, graduates from computing degrees go on to seek work in what is known as the IT industry or the IT employment sector. The term computing industry is also used. Therefore the name of the industry sector in the USA is IT/computing.

We began by determining the names of the academic and industry sectors in our own seven countries. We then asked ITiCSE attendees from other countries if they could provide the same information for those countries, translated if appropriate into English. Note that no formal survey process was used: this was a simple sample of convenience. Furthermore, it is distinctly possible that some of the informants, including members of the working group, are wrong: that they do not know the current terminology used for these concepts in their countries. Therefore the results, which are shown in Table 1, must be taken as indicative rather than definitive.

It is clear from Table 1 that there are many names for the academic sector, while the industry sector is known almost exclusively as the IT industry.

Despite the differing names for the academic sectors, all seven of the countries represented in the working group have CS (or “informatics which translates to CS”) as the name for the most technical/theoretical degrees. Some also have comparable software engineering or computer engineering degrees. At the softer, less technical, end of the spectrum are information systems degrees and, for some, IT degrees. The harder end of the scale appears fairly uniform, but the softer end is more ragged, with differing levels of technical content in degrees of the same name.

6. CONSIDERATION OF A FORMAL TAXONOMY
The working group considered the creation of a formal taxonomy of the terminology of computing. Such a taxonomy might be created and maintained using one of many tools designed for the purpose, tools that permit the definition of classes, properties, and annotations. Figure 1 shows the beginnings of an example taxonomy for computing community, based on the object-oriented suggestion by Hasselbring [13], with rectangles representing classes and rhombuses indicating aggregation. The example was created using the open-source ontology tool WebProtégé [31].

In this example, the educational programmes class is created as an aggregation of the five computing disciplines recognised by the ACM, together with informatics and a select handful of the many other names that have been proposed.

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<th>Country</th>
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</tr>
<tr>
<td>Romania</td>
<td>informatics</td>
<td>IT or computing</td>
</tr>
<tr>
<td>Sweden</td>
<td>computer science</td>
<td>IT</td>
</tr>
<tr>
<td>USA</td>
<td>computing</td>
<td>IT or computing</td>
</tr>
<tr>
<td>UK</td>
<td>computing</td>
<td>IT</td>
</tr>
</tbody>
</table>
However, as the work of the working group progressed it became clear that a formal taxonomy is of more use when the definitions are agreed by all. When there are substantial differences both between and within groups, a formal taxonomy would serve only to support some usages of the terminology at the expense of others; we therefore proceeded no further in this direction.

7. SURVEY OF ACADEMIC NOMENCLATURE

Prior to ITiCSE 2015 we circulated a survey to computing academics by way of the SIGCSE members’ mailing list and various local lists accessible to working group members.

The survey asked seven substantive questions:

1. Name of degree, and name of major if it’s the major that defines the computing content.
2. Language in which the degree/major is named.
3. If applicable, normal translation of the degree/major name into English.
4. Identifiable computing topics taught as one or more courses/units/subjects/papers/etc., with approximate proportion of degree. (Examples: programming 5/24; computer graphics 2/32; artificial intelligence 1/12; database development 3/24.) (These can include mandatory and elective courses. We’ll be using this to try to identify the flavour of the degree/major, not just the bare minimum covered.)
5. If the Education Council of the ACM were to ask you to change the name of your degree/major (e.g. from Informatics to Computer Science, from Computer Science to Computing, etc.) would you be willing and able to do so?
6. If there's a computing association in your country, and it has a web page describing the different computing terms and their relationships - preferably in English - it would be appreciated if you could give us a link to that page.
7. Please add anything else that you would like us to know about the terminology of computing

The survey did not distinguish between bachelors and masters degrees, and the 85 responses comprised 77 bachelors degrees and eight masters degrees.

From an optional identifying question we were able to determine the countries of 79 of the 85 respondents, which break down as follows: Australia (19), Bulgaria (3), Canada (4), Estonia (1), Germany (4), India (1), Israel (4), Italy (1), Malaysia (1), New Zealand (2), Poland (1), Romania (3), Slovakia (5), South Africa (1), UK (1), and USA (28).

