Analysis of existing standards and guidelines for Informatics / Informatics Engineering higher education in Italy and comparison with the Euro-Inf Framework Standards and Accreditation Criteria

(**FINAL**)

Content

1 Introduction

This document provides an analysis on existing standards and guidelines for Informatics and Informatics Engineering Higher Education in Italy and compares them to the Euro-Inf Framework Standards and Accreditation Criteria, the set of accreditation guidelines defined by EQANIE (European Quality Assurance Networks for Informatics Education – http//www.eqanie.eu).

It is divided in two parts:

1. Analysis of the state of implementation of the Bologna process with regard to quality assurance and enhancement in Informatics / Informatics Engineering Higher Education in Italy.
2. Comparison of the Euro-Inf Framework Standards and Guidelines to the existing field specific standards and guidelines applicable to Italian informatics and Informatics Engineering degree programmes.

This document has been prepared with input received from the two communities GRIN (*Gruppo di Informatica* – Italian Association of Informatics University Professors) and GII (*Gruppo di Ingegneria Informatica* – Italian Association of Informatics Engineering University Professors), whose contribution is here acknowledged. The final responsibility for what is reported here is uniquely of the author, Prof. Enrico Nardelli, past president of GRIN.

2 State of implementation of the Bologna process with respect to quality assurance and enhancement

2.1 Structure of Informatics Higher Education in Italy

Higher Education in Italy is structured around Faculties, i.e. grouping of culturally homogeneous disciplines, which are in charge of organizing degree programs. Such a structure is sometimes also influenced by historical motivations.

Concerning Informatics, it is taken care by two Faculties: the Science Faculty and the Engineering Faculty. The former groups the traditional scientific disciplines (i.e., Mathematics, Physics, Chemistry, Biology, Geology, Environmental Sciences), while the latter groups the engineering ones (i.e. Civil Engineering, Industrial Engineering, Information Engineering).

An important distinction from the professional viewpoint is that students coming out from Engineering faculties are usually self-employed (above at all in civil engineering) with the normal consequences in terms of professional liability towards their customers, while student coming out from Science faculties are usually employed by an organization, with a different set of liabilities. This distinction is reflected in the existence, and importance for society, of the so-called "*Ordini Professionali*", i.e. the public registries of self-employed professionals.

Concerning Informatics, though, such a distinction is less relevant, since students with a degree in Informatics from a Science Faculty can ask to be registered in the Public Registries of Information Engineers, which is the Public Registry that, according to the law, enlists all and only the self-employed professionals in Information Engineering.

In terms of organization of teaching, the bachelor and master degree programs for Informatics in Science and Engineering Faculties have a lot of common points. In some Engineering Faculties there may be more emphasis on a broad cultural base insisting on electronics issues or on a system-oriented viewpoint, while in some Science Faculties there may be more emphasis on formal/mathematical aspects of Informatics. But, generally speaking, it is not easy, by just looking at the degree program, to infer whether it is a Science or an Engineering degree.

One of the problem in understanding how Higher Education is organized in Italy is the fact that after the first major change in the structure and organization of the Higher Education, happened with the Ministerial Decree ("*Decreto Ministeriale*") n.509 of 3 november 1999 (DM 509/99), which introduced the Bologna process, there has been one more intervention, in the years 2004-2007, through a series of Ministerial Decrees (decree n.270 of 22 october 2004 plus four unnumbered decrees of 16 march 2007) whose main apparent change was the name change of master programs from "*Laurea Specialistica*" to "*Laurea Magistrale*".

The Bachelor degree is organized around a program covering 180 credits, while the Master degree requires the student to get 120 credits. This is true both for Science and Engineering degrees. Remember that 1 credit corresponds to 25 hours of overall work by the average student, including everything from lectures to home study. There are several types of activities giving credits, among them: lectures, usually covering 8 to 10 hours of the 25 while the rest if left to rehearsal; laboratories, usually covering 12 to 14 hours of the 25; autonomous activities, where all the 25 hours are self-organized by the student.

In any case, both bachelor and master degrees are organized around the concept of Class, grouping all degrees sharing the same cultural content, at a different granularity level. After the last ministerial intervention there are 43 Classes of Bachelor Degrees plus 4 Classes of Bachelor Degrees for Nursing Disciplines, plus 2 Classes of Bachelor Degrees for Police and Defense Disciplines. At the Master level there are 94 Classes plus 4 for Nursing Disciplines plus 2 for Police and Defense Disciplines. Medical studies have an autonomous structure. Teaching activities related to a Class are usually managed by a single Faculty.

The specific regulations – four Ministerial Decrees ("*Decreti Ministeriali*") of 16 march 2007 – defined more specific requirements for Science and Engineering. For all bachelor degrees, regulations requirements are expressed in terms of Foundational Studying Activities – FSA ("*Attività Formative di Base*") and Characterizing Studying Activities – CSA ("Attività Formative Caratterizzanti"). For all master degrees, regulations requirements are expressed only in terms of Characterizing Studying Activities. Then, each university can decide on some specialization of the general framework defined by these regulations while satisfying the overall constraints fixed in the regulations themselves.

For a Bachelor degree in Informatics (Class L-31 – "*Scienze e Tecnologie Informatiche*" – usually managed by Science faculties), the national regulation prescribes at least 12 credits of FSA in an area covering both Mathematics and Physics, and at least 18 credits of FSA in the area of Informatics/Informatics Engineering, and at least 60 credits of CSA in the area Informatics/Informatics Engineering. The remaining 90 credits in the bachelor program can be assigned by various universities according to their specific orientation, as long as at least 12 credits can be freely chosen by students and at least 18 credits are assigned to scientific disciplines distinct from the one included into FSA and CSA.

For a Bachelor degree in Information Engineering (Class L-8 – "*Ingegneria dell'Informazione*" – usually managed by Engineering faculties), the national regulation prescribes at least 36 credits of FSA in two areas, one covering both Mathematics and Informatics and another one covering both Physics and Chemistry, and at least 45 credits of CSA in various information engineering areas (Automation, Biomedical, Electronics, Management, Informatics, Telecommunications, Information Security). The remaining 99 credits in the bachelor program can be assigned by various universities according to their specific orientation, as long as at least 12 credits can be freely chosen by students and at least 18 credits are assigned to scientific disciplines distinct from the one included into FSA and CSA.

For a Master degree in Informatics (Class LM-18 – "*Informatica*" – usually managed in Science faculties), the national regulation prescribes at least 45 credits of CSA in the area Informatics/Informatics Engineering. The remaining 75 credits in the master program can be assigned by various universities according to their specific orientation, as long as at least 8 credits can be freely chosen by students and at least 12 credits are assigned to scientific disciplines distinct from the one included into CSA.

For a Master degree in Informatics Engineering (Class LM-32 – "*Ingegneria Informatica*" – usually managed in Engineering faculties), the national regulation prescribes at least 45 credits of CSA in an area covering both Automation Engineering and Informatics Engineering. The remaining 75 credits in the master program can be assigned by various universities according to their specific orientation, as long as at least 8 credits can be freely chosen by students and at least 12 credits are assigned to scientific disciplines distinct from the one included into CSA.

2.2 Existing Higher Education programs in Informatics in Italy

Degree programs in Informatics existing in Italy in the academic year 2009/2010 are listed in Appendix A, divided by their Class, according to the organization explained in the previous section.

2.3 Quality assurance and enhancement

For a combined effect of the implementation of the Bologna process and of a parallel effort to give more autonomy to universities, the bachelor and master system in Italy is in transition, since 1999, from a situation where the study programs were nationally established by the Ministry to a situation where a national framework defines only a very loose set of requirements, leaving its implementation to each university.

But the final degree still maintain its legally binding value independently from the specific implementation. This may be dangerous for the quality of education without a proper auditing

system, since it transforms the degree in a "product" whose "market value" is defined by the law, but whose "production cost" are largely unregulated.

Therefore the government has since some years established the foundation of a National Agency for University and Research Evaluation (ANVUR – "*Agenzia Nazionale di Valutazione dell'Università e della Ricerca*" – http://www.anvur.it), not yet operational, though. In the meantime, there is a National Committee for the Evaluation of University System (CNVSU – "*Consiglio Nazionale di Valutazione del Sistema Universitario*" – http://www.cnvsu.it) having the role of prescribing "minimum requirements" concerning quality of degree programs. But its intervention is mainly limited to "structural" requirements, e.g.: number of professors, number of students, number of exams, etc.

Given this state of affairs, some scientific communities (i.e. biology, chemistry, informatics) have taken the initiative of defining a more strict set of requirements for the university degree of their disciplines. This has been done until now for the bachelor level, while efforts for the master level are undergoing.

For informatics, GRIN (http://www.grin-informatica.it) the Association of Italian University Professors in Informatics in Science Faculties, has played this role by implementing since 2004 the so-called "*Bollino GRIN*" (GRIN accreditation mark), a light and content-oriented accreditation process for bachelor informatics degrees in Science faculties. Its results are publicly available at https://grin.informatica.uniroma2.it/certificazione/. A more detailed description of the "*Bollino GRIN*" is contained in section 3.

The last law regulation concerning quality of Higher Education is the Ministerial Decree ("*Decreto Ministeriale*") n.544 of 2007 (DM 544/07) requiring each university to establish a "University Quality Committee" ("*Presidio della Qualità d'Ateneo*") overseeing all aspects of quality.

It has to be said that by, current regulations, all universities have an Evaluation Committee (NDV – "*Nucleo di Valutazione*") having the task of certifying when the "minimum requirements" prescribed by law to have a degree program are satisfied. The law allows to have degree programs not satisfying the minimum requirements, but in such a case the degree program shall not receive the financial contribution by the Ministry. One of the most important tasks of NDVs is the definition of a strategic long-term development plan. The overall goal is to encourage the different faculties to define long term strategic plans and to implement a system of quality assurance.

The same DM 544/07 defines a number of efficiency and effectiveness criteria to be used to evaluate quality.

The efficiency criteria there are:

- Efficiency in the use of professors in teaching activities
- Efficiency of the students enrolling in the degree programs
- Regularity of the progress of students in the degree programs

The effectiveness criteria are:

- How pre-requisites for students entering degree programs are verified
- Students evaluation of courses
- Students evaluation of the entire degree program
- Percentage of employment of graduated students, after 1, 3, and 5 years

Moreover, for Informatics bachelor programmes, both in Science and Engineering faculties, the "minimum requirements" regulations prescribe to have at least 12 (for bachelor – 180 credits) and 9 (for master – 120 credits) faculty professors uniquely assigned to the degree program (but they need not necessarily to be Informatics professors, they can be Mathematics', Physics', etc…).

Finally, the same DM 544/07 lists 7 quality criteria, at least 5 of which have to be matched by a degree program to respect the "minimum requirements" regulation:

1. Average number of credits acquired by a student per year greater than the national median value for similar degree programs
2. Percentage of courses (computed using credits of courses) taught by faculty professors greater than the national median value for similar degree programs
3. Percentage of course evaluated by students greater then the national median value for similar degree programs
4. Existence of procedures to test pre-requisites satisfaction for students entering degree programs and of procedures to help students catching up the gap
5. Existence of quality evaluation system for teaching activities, different from the student evaluation by means of anonyms questionnaires
6. Existence of a specific teaching organization for part-time students
7. There is a tutor for each 30 students

There are two additional criteria to be satisfied:

1. At least 80% of all professors of a degree program are faculty professors
2. At 3 professors of a master program have a scientific curriculum satisfying requirements defined for each specific scientific area, by Committee for Research Evaluation (CIVR – "*Comitato di Indirizzo per la Valutazione della Ricerca*" – a committee similar to CNVSU, but evaluating research; both CNVSU and CIVR competencies shall be absorbed by ANVUR; when the Agency will start to work).

2.4 Existing practices for quality assurance and enhancement

In this section we describes current more specific activities regarding quality assurance and enhancement, as they have been communicated by various degree programs (both bachelor and master) in the Science and Engineering Faculties in Italy. A call for contribution has been circulated in the beginning of 2010 in the mailing lists of the two communities, and what is reported here is the received feedback.

2.4.1 Libera Università di Bolzano – Free University of Bozen (FUB)

The Free University of Bozen-Bolzano has already started to implement quality guidelines defined by MIUR.

The students of the Free University of Bozen-Bolzano are periodically asked to report on the quality of the academic and administrative services as well as on the teaching by means of an anonymous audit. The internal Evaluation committee of the FUB analyses data concerning the efficiency and effectiveness of the resource deployment. Yearly the committee produces a report on these themes.

As far as research projects are concerned, the evaluation is delegated to the internal Central Research Committee, made up of internal and external members, distinguished members of their scientific fields. More specifically, this committee is made by one FUB professors, one external professor, one person belonging to industry.

Furthermore, the Academic Senate appoints different working groups with the purpose of defining special issues according to criteria of quality management: these groups have to deal with critical situations and propose solutions or quality guidelines, for example the recruitment of academic staff, the quality of administrative and academic services and the improvement of the trilingual teaching model of the Free University of Bozen-Bolzano. Researchers and professors confirmation is given on the basis of a positive performance assessment by the faculty council and by a national commission appointed by the ministry after a 3 year period.

As a best practice the FUB recognizes and supports the accreditation process of all academic programmes. The Faculty of Informatics succeeded in gaining an international accreditation for their Bachelor programmes.

2.4.1.1 The European Master in Software Engineering:

Moreover, FUB has a European Master in Software Engineering (EMSE) funded by the European Union under the Erasmus Mundus Program. Partners of FUB UPM (Universitad Politecnica de Madrid), BTH (Blekinge Tekniska Hoskola), and UKL (Universitaet Kaiserslautern).

Here are quality procedures:

1. Teaching quality
    - Each course is quality ensured by course evaluations according to local regulations.
    - After a year and a half each EMSE student fills out an on-line questionnaire. One or two years after graduation a follow-up is done where we also check what the students are working with (relevance to their educational background).
    - Every year a student workshop is arranged by the students where they present their work, their experiences and also provide feedback on studying at EMSE.
2. An annual report is submitted to European Union describing:
    - Description of the implementation of the Masters Course to date
    - Consortium's composition
        - course contents and course structure
        - Mobility arrangements
        - Course language policy
        - Student selection procedures
        - Tuition fees
        - EU students

  - Recognition of degrees
  - Diploma Supplement
- Scholarship scheme
  - Description of the implementation of the scholarship scheme to date
  - Course promotion policy
  - 3rd country students and 3rd country scholars
  - Facilities to mobility
  - Scholarship management
  - Selection of 3rd country scholars
- Experiences, problems and future improvements
- Foreseen tasks for implementation of the Masters Course
- Summary data

2.4.2 Università di Verona

University of Verona, after an experimental phase run from 2006 to 2008 has just set up a quality evaluation process based on a Quality Model featuring four dimensions and a Conclusion section. The entire process is based on a self-evaluation approach, managed by Self-Evaluation Teams (*Team di Autovalutazione*) and is coordinated by the University Committee for Self-Evaluation of Teaching Activities ("*Comitato di Ateneo per l'Auto-Valutazione delle Attività Didattiche*").

Each Self-Evaluation Team (SET) manages quality evaluation procedures for a specific degree program and is appointed by the Faculty where the degree program is hosted. It is made up by three professors, one students, and one technical/administrative employee.

The four dimensions of the Quality Model are:

1. Needs and Objectives
2. Teaching, Studying, and Assessment
3. Resources and Services
4. Management and Control System

Each dimension is made up by many quality requirements, organized around many questions, to be answered by the SET in a thorough and traceable way.

For each dimension then the SET formulates a synthetic judgment, chosen among the four ones listed below, and provides motivations for it:

1. Fully positive
2. Positive with remarks
3. Not Adequate
4. Impossible to evaluate

The Conclusion section collects the major critical issues to be improved and any suggestion for further improvement of positive aspects.

We now describes in more detail quality requirements considered in each dimension, indicating how many questions the SET has to consider for each quality requirement. For a more in-depth description of this Quality Model please see the main web page ot the University Committee for Self-Evaluation of Teaching Activities (http://www.univr.it/main?ent=organo&id=420) and the main document describing the Quality model (http://www.univr.it/documenti/OrganoCol/allegato/allegato540031.pdf).