Almost half of the respondents (42 of 85) described degrees or majors called computer science. Within the USA, 23 of the 28 programmes were called computer science. Information technology is a popular title in Australia, comprising 9 of the 19 programmes there.

7.1 Spread of Names

The first survey question was designed to elicit the computing-related part of the degree name. In some countries, such as Australia, the degree name typically indicates the academic field in which the students will study: examples are Bachelor of Computer Science, Bachelor of Software Engineering. In other countries, such as the USA, the degree name is often more generic, and the academic focus is indicated by the name of a major: examples are Bachelor of Science in Computer Science, Bachelor of Arts in Informatics. In the former case we were interested in the name of the degree; in the latter case, the name of the major.

Some regularisation was applied to the responses to question 1 (or question 3 if question 1 was answered in a language other than English); for example, Engineering (Software) was rendered as software engineering. We then grouped the responses in two different ways.

Table 2 shows the degree/major names that were identified, the number of times each was mentioned, and the countries in which it was found. There were 18 distinct names, 16 if we discount the word ‘applied’ on two of them. Computer science is clearly dominant, with 37 mentions in 9 or more countries; information technology follows, with 12 mentions in just two or more countries; computing rates six mentions from three countries, and informatics rates five mentions from four countries.

Figure 1. Sample taxonomy of the computing community
Table 2. Names of degrees/majors, number of mentions, and countries in which they were found.

<table>
<thead>
<tr>
<th>Degree/major</th>
<th>Count</th>
<th>Countries</th>
</tr>
</thead>
<tbody>
<tr>
<td>computer science</td>
<td>37</td>
<td>Australia, Canada, Estonia, Germany, Israel, New Zealand, Poland, South Africa, USA, unidentified</td>
</tr>
<tr>
<td>information technology</td>
<td>12</td>
<td>Australia, Romania, unidentified</td>
</tr>
<tr>
<td>computing</td>
<td>6</td>
<td>Bulgaria, Canada, UK</td>
</tr>
<tr>
<td>informatics</td>
<td>5</td>
<td>Germany, Romania, Slovakia, USA</td>
</tr>
<tr>
<td>applied informatics</td>
<td>3</td>
<td>Slovakia</td>
</tr>
<tr>
<td>computer engineering</td>
<td>3</td>
<td>Israel, Italy, USA</td>
</tr>
<tr>
<td>computer information systems</td>
<td>3</td>
<td>USA</td>
</tr>
<tr>
<td>information and communication technology</td>
<td>3</td>
<td>Australia, New Zealand</td>
</tr>
<tr>
<td>software engineering</td>
<td>2</td>
<td>Israel, unidentified</td>
</tr>
<tr>
<td>technology</td>
<td>2</td>
<td>Australia, India</td>
</tr>
<tr>
<td>applied computer science</td>
<td>1</td>
<td>Germany</td>
</tr>
<tr>
<td>business informatics</td>
<td>1</td>
<td>Romania</td>
</tr>
<tr>
<td>business information systems</td>
<td>1</td>
<td>Australia</td>
</tr>
<tr>
<td>computer science and engineering</td>
<td>1</td>
<td>USA</td>
</tr>
<tr>
<td>computer science and software engineering</td>
<td>1</td>
<td>unidentified</td>
</tr>
<tr>
<td>information engineering</td>
<td>1</td>
<td>Germany</td>
</tr>
<tr>
<td>information systems</td>
<td>1</td>
<td>Malaysia</td>
</tr>
<tr>
<td>information systems engineering</td>
<td>1</td>
<td>Israel</td>
</tr>
</tbody>
</table>

Next we sorted the same data by country rather than by name of degree/major, as shown in Table 3. From this table we see that Australia and the USA, the countries best represented, each have five distinct names. In Australia the name information technology dominates, with computer science also accounting for a substantial number of the degrees. In the USA computer science dominates, with no other name coming close. This reinforces the suggestion that an information technology degree in Australia is somewhat comparable to a computer science degree in the USA; the alternative, that all the IT degrees in Australia are teaching little more than technical support, is not borne out either by the authors’ knowledge or by the survey data from question 4.

It is important to reiterate that these 85 responses constitute a convenience sample of those who chose to respond to the email request, and that the request was sent to the SIGCSE mailing list and local lists accessible to the working group members. The responses cannot be considered as representative of terminology world-wide, nor of terminology within any country, nor of the number or range of computing degrees taught in any country. Notwithstanding the inclusion of counts, the usefulness of the responses is principally qualitative.

Even so, the topic lists provided by the respondents for their degrees confirm that it would be a mistake to believe that all

<table>
<thead>
<tr>
<th>Country</th>
<th>Degree/major</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>business information systems</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>computer science</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>information and communication technology</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>information technology</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>technology</td>
<td>1</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>computing</td>
<td>3</td>
</tr>
<tr>
<td>Canada</td>
<td>computer science</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>computing</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>[not specified]</td>
<td>1</td>
</tr>
<tr>
<td>Estonia</td>
<td>computer science</td>
<td>1</td>
</tr>
<tr>
<td>Germany</td>
<td>applied computer science</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>computer science</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>informatics</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>information engineering</td>
<td>1</td>
</tr>
<tr>
<td>India</td>
<td>technology</td>
<td>1</td>
</tr>
<tr>
<td>Israel</td>
<td>computer engineering</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>computer science</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>information systems engineering</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>software engineering</td>
<td>1</td>
</tr>
<tr>
<td>Latvia</td>
<td>business informatics</td>
<td>1</td>
</tr>
<tr>
<td>New Zealand</td>
<td>computer science</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>information and communication technology</td>
<td>1</td>
</tr>
<tr>
<td>Poland</td>
<td>computer science</td>
<td>1</td>
</tr>
<tr>
<td>Romania</td>
<td>business informatics</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>informatics</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>information technology</td>
<td>1</td>
</tr>
<tr>
<td>Slovakia</td>
<td>applied informatics</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>informatics</td>
<td>2</td>
</tr>
<tr>
<td>South Africa</td>
<td>computer science</td>
<td>1</td>
</tr>
<tr>
<td>UK</td>
<td>computing</td>
<td>1</td>
</tr>
<tr>
<td>USA</td>
<td>computer engineering</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>computer information systems</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>computer science</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>computer science and engineering</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>informatics</td>
<td>1</td>
</tr>
<tr>
<td>unidentified</td>
<td>computer science</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>computer science and software engineering</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>information technology</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>software engineering</td>
<td>1</td>
</tr>
</tbody>
</table>

Author draft, pre-publication
computer science graduates have learnt one set of topics, that all
information technology graduates have learnt a different set, and
so on.

7.2 Identifiable Topics
We asked survey respondents to indicate the identifiable
computing topics taught in each degree, with the approximate
proportion of degree devoted to each. To prepare the responses
for quantitative evaluation, we cleaned and transformed them as
follows. First we cleaned the entries by removing non-specific
responses such as URLs (e.g. “see study plan at http://...edu”),
explanatory text, and general comments (e.g. “do not understand
the question”). We then transformed the cleaned entries by
mapping semantically similar topics into a single designator, such
as ‘analysis of algorithms’ into ‘algorithm analysis’. When a
reported topic appeared as a combination of two other topics, we
left it as a combined topic, rather than break it into two separate
topics. For example, ‘algorithms and data structures’ was left as is,
rather than breaking it into ‘algorithms’ and ‘data structures’.
Finally, we created a spreadsheet with all integrated topics. The
content of the spreadsheet is summarised in Table 4, which
includes all topics with at least 10 entries.

As expected, the most frequently reported topic is programming,
which was mentioned in three-quarters of the programmes. It is
worth noting that the topics of computer architecture and
computer organisation had fewer than 10 entries each. Often,
respondents combined these two topics with each other or with
other topics, such as operating systems or assembly language.