2.4.2.1 Needs and Objectives

This dimension contains 3 quality requirements:

1. Needs of stakeholders (4 questions)
2. Perspectives of graduates with respect to future job/continuation of study (10 questions, structured in three groups of questions: on perspectives identification, on perspectives comparison with similar degree programs, on matching between perspective and program objectives)
3. Learning objectives (3 questions)

2.4.2.2 Teaching, Studying, and Assessment

This dimension contains 3 quality requirements:

1. Degree program design (7 questions, structured in two groups of questions: on matching between program design and learning objectives, on matching between teaching plans and learning objectives)
2. Teaching and studying (5 questions, structured in two groups of questions: on checking teaching happens according to plans, on checking reliability of teaching and assessment)
3. Support activities (14 questions, structured in three groups of questions: on tutorship, on liaisons with the job market, on internationalization activities)

2.4.2.3 Resources and Services

This dimension contains 3 quality requirements:

1. Human resources (16 questions, structured around four groups of questions: on matching between professors and learning objectives, on matching between technical/administrative employees and program degree management needs, on the presence of tutors, on the presence of employees taking care of stages)
2. Infrastructures (15 questions, structured around tree groups of questions: on lecture rooms, on libraries, on laboratories)
3. Services (9 questions, structured around two groups of questions: on orienteering for newcomer students, on accompanying graduates to the job market)

2.4.2.4 Management and Control System

This dimension contains 3 quality requirements:

1. Decision making (5 questions, structured around two groups of questions: on clear and unique responsibility for taking decisions, on effective communication of decisions)

2. Control (9 questions, structured around four groups of questions: on working of SET, on data collection about quality of the degree program, on relation between control subsystem and decision making subsystem, on periodical checking of control procedures)
3. Communication (7 questions)

3 Comparison of Euro-Inf standards and guidelines with existing field specific standards and guidelines

3.1 The GRIN effort for accreditation (*Bollino GRIN*)

3.1.1 Introduction

The autonomy that has been granted to Italian universities in the specification of their curricula forces the faculties to qualify their products with respect to the plethora of courses that are offered in the educational market. Students and families often get confused by radio and TV commercials. Also when focusing just on curricula offered by the university system, it is very difficult to evaluate the values of curricula that look very similar. The same holds for enterprises and recruitment agencies, having difficulties to classify the different universities with respect to the quality of each degree program as the content and the structure of the whole university system has deeply changed in the last decade.

In this context, each university delivering a degree program in Informatics should be fair enough to guarantee that their curricula cover the basic spectrum of scientific knowledge in Informatics, and that courses are given by qualified professors. Unfortunately, the conditions above are not always satisfied. For instance, there are university degree programs in Informatics where not even one faculty member has a PhD either in Informatics or in Informatics Engineering.

GRIN, the Italian Association of Informatics University Professors (http://www.grin-informatica.it) promoted a common effort involving almost all the Italian universities towards the elicitation of the "product qualities" of undergraduate degree programs in Informatics, and characterized the constraints to be fulfilled in order to obtain the "*Bollino GRIN*" (GRIN Certification Mark). Rules and results of this accreditation process are public, in order to provide families and enterprises with information to make the right choice. There is no other similar initiative in the Italian academic context, and as far as we know, in Europe only the Chemistry Eurobachelor has similar purposes.

In order to manage this accreditation process, a web site is maintained by Università di Roma "Tor Vergata". The project is running since 2004 and is supported by the Italian Council of University Rectors (CRUI) and by the Italian Association for Informatics (AICA).

Given the many changes happened to the master level of Higher Education in Italy in the last five years, GRIN focused its effort on accreditation of degree programs only on the bachelor level. Starting from 2010, hoping that now the situation regarding master level degrees should be stable, GRIN is working to define accreditation also for masters.

3.1.2 Accreditation Requirements

GRIN decided to adopt the following criteria in order to avoid the need for heavy organizational duties:

1. the quantity of data to be treated should be quite limited;
2. data should be easy to get and to check;
3. data should be already available at each site, as part of the usual public information provided to potential students
4. use a validation committee with external experts to validate the process

The GRIN quality accreditation is based on the verification of the fulfillment of a set of constraints on the programs.

The general guidelines to define the accreditation rules are as follows:

1. The percentage of courses in Informatics in the degree program has to be relevant.
2. The main areas of Informatics should be properly covered
3. The degree program should not be overly focused on a single area.
4. A proper level of adequate mathematical subjects has to be covered (since 2008)
5. There should be enough informatics professors as faculty members (since 2008)

Taking inspiration from the ACM-IEEE classification, the following 11 Informatics top-level areas of Informatics were identified:

A. Foundations
B. Algorithms
C. Programming
D. Computer Languages
E. Computer Architectures
F. Operating Systems
G. Data Bases
H. Network Computing
I. Software Engineering
J. Human Computer Interaction – Graphics - Multimedia
K. Knowledge Representation

The accreditation rules are defined in terms of credits (cfu), where one cfu corresponds to 25 hours of learning activities, including lectures, training, and individual study for the average student.

In order to be eligible for the GRIN quality accreditation mark, each University degree program in Informatics must satisfy the following constraints:

1. At least 78 cfu must be assigned to learning activities in Informatics or Informatics Engineering.
2. At least 60 cfu (out of the 78 above) must be assigned to learning activities in the 11 top-level areas

3. At least 7 top-level areas (out of the 11 listed in Fig.1) must be covered by at least 6 cfu.
4. At least 24 credits must be assigned to Mathematics:
    a. At least 6 to Calculus
    b. At least 6 to Geometry and Algebra
    c. At least 6 to Logics, Probability and Statistics, Numerical Analysis, Operational Research
5. At least 8 Informatics or Informatics Engineering professors must be fully assigned to the degree program (for the first program, then 6)

It is easy to verify that these rules strictly correspond to the five criteria presented above. The first rule guarantees that more than 1/3 of the program is specifically dedicated to Informatics topics; the rest of the credits should cover mathematical and physical foundations, more specialized topics, or complementary aspects (e.g., legal, economical, and ethical issues).

The second rule guarantees a good coverage of the main areas of Informatics: observe that credits assigned to the same area can be spread among different courses.

The third rule prevents from implementing degree programs whose scope is too narrow: at least half of the 11 areas must be properly covered, each of them by at least 48 hours of lectures.

The fourth rule provides the requirements for a proper coverage of Mathematical topics.

The fifth rule requires that enough professors of Informatics / Informatics Engineering are assigned to the degree program.

3.1.3 The supporting web application

Each year, the President of each Informatics degree program Management Committee ("*Consiglio di Corso di Laurea*") may apply for the GRIN quality accreditation by inserting in the accreditation web site (http://grin.informatica.uniroma2.it) the data concerning the activated curricula, and the syllabus of each course taught.

For each course in the degree program, the following information has to be provided:

1. total number of credits,
2. number of credits labelled as "Informatics", and corresponding top-level area
3. a brief description of the contents of each credit in the 11 top-level areas has to be inserted as well
4. assignment of each brief description to the sub-areas defined for each of the 11 top level areas (described in sub-section 3.1.5).

Observe that this data results in a system of comparable and transparent curricula that allows both the comparison of different curricula and student mobility. Three screenshots of the systems are depicted in Fig. 3 to Fig. 6.

3.1.4 Results for past years

The GRIN accreditation mark started with a pilot study in the academic year 2002-03, that was essential to create consensus in the community regarding the importance of the accreditation process.

Then, from 2004 the accreditation procedure is run every year, with the results shown below. Note that the new – stricter – accreditation criteria introduced in 2008 caused the reduction in the number of accredited degree programs:

- 2004: 39 certified out of 57 – 68% (univ. 31/39 – 79%)
- 2005: 42 certified out of 54 – 78% (univ. 35/42 – 83%)
- 2006: 44 certified out of 57 – 77% (univ. 37/42 – 88%)
- 2007: 45 certified out of 57 – 79% (univ. 38/43 – 88%)
- 2008: 39 certified out of 53 – 74% (univ. 32/42 – 76%)
- 2009: 39 certified out of 53 – 74% (univ. 32/42 – 76%)

Each degree program pays a fee of 200 Euros to get the accreditation mark. The money is used to run and manage the process and the web site.

3.1.5 The accreditation authority

The quality accreditation is issued by AICA, a accreditation authority that grants other Informatics accreditation marks like ECDL and EUCIP. It is important to notice that all the data about the certified courses are publicly available in the web: they offer the reader a complete and synoptic picture of the main academic degree programs in Informatics.

3.1.6 The sub-areas defined for each of the top-level area

In this section for each of the area the set of sub-areas defined for classifying the various credits assigned to a given course. The starred sub-areas are those GRIN considers essential with respect to the area and therefore suggest are preferentially covered in assigning credits to the area. But no check is executed on this.

A.	FOUNDATIONS
* ALF	Automata and Formal Languages
* CAL	Computability
* COM	Complexity
* SLP	Semantics of Programming Languages
TIC	Information Theory
L	Logics
SD	Dynamical Systems
V	Other Topics

B. ALGORITHMS	
* SDF	Fundamentals of Data Structures
* TAPA	Basic Techniques for Algorithm Analysis and Design
* A	Fundamentals of Algorithms
* ASC	Algorithms for Combinatorial Structures
TAA	Advanced Algorithmic Techniques
SDA	Advanced Data Structures
AD	Distributed Algorithms
AP	Parallel Algorithms
AN	Numerical Algorithms
V	Other Topics

C. PROGRAMMING	
* PSA	Problem Solving and Algorithms
* SS	Syntax and Semantics
* CB	Fundamentals of Programming Structures
* P	Procedures and Functions
* R	Recursion
* SDTD	Basic Data Structures and Abstract Data Types
* SCP	Program Development and Correctness
* POO	Object Oriented Programming
PP	Programming Paradigms
PPCC	Concurrent Programming
V	Other Topics

D. LANGUAGES	
* LF	Formal Languages
* S	Semantics
* MATR	Abstract Machines and Techniques for Implementing Programming Languages
* TTCI	Compilers and Intepreters
PLN	Programming Languages Paradigms
ALC	Linguistic Abstraction and Compositionality
MP	Programming Methodologies
TAV	Analysis and Verification Techniques
V	Other Topics

E. ARCHITECTURE	
* CCS	Combinatorial and Sequential Circuits
* AC	Computer Arithmetics
* LIS	Instruction Set Level
* LMP	Microprogramming Level
* ASS	Assembly Language
GM	Memory Management
GIO	Input/Output Management
VMP	Performance Evaluation and Optimization
AA	Advanced Architecture
V	Other Topics

F. OPERATING SYSTEMS	
* SC	Structure and Component of an Operating System
* GSP	Process Management and Synchronization
* GM	Memory Management
* FS	File System
* AMM	System Administration
GP	Peripheral Management
GCA	Access Control and Management
PS	System Programming
MA	Models and Architectures of Operating Systems
SAA	Operating Systems for Advanced Computing Architectures
V	Other Topics

G. DATA BASES	
* ML	Logical Models
* PC	Conceptual Design
* PL	Logical Design
* LI	Query Languages
* DBMS	Data Base Management Systems
LP	Data Base Programming Languages
NBD	Data Base Normalization
OFGI	Physical Organization and Query Processing
TCR	Transactions, Concurrency, and Recovery
BDA	Advanced Data Bases
V	Other Topics

H. NETWORK COMPUTING	
* FCD	Fundamentals of Distributed Computation
* ARTC	Computer Network Architectures
* PT	Protocols
* SR	Network Security
* MIR	Models for Interaction in Networks
SRM	Network Operating Systems and Network Programming Middleware
PASR	Application and Service Programming
GRC	Network Management
DR	Network Devices
V	Other Topics

I. SOFTWARE ENGINEERING	
* PSS	Software Development Processes
* LMS	Software Modeling Languages
* AR	Requirement Analysis
* ASW	Software Architecture
* PSC	Software Design and Coding
* TVV	Testing, Verification, and Validation
AS	Development Environment
MES	Software Maintenance and Evolution
EPGS	Economics of Software Production and Management
MSQ	Software Measurement and Quality
EPG	Ethical, Professional and Legal Issues
V	Other Topics

L. HUMAN COMPUTER INTERACTION, GRAPHICS AND MULTIMEDIA	
* MMPI	Models and Methods for Interaction Design
* PMTV	Principles, Methods and Techniques for Interface Evalution
* IMW	Hypertexts, Multimedia and WWW
TMI	Human-Computer Interaction: Theories and Models
PIRV	Interaction Paradigms and Virtual Reality
SIAS	Interaction Support System and Development Environment
MG	Geometrical Modelling
RV	Rendering and Visualization
ESM	Multimedia Signal Processing
V	Other Topics

M. KNOWLEDGE REPRESENTATION	
* RP	Problem Representation
* SBC	Knowledge-Based Systems
* LPD	Logics and Declarative Programming
ARC	Knowledge Acquisition and Representation
AI	Intelligent Agents
RA	Automated Reasoning
AASC	Automated Learning and Knowledge Discovery
BC	Knowledge Bases
AIA	Artificial Intelligence Application
V	Other Topics

3.2 The GII effort for quality of Informatics Engineering degree programs

GII, the Italian Association of Informatics Engineering University Professors (http://gii.consorzio-cini.it) has followed an approach to quality of degree program different from GRIN's. In fact, the significant differences among Engineering schools in Italy in terms of both faculty numbers and specialization suggest to adopt the approach followed by the Joint Task Force on Computer Engineering Curricula formed by the IEEE Computer Society and by the Association for Computing Machinery in the definition of the Curriculum Guidelines for Undergraduate Degree Programs in Computer Engineering. The approach is based on the definition a set of minimum knowledge

requirements ("*saperi minimi*"), that is a set of those concepts that are the core of any bachelor degree in Informatics Engineering.

This set of requirements identifies four reference areas for the curriculum of a bachelor degree in informatics engineering and provides their relative importance in the overall curriculum:

AREA	Weight	Credits
Informatics Engineering Disciplines	40%	72
Scientific Disciplines	25%	45
Engineering Disciplines	25%	45
Complementary Disciplines (Soft Skills)	10%	18

Then, for each area the overall number of credits is partitioned between core subjects and elective subjects. The rationale is that during hours assigned to core subjects the same set of knowledge elements should be covered in all degree programs, while the single degree programs can specialize their program providing during hours assigned to elective subjects the set of knowledge elements best matching their specific background and specialization. In the table below there is the assignment of credits for each area to core and elective subjects.

AREA	Core Credits	Elective Credits
Informatics Engineering Disciplines	43,2	28,8
Scientific Disciplines	27,0	18,0
Engineering Disciplines	18,0	27,0
Complementary Disciplines (Soft Skills)	7,2	10,8

Consider that the 25 working hours of each credit are distributed in 8 hours of lecture, 8 hours of hands-on experience (assisted learning), and 9 hours of individual study. Then, here is the assignment in terms of hours, without differentiating between lecture and hands-on experience:

AREA	Core Hours	Elective Hours
Informatics Engineering Disciplines	691,2	460,8
Scientific Disciplines	432,0	288,0
Engineering Disciplines	288,0	432,0
Complementary Disciplines (Soft Skills)	115,2	172,8

Subsequently, the document identifies for each of the four areas the specific sub-areas to be covered and how hours corresponding to credits are distributed among core and elective subjects:

Informatics Engineering Disciplines			
Sub-Area Code	Sub-Area Name	Core Hours	Elective Hours
INF-AI	Artificial Intelligence	22	26
INF-APP	Applications	24	16
INF-CAO	Computer Architecture and Organization	58	64
INF-CSE	Computer Systems Engineering	20	18
INF-CSF	Computer Science Fundamentals	50	12
INF-DB	Databases	40	42
INF-DSD	Digital System Design	50	86
INF-HCI	Human-Computer Interaction	12	26
INF-IAW	Internet Applications and Web	38	30
INF-ISE	Information Security	8	26
INF-ISY	Information Systems	8	12
INF-NAR	Network Architectures	26	18
INF-OS	Operating Systems	26	14
INF-PRO	Programming	86	32
INF-SE	Software Engineering	56	44
INF-DIS	Distributed Systems	0	18
INF-GRA	Computer Graphic	0	24
INF-MCW	Mobile computing and wireless	0	10
INF-MMS	Multimedia Systems	0	24
INF-VIS	Computer Vision	0	22

Scientific Disciplines			
Sub-Area Code	Sub-Area Name	Core Hours	Elective Hours
BAS-DMA	Discrete Mathematics	24	0
BAS-LOG	Logic	16	28
BAS-MAT	Mathematics and Modeling in Science and Technology	120	45
BAS-MEA	Measurement Theory	22	0
BAS-OPR	Operation Research	54	0
BAS-PHY	Physics	86	36
BAS-PRS	Probability and Statistic for Computer Engineering	18	12
BAS-CHE	Chemistry	0	42

Engineering Disciplines			
Sub-Area Code	Sub-Area Name	Core Hours	Elective Hours
ING-AUC	Automatic Control	48	22
ING-CIR	Circuit Theory	30	12
ING-COM	Communications	48	22
ING-ELN	Electronics	50	0
ING-EPM	Economics, Planning, and Management for ICT	52	16
ING-ELM	Electromagnetics	0	22
ING-IRO	Industrial Robotics	0	28
ING-MEA	Measurement Instrumentation for Computer Engineering	0	18

Complementary Disciplines (Soft Skills)			
Sub-Area Code	Sub-Area Name	Core Hours	Elective Hours
INT-ELI	Ethical and Legal aspects	12	0
INT-LAN	Foreign Language	52	0
INT-PRE	Technical presentations	20	0
INT-MAN	Group management and cooperative working	0	16

Finally, for each of the sub-areas the document provides a further decomposition in the terms of a set of fine-grained subjects to be covered in the core or elective hours. Most of subjects refers to few hours (tipically, 2 to 4) but to some of them 10 to 20 hours are assigned.