The approximate proportions of the topics in their degrees are not
included in Table 4 as it is difficult, if not impossible, to
aggregate them meaningfully. The topics and proportions were
asked for so that the working group could use them to cluster
similar degrees and then compare their names. We might have
confirmed, for example, that an ICT degree from New Zealand
has very much the same content as a CS degree from the USA.
However, the fragmentary nature of the responses has made this
task more challenging than anticipated, and it was not completed.

7.3 Changing Name
Question 5, which concerned changing the name of a degree or
major, was possibly the most contentious, and elicited a very
broad range of responses. The non-empty responses to the
question were grouped into categories, whose distribution is
shown in Table 5.

Comments relating to, and justifying, the answers were also
provided. Some sample responses are listed below.

No:
- The program name must conform to ABET/CAC
  accreditation guidelines.
- Computer Science has a defined curriculum - the industry is
  looking for broader skills than just CS.
- Our degree name matches what is commonly described
  throughout the United States.
- The name is good.
- Not possible due to accreditation and political reasons.

Probably not:
- We believe that Computer Science and Software Engineering
  are the appropriate names. We should need to see a pretty
  convincing argument to change them.
- Not sure, probably not since it has been called computer
  science since its inception and we have other computing
  related majors.

Possibly / yes:
- It would depend on why and what to...
- Would not be a simple change and would need to have a
  strong justification.
- Willingness depends on the reasonableness of the
  framework.

Table 4. Topics covered in the degrees, with number and
proportion of the degrees in which each was included.

<table>
<thead>
<tr>
<th>Topic</th>
<th>Occurrences</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Programming</td>
<td>64</td>
<td>76%</td>
</tr>
<tr>
<td>Databases</td>
<td>46</td>
<td>55%</td>
</tr>
<tr>
<td>Artificial intelligence</td>
<td>37</td>
<td>44%</td>
</tr>
<tr>
<td>Software engineering</td>
<td>27</td>
<td>32%</td>
</tr>
<tr>
<td>Theory</td>
<td>25</td>
<td>30%</td>
</tr>
<tr>
<td>Networks</td>
<td>24</td>
<td>29%</td>
</tr>
<tr>
<td>Graphics</td>
<td>23</td>
<td>27%</td>
</tr>
<tr>
<td>Algorithms</td>
<td>22</td>
<td>26%</td>
</tr>
<tr>
<td>Operating systems</td>
<td>18</td>
<td>21%</td>
</tr>
<tr>
<td>Security</td>
<td>18</td>
<td>21%</td>
</tr>
<tr>
<td>Information technology</td>
<td>17</td>
<td>20%</td>
</tr>
<tr>
<td>Programming languages</td>
<td>16</td>
<td>19%</td>
</tr>
<tr>
<td>Project, capstone</td>
<td>15</td>
<td>18%</td>
</tr>
<tr>
<td>Discrete mathematics</td>
<td>14</td>
<td>17%</td>
</tr>
<tr>
<td>Web</td>
<td>14</td>
<td>17%</td>
</tr>
<tr>
<td>Systems</td>
<td>13</td>
<td>15%</td>
</tr>
<tr>
<td>Data structures</td>
<td>11</td>
<td>13%</td>
</tr>
<tr>
<td>Compilers</td>
<td>10</td>
<td>12%</td>
</tr>
<tr>
<td>Other</td>
<td>233</td>
<td></td>
</tr>
</tbody>
</table>

Table 5. Classes of non-empty responses to whether the name
could be changed, as percentages of the total non-empty
responses to that question.

<table>
<thead>
<tr>
<th>Response</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>19%</td>
</tr>
<tr>
<td>Doubtful</td>
<td>8%</td>
</tr>
<tr>
<td>Not sure</td>
<td>11%</td>
</tr>
<tr>
<td>Depends</td>
<td>15%</td>
</tr>
<tr>
<td>Probably</td>
<td>10%</td>
</tr>
<tr>
<td>If everyone else does</td>
<td>4%</td>
</tr>
<tr>
<td>Able yes, willing no</td>
<td>6%</td>
</tr>
<tr>
<td>Yes</td>
<td>13%</td>
</tr>
<tr>
<td>Not up to me</td>
<td>10%</td>
</tr>
<tr>
<td>For a particular degree</td>
<td>5%</td>
</tr>
</tbody>
</table>
We would consider it, and quite likely change if it seemed that everyone else was.