The full document, called Body of Knowledge (BoK) – Curriculum Guidelines for the Italian "Laurea in Ingegneria Informatica"can be consulted at the following address

http://gii.consorzio-cini.it/sites/default/files/GII%20-%20BoK%20-%20Vers%201-01.pdf

GII has not implemented any mechanism or procedure for checking whether a bachelor degree program is compliant or not with the defined guidelines.

3.3 Comparison requirement by requirement

The document Euro-Inf Framework Standards and Accreditation list 26 Requirements (the "boxes" in the column named "Requirements" in the table, partitioned in 5 Categories and 14 Criteria, to be considered in the accreditation procedure. Some requirements are expressed in terms of a single questions, for others there are more questions (up to seven) In the following the requirements are compared to the GRIN accreditation procedure.

A general remark that the Executive Committee of GRIN expressed after a consultation of the committees managing the informatics bachelor degree programs in Italian universities is the following:

> To properly prepare the report for the Euro-Inf accreditation visit is a task estimated in about 200 person/hours of a skilled person in teaching organization and management. Given the

current financial situation of Italian universities, very few degree programs can manage to deploy such an effort (it has to be noted that for the *Bollino GRIN* of 2009 there have been some degree programs finding it difficult to pay even the small fee of 200 Euros). This would leave out from the EQANIE accreditation process many degree programs that are certainly good, but that cannot apply just for monetary reasons. Hence the GRIN Executive Committee asks to EQANIE to consider also a "staged-approach" for accreditation, where a degree program can apply for accreditation for some, but not all, the categories of requirements.

The 5 Categories organizing the criteria and requirements for EQANIE accreditation procedure are:

1. Needs, Objectives, and Outcomes
2. Educational Process
3. Resources and Partnerships
4. Assessment of Educational Process
5. Management System

For each category the specific criteria and requirements are now compared to the GRIN accreditation procedure

3.3.1 Needs, Objectives, and Outcomes

This category contains 3 criteria:

1. Needs of the Stakeholder

   One requirement has to be considered for this criterion, and it is not analyzed by the GRIN accreditation procedure.

2. Educational Objectives

   One requirement has to be considered for this criterion. It is a complex one with six questions. The one dealing with the transparency and publicity of the program educational objectives is implicitly considered by the GRIN accreditation procedure, since a degree program asking to receive the *Bollino GRIN* has to describe its degree program. Also the one dealing with having used national standard is implicitly addressed

3. Programme Outcomes

   Two requirements have to be considered for this criterion. The one dealing with the proper coverage of the program outcomes specified in the Euro-Inf Standards for accreditation is implicitly addressed by the criteria used in the *Bollino GRIN*.

3.3.2 Educational Process

This category contains 3 criteria:

1. Planning

One requirement has to be considered for this criterion. It is a complex one with seven questions. The ones addressing curriculum adequacy and educational level are implicitly addressed by the criteria used in the *Bollino GRIN*.

2. Delivery

   Two requirements have to be considered for this criterion. None of them is considered for the GRIN accreditation procedure.

3. Learning Assessment

   One requirement has to be considered for this criterion. It is not considered for the GRIN accreditation procedure.

3.3.3 Resources and Partnerships

This category contains 4 criteria:

1. Academic and Support Staff

   Two requirements have to be considered for this criterion. The first one is partially addressed in the GRIN accreditation procedure by the criterion asking for a given number of Informatics or Informatics Engineering professors which are faculty members.

2. Learning Environment

   Four requirements have to be considered for this criterion. None of them is considered for the GRIN accreditation procedure.

3. Financial Resources

   One requirement has to be considered for this criterion. It is not considered for the GRIN accreditation procedure.

4. Partnerships

   One requirement has to be considered for this criterion. It is not considered for the GRIN accreditation procedure.

3.3.4 Assessment of Educational Process

This category contains 2 criteria:

1. Students

   Two requirements have to be considered for this criterion. None of them is considered for the GRIN accreditation procedure, but it is a requirement established by national regulations that students' knowledge is tested when enrolling to the university and students are given feedback on their results.

2. Graduates

Two requirements have to be considered for this criterion. None of them is considered for the GRIN accreditation procedure.

3.3.5 Management System

This category contains 2 criteria:

1. Organization and Decision Making Processes

   One requirement has to be considered for this criterion. It is not considered for the GRIN accreditation procedure.

2. Quality Assurance System

   Three requirements have to be considered for this criterion. None of them is considered for the GRIN accreditation procedure.

4 APPENDIX A: Existing Higher Education programs in Informatics in Italy

In this Appendix we list degree programs in Informatics existing in Italy in the academic year 2009/2010, divided by their Class, according to the organization explained in section 2.1.

Please take into account that the reform of years 2004-2007 changed also the numbering of classes and some programs with the old numbering schema still exist. These programs are listed in a separate paragraph inside each subsection, without further explanation, since they all are transforming to satisfy the new numbering schema.

For each degree program are listed, in the following order and following the name of the university

1. Web site of the University
2. Name of the degree and city where it is hosted (some university are spread over more than one city)
3. Web site of the degree program

4.1.1 Bachelor degrees in Informatics (Class L-31 – "Scienze e Tecnologie Informatiche")

There are 46 degree programs in 31 Universities

Università degli Studi di Bari

1. http://www.uniba.it
2. Informatica, BRINDISI
3. http://informatica.uniba.it/laurea_inf_brindisi/index.htm

Università degli Studi di Bari

1. http://www.uniba.it
2. Informatica, BARI
3. http://informatica.uniba.it/laurea_informatica3/index.htm

Università degli Studi di Bari

1. http://www.uniba.it
2. Informatica e Comunicazione Digitale, TARANTO
3. http://informatica.uniba.it/laurea_dig_taranto/index.htm

Università degli Studi di Bari

1. http://www.uniba.it
2. Informatica e Comunicazione Digitale, BARI
3. http://informatica.uniba.it/laurea_digitale3/index.htm

Università degli Studi di Bari

1. http://www.uniba.it
2. Informatica e Tecnologie per la Produzione del Software, BARI
3. http://informatica.uniba.it/laurea_produzione3/index.htm

Università degli Studi di Bologna

1. http://www.unibo.it
2. Informatica, BOLOGNA
3. http://www.scienze.unibo.it/Scienze+Matematiche/Didattica/Lauree/2009/PaginaCorso20098009.htm

Università degli Studi di Bologna

1. http://www.unibo.it
2. Informatica per il Management, BOLOGNA
3. http://www.scienze.unibo.it/Scienze+Matematiche/Didattica/Lauree/2009/PaginaCorso20098014.htm

Università degli Studi di Bologna

1. http://www.unibo.it
2. Scienze e Tecnologie Informatiche, CESENA
3. http://www.scienze.unibo.it/Scienze+Matematiche/Didattica/Lauree/2009/PaginaCorso20098013.htm

Università degli Studi di Cagliari

1. http://www.unica.it
2. Informatica, CAGLIARI
3. http://informatica.unica.it/

Università della Calabria

1. http://www.unical.it
2. Informatica, RENDE
3. http://www.mat.unical.it/informatica

Università degli Studi di Camerino

1. http://www.unicam.it/
2. Informatica, ASCOLI PICENO, CAMERINO
3. http://www.cs.unicam.it

Università degli Studi di Catania

1. http://www.unict.it
2. Informatica, CATANIA
3. http://www.dmi.unict.it/informatica/

Università degli Studi di Firenze

1. http://www.unifi.it
2. Informatica, FIRENZE
3. http://www.scienze.unifi.it

Università degli studi di Genova

1. http://www.unige.it
2. Informatica, GENOVA
3. http://dida.disi.unige.it/

Università degli Studi dell'Aquila

1. http://www.univaq.it
2. Informatica, L'AQUILA
3. http://informatica.univaq.it/

Università degli Studi di Messina

1. http://www.unime.it
2. Informatica, MESSINA
3. http://informatica.unime.it/

Università degli Studi di Milano

1. http://www.unimi.it
2. Comunicazione Digitale, MILANO
3. http://www.scienzemfn.unimi.it/

Università degli Studi di Milano

1. http://www.unimi.it
2. Informatica, MILANO
3. http://www.scienzemfn.unimi.it/

Università degli Studi di Milano

1. http://www.unimi.it
2. Informatica (Polo di Crema), CREMA
3. http://www.scienzemfn.unimi.it/

Università degli Studi di Milano

1. http://www.unimi.it
2. Informatica Musicale, MILANO
3. http://www.scienzemfn.unimi.it/

Università degli Studi di Milano

1. http://www.unimi.it
2. Sicurezza dei Sistemi e delle Reti Informatiche, MILANO
3. http://www.scienzemfn.unimi.it/