Able but not willing:
- Accreditation is based on degree/major, so changing would be a lot of work.
- "Computer Science" is fairly standard in US, and changing name is likely a lot of work as it would need to be approved at many levels.
- The School can only recommend such a change - this would need to be approved at various levels within the University and other parts of the University may have opinions about this.

8. IDENTIFIED TERMS AND EQUIVALENCES

If we were to propose a way of mapping the various names onto a set of standard ones, we would first have to agree on what that standard set would be. This would be simpler if we could wipe the slate clean and start afresh with naming conventions. Now, however, different countries have different naming conventions that are entrenched, and we have graduates and students in named programmes that have specific meanings within each country.

For educational programmes we could suggest the five computing disciplines of computer engineering, computer science, information technology, information systems, and software engineering, as recognised by the ACM/IEEE, perhaps adding information science as a sixth.

For industry we could suggest the IT industry for jobs associated with developing applications and providing IT services in support of businesses and organisations, and the computing industry for software developers working on the products of firms such as Microsoft and Google in the computing or technology sector.

However, this predominantly North American perspective would leave large parts of the world having to change their equally well entrenched and valid naming schemes. One can easily argue that the Australian and New Zealand degree title of IT matches more appropriately to the industry sector title of IT that most of our graduates enter; certainly the naming is less confusing.

At the same time we recognise that it would be impossible to require the North American academic sector to change its terminology to suit the rest of the world – even if the rest of the world were uniform in its terminology. Therefore we conclude that computing educators, practitioners, and employers must learn to live with the wide variation in terminology, and we recommend that they all take the trouble to become and to remain aware of the wide variation.

Here are some of the terms we have identified and their equivalences.

8.1 The encompassing term

As a term for the overall professional sector, computing appears to be the least value-laden term, the term that is understood in the greatest number of contexts. IT appears to be best understood in the European countries, New Zealand, and North America. Australia also uses the term IT, but ICT was introduced some years ago and appears to be gaining currency.

8.2 The degree names

For a programme of study, typically the name of a degree or a major, computer science is the best-known term in the USA and Canada, and informatics is best known in most of Europe. European computing educators generally translate their form of informatics to computer science when talking or writing for an English-speaking audience, but sometimes translate it to the English word informatics. IT is used for many degrees in Australia and New Zealand, degrees that would clearly be classified as computer science in the USA. When the same institution in these countries has both IT and computer science degrees, the latter will sometimes be more ‘hard’, in the sense of covering such subjects as compiler design and artificial intelligence, and the IT degrees might tend more to software for business purposes.

8.3 IT and Tech Support

In North America the term IT tends to refer to technical support and other activities that would be carried out by a help-desk staff member. However, it is also widely used to refer to the whole of the computing industry. These two distinct uses of the term leave it open to misunderstandings, for example when an IT graduate from outside North America seeks employment in areas such as programming or database design.

Outside North America there tends to be no such confusion, and IT is generally seen as a broad name for the whole of the industry.

8.4 ICT and Productivity Tools

While there is some concern that ICT refers just to digital literacy and/or productivity tools, one of the two New Zealand responses to our survey concerned an ICT degree, which has separate streams in programming, software engineering, networking, and interactive media. It is clear from this single example that ICT in New Zealand means a great deal more than digital literacy.

We have also indicated that in Australia, the term ICT is taking over from IT for the name of the industry as a whole. Again, this is clearly a great deal broader than digital literacy or the use of personal productivity software.

8.5 Digital Literacy and Digital Skills

We did not encounter digital literacy or digital skills as the name of a degree, and we would not expect to, because we have only ever seen this term used to mean the computing skills that every reasonably educated person is expected to have: word processing, spreadsheets, presentation software, and perhaps simple webpage construction.