Università degli Studi di Milano

1. http://www.unimi.it
2. Sicurezza dei Sistemi e delle Reti Informatiche, CREMA
3. http://www.scienzemfn.unimi.it/

Università degli Studi di Milano - Bicocca

1. http://www.unimib.it
2. Informatica, MILANO
3. http://www.disco.unimib.it

Università degli Studi di Modena e Reggio Emilia

1. http://www.unimo.it
2. Informatica, MODENA
3. http://informatica.scienze.unimo.it

Università degli Studi del Molise

1. http://www.unimol.it
2. Informatica, ISERNIA
3. http://www.unimol.it

Università degli Studi di Napoli

1. http://www.unina.it
2. Corso di Laurea in Informatica, NAPOLI
3. http://informatica.dsf.unina.it/

Università degli Studi di NAPOLI Parthenope

1. http://www.uninav.it
2. Informatica, NAPOLI
3. http://informatica.uniparthenope.it

Università degli Studi di Padova

1. http://www.unipd.it
2. Informatica, PADOVA
3. http://informatica.scienze.unipd.it/2009/laurea

Università degli Studi di Palermo

1. http://www.unipa.it
2. Informatica, PALERMO
3. http://www.cs.unipa.it

Università degli Studi di Parma

1. http://www.unipr.it
2. Informatica, PARMA
3. http://informatica.unipr.it

Università degli Studi di Perugia

1. http://www.unipg.it
2. Informatica, PERUGIA
3. http://informatica.unipg.it

Università degli Studi del Piemonte Orientale "Amedeo Avogadro"

1. http://www.unipmn.it
2. Informatica, ALESSANDRIA
3. http://www.mfn.unipmn.it/Informazioni/Offerta/default.aspx?DisplayAll=|147|

Università degli Studi di Pisa

1. http://www.unipi.it
2. Informatica, PISA
3. http://www.di.unipi.it/didattica

Università degli Studi di Pisa

1. http://www.unipi.it
2. Informatica Applicata, LA SPEZIA
3. http://www.di.unipi.it/didattica

Università degli Studi di Roma "La Sapienza"

1. http://www.uniroma1.it
2. Informatica, ROMA
3. http://w3.uniroma1.it/dipinfo/corsi_di_studio/default.asp

Università degli Studi di Roma "Tor Vergata"

1. http://www.uniroma2.it
2. Informatica, ROMA
3. http://www.informatica.uniroma2.it

Università degli Studi di Salerno

1. http://www.unisa.it
2. Informatica, FISCIANO
3. http://www3.unisa.it/facolta/scienze_mmffnn/offerta_formativa/lauree/laurea_inf

Università degli Studi di Salerno

1. http://www.unisa.it
2. Informatica Applicata, FISCIANO
3. http://www3.unisa.it/facolta/scienze_mmffnn/offerta_formativa/lauree/laurea_inf_app

Università degli Studi di Siena

1. http://www.unisi.it
2. Informatica, SIENA
3. http://www.mat.unisi.it/newsito/didattica.php

Università degli studi di Torino

1. http://www.unito.it
2. Informatica, TORINO
3. http://www.educ.di.unito.it

Università degli Studi di Trento

1. http://www.unitn.it
2. Informatica, TRENTO
3. http://portale.unitn.it/scienze/presCDS.do?channelId=-12833&channel2Id=-16571&yyAcc=2008&tipo_corso='L2','LC5','LM5'&cdsId=10114&yyOrd=2008

Università degli Studi di Udine

1. http://www.uniud.it
2. Informatica, UDINE
3. http://www.uniud.it/didattica/facolta/scienze/informatica-1

Università degli Studi di Udine

1. http://www.uniud.it
2. Tecnologie Web e Multimediali, UDINE
3. http://www.uniud.it/didattica/facolta/scienze/tecnologie-web-e-multimediali

Università degli Studi "Ca' Foscari" di Venezia

1. http://www.unive.it
2. Informatica, VENEZIA
3. http://www.unive.it/nqcontent.cfm?a_id=51924

Università degli Studi di Verona

1. http://www.univr.it
2. Bioinformatica, VERONA
3. http://www.scienze.univr.it/fol/main

Università degli Studi di Verona

1. http://www.univr.it
2. Informatica, VERONA
3. http://www.scienze.univr.it/fol/main

4.1.1.1 Old Numbering Schema:

There exists also the following 6 bachelor degree programs with the old numbering schema (Class 26) in 5 universities.

Università degli Studi della Basilicata

1. http://www.unibas.it
2. Informatica, POTENZA
3. http://www.informatica.unibas.it/informatica

Libera Università degli Studi di Bolzano

1. http://www.unibz.it
2. Informatica Applicata, BOLZANO
3. http://www.unibz.it/en/inf/progs/bacs/default.html

Università degli Studi di Ferrara

1. http://www.unife.it
2. Informatica, FERRARA
3. http://www.unife.it/scienze/informatica

Università degli Studi dell' Insubria

1. http://www.uninsubria.it
2. Informatica, VARESE
3. http://www.uninsubria.it/url/scienze-varese/lt-info

Università degli Studi dell' Insubria

1. http://www.uninsubria.it
2. Scienze e Tecnologie dell'Informazione, COMO
3. http://www.uninsubria.it/url/scienze-como/lt-sti

Università degli Studi di Urbino

1. http://www.uniurb.it
2. Informatica Applicata, URBINO
3. http://www.sti.uniurb.it/info_appl_liv1/

4.1.2 Bachelor degrees in Informatics Engineering in the class of Information Engineering bachelor degree (Class L-8 – "*Ingegneria dell'Informazione*")

This class contains all engineering bachelor degree dealing with "information" in a generic sense. Therefore one can find Electricity/Electronic degrees, or Biomedicine degrees, or Telecommunications degrees, or Managerial degrees (and still others). Hence we list here only those degrees having at least the word "*Informatica*" in their name, even if sometimes the degree is a mixed one (e.g. Informatics and Telecommunications): there are 31 of them in 29 Universities.

Politecnica delle Marche

1. http://www.univpm.it/
2. Ingegneria Informatica e dell'Automazione, ANCONA
3. http://e-ntrasites.univpm.it/Ingegneria/Engine/RAServePG.php/P/262720020207

Politecnico di Bari

1. http://www.poliba.it
2. Ingegneria Informatica e dell'Automazione, BARI
3. http://www.poliba.it

Università degli Studi di Bergamo

1. http://www.unibg.it
2. Ingegneria Informatica, DALMINE
3. http://WWW.UNIBG.IT/LT-II

Università degli Studi di Bologna

1. http://www.unibo.it
2. Ingegneria Elettronica, Informatica e Telecomunicazioni, CESENA
3. http://www.unibo.it/Ingegneria+Cesena/Didattica/Lauree/2009/PaginaCorso20098196.htm

Università degli Studi di Bologna

1. http://www.unibo.it
2. Ingegneria Informatica, BOLOGNA
3. http://www.unibo.it/Ingegneria/Didattica/Lauree/2009/PaginaCorso20090926.htm

Università degli Studi di Brescia

1. http://www.unibs.it
2. Ingegneria Informatica, BRESCIA
3. http://www.ing.unibs.it/offertaformativa

Università della Calabria

1. http://www.unical.it
2. Ingegneria Informatica, RENDE
3. http://www.ingegneria.unical.it/cdl/inf

Università degli Studi di Cassino

1. http://www.unicas.it
2. Ingegneria Informatica e delle Telecomunicazioni, CASSINO
3. http://www.telecomunicazioni.unicas.it

Università degli Studi di Ferrara

1. http://www.unife.it
2. Ingegneria dell'Informazione (Automazione, Elettronica, Informatica, Telecomunicazioni), FERRARA
3. http://www.unife.it/ing/informazione

Università degli Studi di Firenze

1. http://www.unifi.it
2. Ingegneria Informatica, FIRENZE
3. http://inginf.dsi.unifi.it

Università degli studi di Genova

1. http://www.unige.it
2. Ingegneria Informatica, GENOVA
3. http://www.informatica.ingegneria.unige.it/

Università degli Studi dell'Aquila

1. http://www.univaq.it
2. Ingegneria Informatica e Automatica, L'AQUILA
3. http://www.ing.univaq.it

Università degli Studi di Messina

1. http://www.unime.it
2. Ingegneria Elettronica e Informatica, MESSINA
3. http://ww2.unime.it/ingegneria/new/

Politecnico di Milano

1. http://www.polimi.it
2. Ingegneria Informatica, COMO, CREMONA, MILANO
3. http://www.inginf.polimi.it/

Università degli Studi di Modena e Reggio Emilia

1. http://www.unimo.it
2. Ingegneria Informatica, MODENA
3. https://www.ing.unimo.it/L/IngInf

Università degli Studi di Napoli

1. http://www.unina.it
2. Corso di Laurea in Ingegneria Informatica, NAPOLI
3. http://www.ingegneria.unina.it

Seconda Università degli Studi di Napoli

1. http://www.unina2.it
2. Ingegneria Elettronica e Informatica, AVERSA
3. http://www.CdCInformazione.unina2.it

Università degli Studi di Padova

1. http://www.unipd.it
2. Ingegneria Informatica, PADOVA
3. http://www.ing.unipd.it/IFt270

Università degli Studi di Palermo

1. http://www.unipa.it
2. Ingegneria Informatica, AGRIGENTO
3. http://corsi.dinfo.unipa.it

Università degli Studi di Palermo

1. http://www.unipa.it
2. Ingegneria Informatica e delle Telecomunicazioni, PALERMO
3. http://corsi.dinfo.unipa.it

Università degli Studi di Parma

1. http://www.unipr.it
2. Ingegneria Informatica, PARMA
3. http://ingegneria.unipr.it/2010/ing-informatica

Università degli Studi di Pavia

1. http://www.unipv.it
2. Ingegneria Informatica, PAVIA
3. http://www-1.unipv.it/ingegneria/orientamento/triennali.php

Università degli Studi di Perugia

1. http://www.unipg.it
2. Ingegneria Informatica ed Elettronica, PERUGIA
3. http://www.ing-inf.unipg.it/

Università degli Studi di Pisa

1. http://www.unipi.it
2. Ingegneria Informatica, PISA
3. http://www.ing.unipi.it

Università degli Studi di Roma "La Sapienza"

1. http://www.uniroma1.it
2. Ingegneria Informatica e Automatica, ROMA
3. http://cclii.dis.uniroma1.it/

Università degli Studi di Roma "Tor Vergata"

1. http://www.uniroma2.it
2. Ingegneria Informatica, ROMA
3. http://inginformatica.uniroma2.it

Università degli Studi Roma Tre

1. http://www.uniroma3.it
2. Ingegneria Informatica, ROMA
3. http://www.uniroma3.it/schedaCds08.php?cds=108601&facolta=108

Università degli Studi di Salerno

1. http://www.unisa.it
2. Ingegneria Informatica, FISCIANO
3. http://www.adinf.unisa.it

Università degli Studi del Sannio

1. http://www.unisannio.it
2. Ingegneria Informatica, BENEVENTO
3. http://www.ing.unisannio.it

Università degli Studi di Siena

1. http://www.unisi.it
2. Ingegneria Informatica e dell'Informazione, SIENA
3. http://www.ing.unisi.it

Universita Telematica GUGLIELMO MARCONI

1. http://www.unimarconi.it
2. Ingegneria Informatica, ROMA
3. http://www.unimarconi.it

4.1.2.1 Old Numbering Schema:

There exists also the following 5 master degree programs with the old numbering schema (Class 9) in 5 universities.

Università degli Studi di Catania

1. http://www.unict.it
2. Ingegneria Informatica, CATANIA
3. http://www.ing.unict.it

Università degli Studi di Catanzaro "Magna Grecia"

1. http://www.unicz.it
2. Ingegneria Informatica e Biomedica, CATANZARO
3. http://www.unicz.it/portale/corsi_laurea.asp

Politecnico di Torino

1. http://www.polito.it
2. Ingegneria Informatica, TORINO, VERRES
3. http://didattica.polito.it/pls/portal30/sviluppo.offerta_formativa.corsi_gen?p_sdu_cds=37:206&p_a_acc=2010&p_header=N&p_lang=IT&p_tipo_cds=1

Università telematica internazionale UNINETTUNO

1. http://www.uninettuno.it/nettuno/index.htm
2. Ingegneria Informatica , ROMA
3. http://www.uninettunouniversity.net

Universita telematica e-Campus

1. www.uniecampus.it
2. Corso di Laurea in Ingegneria Informatica, NOVEDRATE
3. http://www.uniecampus.it/facolta/facolta-e-corsi-di-laurea/ingegneria-informatica/index.html

4.1.3 Master degrees in Informatics (Class LM-18 – "*Informatica*")

There are 29 degree programs in 25 Universities.

Università degli Studi di Bari

1. http://www.uniba.it
2. Informatica, BARI
3. http://informatica.uniba.it/laurea_magistrale/index.htm

Università degli Studi di Bologna

1. http://www.unibo.it
2. Informatica, BOLOGNA
3. http://www.scienze.unibo.it/Scienze+Matematiche/Didattica/LaureeMagistrali/2009/PaginaCorso20098028.htm

Università degli Studi di Bologna

1. http://www.unibo.it
2. Scienze e Tecnologie Informatiche, CESENA
3. http://www.scienze.unibo.it/Scienze+Matematiche/Didattica/LaureeMagistrali/2009/PaginaCorso20098030.htm

Libera Università degli Studi di Bolzano

1. http://www.unibz.it
2. Informatica, BOLZANO
3. http://www.unibz.it/en/inf/progs/mcs/default.html

Università della Calabria

1. http://www.unical.it
2. Informatica, RENDE
3. http://www.mat.unical.it/informatica

Università degli Studi di Camerino

1. http://www.unicam.it/
2. Computer Science, CAMERINO
3. http://www.cs.unicam.it

Università degli Studi di Catania

1. http://www.unict.it
2. Informatica, CATANIA
3. http://www.dmi.unict.it/informatica/

Università degli Studi di Ferrara

1. http://www.unife.it
2. Informatica, FERRARA
3. http://www.unife.it/scienze/ls.informatica

Università degli Studi di Firenze

1. http://www.unifi.it
2. Informatica, FIRENZE
3. http://www.scienze.unifi.it

Università degli Studi dell'Aquila

1. http://www.univaq.it
2. Informatica, L'AQUILA
3. http://informatica.di.univaq.it/

Università degli Studi di Messina

1. http://www.unime.it
2. Informatica, MESSINA
3. http://informatica.unime.it/

Università degli Studi di Milano

1. http://www.unimi.it
2. Informatica, CREMA, MILANO
3. http://www.scienzemfn.unimi.it/

Università degli Studi di Milano

1. http://www.unimi.it
2. Informatica per la Comunicazione, MILANO
3. http://www.scienzemfn.unimi.it/

Università degli Studi di Milano - Bicocca

1. http://www.unimib.it
2. Informatica, MILANO
3. http://www.disco.unimib.it

Università degli Studi di Napoli

1. http://www.unina.it
2. Corso di Laurea Magistrale in Informatica, NAPOLI
3. http://informatica.dsf.unina.it/

Università degli Studi di NAPOLI Parthenope

1. http://www.uninav.it
2. Informatica Applicata, NAPOLI
3. http://informatica.uniparthenope.it

Università degli Studi di Padova

1. http://www.unipd.it
2. Informatica, PADOVA
3. http://informatica.scienze.unipd.it/2009/laurea_magistrale

Università degli Studi di Palermo

1. http://www.unipa.it
2. Scienze dell 'Informazione, PALERMO
3. http://www.cs.unipa.it

Università degli Studi di Perugia

1. http://www.unipg.it
2. Informatica, PERUGIA
3. http://www.informatica.unipg.it

Università degli Studi del Piemonte Orientale "Amedeo Avogadro"

1. http://www.unipmn.it
2. Informatica, ALESSANDRIA
3. http://www.mfn.unipmn.it/Informazioni/Offerta/default.aspx?DisplayAll=|147|

Università degli Studi di Pisa

1. http://www.unipi.it
2. Informatica, PISA
3. http://www.di.unipi.it

Università degli Studi di Pisa

1. http://www.unipi.it
2. Informatica e Networking, PISA
3. http://www.di.unipi.it

Università degli Studi di Pisa

1. http://www.unipi.it
2. Informatica per L'Economia e per L'Azienda (Business Informatics), PISA
3. http://compass2.di.unipi.it/didattica/

Università degli Studi di Roma "Tor Vergata"

1. http://www.uniroma2.it
2. Informatica, ROMA
3. http://www.informatica.uniroma2.it/index.htm

Università degli studi di Torino

1. http://www.unito.it
2. Informatica, TORINO
3. http://www.educ.di.unito.it

Università degli Studi di Trento

1. http://www.unitn.it
2. Informatica, TRENTO
3. http://portale.unitn.it/scienze/presCDS.do?channelId=-12833&channel2Id=-16890&yyAcc=2008&tipo_corso='LS','LM'&cdsId=10117&yyOrd=2008

Università degli Studi di Trieste

1. http://www.units.it
2. Informatica, TRIESTE
3. http://www.dmi.units.it/informatica/

Università degli Studi "Ca' Foscari" di Venezia

1. http://www.unive.it
2. Informatica, VENEZIA
3. http://www.unive.it/nqcontent.cfm?a_id=53063

Università degli Studi di Verona

1. http://www.univr.it
2. Ingegneria e Scienze Informatiche, VERONA
3. http://www.scienze.univr.it/fol/main

4.1.3.1 Old Numbering Schema:

There exists also the following 7 master degree programs with the old numbering schema (Class 23/S) in 6 universities.