9. DISCUSSION AND CONCLUSIONS

Each phrase seems to mean different things in different places. Each usage, with its meaning, is valid, because it is meaningful to the people who use it in the context they use it in. It is valid to use IT to mean technology support. It is valid to use IT to mean something very like computer science. It is valid to use IT as the name of the whole industry. In English-speaking countries, perhaps the word computing is the one that comes closest to universal acceptance as an umbrella term for both the industry and the educational programmes. In many European countries, IT and its translations are perhaps the closest. However, informatics and its translations are often used for the educational name in in those countries, as is computer science in northern America.
Another working group at ITiCSE 2015 set out to define an ACM IT curriculum, which that group appears to see as less technical than a CS one. However, the content of an IT degree is clearly dependent on the country in which that degree is offered. Before we can consider proposing a common name space we need to consider an international perspective on terminology. It appears to be deeply ingrained in all of us that the terminology with which we are familiar is the one that we can rely on everyone else to be applying. This is a flawed understanding, and is ultimately problematic. Graduates with an IT degree from one country that corresponds to a CS degree in another have difficulty understanding why their degree is devalued or even denigrated in the other country.

Names are important. There are really significant differences even within the English-speaking world, and more when different languages are considered. It seems unlikely that any project will be able to change terminologies that vary so widely within and between countries. Therefore instead we need some sort of guide to the different uses, which this paper provides; and we need everyone to understand that there are fundamental differences in the terminology, that there is no right or wrong, and that they should be tolerant of the differences.

10. ACKNOWLEDGEMENTS
Many thanks to those who took the time to respond to the survey and to those who talked to us about the issue at ITiCSE 2015.

11. REFERENCES

Author draft, pre-publication
Appendix: A selection of definitions from various sources

<table>
<thead>
<tr>
<th>Information Technology</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>ACM Computing Curriculum 2005 The Overview Report</td>
<td>Information technology (IT) is a label that has two meanings. In common usage, the term “information technology” is often used to refer to all of computing. As a name of an undergraduate degree programme, it refers to the preparation of students to meet the computer technology needs of business, government, healthcare, schools, and other kinds of organizations.</td>
</tr>
<tr>
<td>Institute of Information Technology Professionals (New Zealand)</td>
<td>Information Technology (IT) or Information and Communication[s] Technology (ICT) is the technology required for information processing. In particular it deals with the use of electronic computers and computer software to convert, store, protect, process, transmit, and retrieve information.</td>
</tr>
<tr>
<td>Websters Dictionary <a href="http://www.merriam-webster.com/dictionary/information%20technology">http://www.merriam-webster.com/dictionary/information%20technology</a></td>
<td>The technology involving the development, maintenance, and use of computer systems, software, and networks for the processing and distribution of data.</td>
</tr>
<tr>
<td>Linux information project, Lininfo <a href="http://www.linfo.org/computer_science.html">http://www.linfo.org/computer_science.html</a></td>
<td>There are several additional, commonly used terms related to the study of computers. The most popular of these is information technology (IT), which can be defined as the branch of technology devoted to the study and application of data and the processing thereof. IT can also be thought of as applied computer systems, including both hardware and software, usually in the context of a business or other enterprise, and often including networking and telecommunications. The term computer science is usually reserved for the more theoretical, academic aspects of computing.</td>
</tr>
<tr>
<td>McCann University, USA <a href="http://www.mccann.edu/whats-the-difference-between-information-technology-and-computer-science-degrees">http://www.mccann.edu/whats-the-difference-between-information-technology-and-computer-science-degrees</a></td>
<td>IT professionals apply … computer programs to solve business problems. Essentially, they use the programs created by computer scientists and focus on the practical application of computers in everyday life. They may help to explain to a client how to solve a technology issue or work with businesses to implement new technology plans that meet their needs. Information Technology has become an integral piece of every business plan for both small and large businesses.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Computing</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Wikipedia</td>
<td>Computing is any goal-oriented activity requiring, benefiting from, or creating algorithmic processes—e.g. through computers. Computing includes designing, developing and building hardware and software systems; processing, structuring, and managing various kinds of information; doing scientific research on and with computers; making computer systems behave intelligently; and creating and using communications and entertainment media. The field of computing includes computer engineering, software engineering, computer science, information systems, and information technology.</td>
</tr>
<tr>
<td>Websters Dictionary <a href="http://www.merriam-webster.com/dictionary/computing">http://www.merriam-webster.com/dictionary/computing</a></td>
<td>to find out (something) by using mathematical processes</td>
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## Computer Science

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<tr>
<th>Source</th>
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<td>Wikipedia <a href="https://en.wikipedia.org/wiki/Computer_science">https://en.wikipedia.org/wiki/Computer_science</a></td>
<td>Computer science is the scientific and practical approach to computation and its applications. It is the systematic study of the feasibility, structure, expression, and mechanization of the methodical procedures (or algorithms) that underlie the acquisition, representation, processing, storage, communication of, and access to information, whether such information is encoded as bits in a computer memory or transcribed in genes and protein structures in a biological cell. An alternate, more succinct definition of computer science is the study of automating algorithmic processes that scale.</td>
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<td>ACM <a href="http://computingcareers.acm.org/?page_id=8">http://computingcareers.acm.org/?page_id=8</a></td>
<td>Computer science (CS) spans the range from theory through programming to cutting-edge development of computing solutions.</td>
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<td><a href="https://en.wiktionary.org/wiki/computer_science">https://en.wiktionary.org/wiki/computer_science</a></td>
<td>computer science: The study of computers and their architecture, languages, and applications, in all aspects, as well as the mathematical structures that relate to computers and computation. Synonyms: computing, datalogy</td>
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<td>Computing Curricula 2005 The Overview Report</td>
<td>Computer science spans a wide range, from its theoretical and algorithmic foundations to cutting-edge developments in robotics, computer vision, intelligent systems, bioinformatics, and other exciting areas. We can think of the work of computer scientists as falling into three categories. • They design and implement software. Computer scientists take on challenging programming jobs. They also supervise other programmers, keeping them aware of new approaches. • They devise new ways to use computers. Progress in the CS areas of networking, database, and human-computer-interface enabled the development of the World Wide Web. Now CS researchers are working with scientists from other fields to make robots become practical and intelligent aides, to use databases to create new knowledge, and to use computers to help decipher the secrets of our DNA. • They develop effective ways to solve computing problems. For example, computer scientists develop the best possible ways to store information in databases, send data over networks, and display complex images. Their theoretical background allows them to determine the best performance possible, and their study of algorithms helps them to develop new approaches that provide better performance. Computer science spans the range from theory through programming. Curricula that reflect this breadth are sometimes criticized for failing to prepare graduates for specific jobs. While other disciplines may produce graduates with more immediately relevant job-related skills, computer science offers a comprehensive foundation that permits graduates to adapt to new technologies and new ideas.</td>
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<td>Linux information project, Linio <a href="http://www.linfo.org/computer_science.html">http://www.linfo.org/computer_science.html</a></td>
<td>Computer science is the study of the storage, transformation and transfer of information. The field encompasses both the theoretical study of algorithms (including their design, efficiency and application) and the practical problems involved in implementing them in terms of computer software and hardware.</td>
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<td>McCann University, USA <a href="http://www.mccann.edu/whats-the-difference-between-information-technology-and-computer-science-degrees">http://www.mccann.edu/whats-the-difference-between-information-technology-and-computer-science-degrees</a></td>
<td>Computer Science involves the design and development of all types of usable hardware and software, operating systems, and interactive games and apps. Computer Science employs the use of mathematical algorithms, the understanding of computer theory, and writing code to generate the latest in computer technology. Computer programmers—as the people who create these programs are called—write code to create software programs, then turn these designs into instructions that a computer or mobile device can follow.</td>
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