Università degli Studi di Cagliari

1. http://www.unica.it
2. Tecnologie Informatiche, CAGLIARI
3. http://informatica.unica.it

Università degli studi di Genova

1. http://www.unige.it
2. Informatica, GENOVA
3. http://dida.disi.unige.it

Università degli Studi dell' Insubria

1. http://www.uninsubria.it
2. Laurea Specialistica in Informatica, VARESE
3. http://www.uninsubria.it/url/scienze-varese/lt-info

Università degli Studi di Roma "La Sapienza"

1. http://www.uniroma1.it
2. Informatica, ROMA
3. http://www.uniroma1.it/dipinfo/lauree/index.asp

Università degli Studi di Salerno

1. http://www.unisa.it
2. Informatica, FISCIANO
3. http://www3.unisa.it/facolta/scienze_mmffnn/offerta_formativa/lauree/laurea_inf_sp

Università degli Studi di Udine

1. http://www.uniud.it
2. Informatica, UDINE
3. http://www.uniud.it/didattica/facolta/scienze/informatica-SP

Università degli Studi di Udine

1. http://www.uniud.it
2. Tecnologie dell'Informazione , UDINE
3. http://www.uniud.it/didattica/facolta/scienze/tecnologie_dell'informazione-SP

4.1.4 Master degrees in Informatics Engineering (Class LM-32 – "*Ingegneria Informatica*")

There are 25 degree programs in 21 Universities

Politecnica delle Marche

1. http://www.univpm.it/
2. Ingegneria Informatica, ANCONA
3. http://e-ntrasites.univpm.it/Ingegneria/Engine/RAServePG.php/P/262720020207

Università degli Studi della Basilicata

1. http://www.unibas.it
2. Ingegneria Informatica e delle Tecnologie dell'Informazione, POTENZA
3. http://www.ing.unibas.it

Università degli Studi di Bologna

1. http://www.unibo.it
2. Ingegneria Informatica, CESENA
3. http://www.unibo.it/Ingegneria+Cesena/Didattica/LaureeMagistrali/2009/PaginaCorso20098200.htm

Università degli Studi di Bologna

1. http://www.unibo.it
2. Ingegneria Informatica, BOLOGNA
3. http://www.unibo.it/Ingegneria/Didattica/LaureeMagistrali/2009/PaginaCorso20090937.htm

Università degli Studi di Firenze

1. http://www.unifi.it
2. Ingegneria Informatica, FIRENZE
3. http://inginf.dsi.unifi.it

Università degli studi di Genova

1. http://www.unige.it
2. Ingegneria Informatica, GENOVA
3. http://www.informatica.ingegneria.unige.it/

Università degli studi di Genova

1. http://www.unige.it
2. Robotics Engineering, GENOVA
3. http://www.robotics.ingegneria.unige.it

Università degli Studi dell'Aquila

1. http://www.univaq.it
2. Ingegneria Informatica e Automatica, L'AQUILA
3. http://www.ing.univaq.it

Università degli Studi di Lecce

1. http://www.unile.it
2. Ingegneria Informatica, LECCE
3. http://www.ing.unile.it

Università degli Studi di Modena e Reggio Emilia

1. http://www.unimo.it
2. Ingegneria Informatica, MODENA
3. https://www.ing.unimo.it/LM/IngInf

Seconda Università degli Studi di Napoli

1. http://www.unina2.it
2. Ingegneria Informatica, AVERSA
3. http://www.ingegneria.unina2.it

Università degli Studi di Padova

1. http://www.unipd.it
2. Ingegneria Informatica, PADOVA
3. http://www.ing.unipd.it/IFm270

Università degli Studi di Palermo

1. http://www.unipa.it
2. Ingegneria Informatica, PALERMO
3. http://corsi.dinfo.unipa.it

Università degli Studi di Parma

1. http://www.unipr.it
2. Ingegneria Informatica, PARMA
3. http://ingegneria.unipr.it/2010/ing-informatica/magistrale

Università degli Studi di Perugia

1. http://www.unipg.it
2. Ingegneria Informatica e dell'Automazione, PERUGIA
3. http://www.ing-inf.unipg.it

Università degli Studi di Roma "La Sapienza"

1. http://www.uniroma1.it
2. Ingegneria Informatica, ROMA
3. http://cclii.dis.uniroma1.it

Università degli Studi di Roma "La Sapienza"

1. http://www.uniroma1.it
2. Intelligenza Artificiale e Robotica, ROMA
3. http://www.dis.uniroma1.it/~airo

Università degli Studi di Roma "Tor Vergata"

1. http://www.uniroma2.it
2. Ingegneria Informatica, ROMA
3. http://inginformatica.uniroma2.it

Università degli Studi Roma Tre

1. http://www.uniroma3.it
2. Ingegneria Gestionale e dell'Automazione, ROMA
3. http://www.uniroma3.it/schedaCds08.php?cds=108654&facolta=108

Università degli Studi Roma Tre

1. http://www.uniroma3.it
2. Ingegneria Informatica, ROMA
3. http://www.uniroma3.it/schedaCds08.php?cds=108655&facolta=108

Università degli Studi di Salerno

1. http://www.unisa.it
2. Ingegneria Informatica, FISCIANO
3. http://www.adinf.unisa.it

Università degli Studi di Siena

1. http://www.unisi.it
2. Ingegneria Informatica, SIENA
3. http://www.ing.unisi.it/

Università degli Studi di Trieste

1. http://www.units.it
2. Informatica, TRIESTE
3. http://www.dmi.units.it/informatica/

Università degli Studi di Verona

1. http://www.univr.it
2. Ingegneria e Scienze Informatiche, VERONA
3. http://www.scienze.univr.it/fol/main

Universita Telematica GUGLIELMO MARCONI

1. http://www.unimarconi.it
2. Ingegneria Informatica, ROMA
3. http://www.unimarconi.it

4.1.4.1 Old Numbering Schema:

There exists also the following 18 master degree programs with the old numbering schema (Class 35/S) in 14 universities.

Politecnico di Bari

1. http://www.poliba.it
2. Corso di Laurea Specialistica in Ingegneria Informatica, BARI
3. http://www.ingbari.poliba.it/ingbari/Didattica/CORSI%20DI%20LAUREA/AA_08_09/ord_did_08_09.htm

Università degli Studi di Bergamo

1. http://www.unibg.it
2. Ingegneria Informatica, DALMINE
3. http://www.unibg.it/LS-II

Università degli Studi di Brescia

1. http://www.unibs.it
2. Ingegneria Informatica, BRESCIA
3. http://www.ing.unibs.it/offertaformativa

Università della Calabria

1. http://www.unical.it
2. Ingegneria Informatica, RENDE
3. http://www.ingegneria.unical.it/cdls/inf

Università degli Studi di Catania

1. http://www.unict.it
2. Ingegneria Informatica, CATANIA
3. http://www.ing.unict.it

Libera Università della Sicilia Centrale "Kore" (ENNA)

1. http://www.unikore.it
2. Ingegneria Telematica, ENNA
3. http://www.unikore.it/telematica.magistrale

Università degli Studi di Ferrara

1. http://www.unife.it
2. Ingegneria Informatica e dell'Automazione, FERRARA
3. http://www.unife.it/ing/ls.infoauto

Università degli Studi di Messina

1. http://www.unime.it
2. Ingegneria Informatica, MESSINA
3. http://ww2.unime.it/ingegneria/new/

Politecnico di Milano

1. http://www.polimi.it
2. Ingegneria Informatica, MILANO
3. http://www.inginf.polimi.it/didattica/regolamenti_didattici/.

Politecnico di Milano

1. http://www.polimi.it
2. Ingegneria Informatica, COMO
3. http://www.inginf.polimi.it/didattica/regolamenti_didattici/.

Università degli Studi di Napoli

1. http://www.unina.it
2. Ingegneria Informatica, NAPOLI
3. http://www.ingegneria.unina.it

Università degli Studi di Pavia

1. http://www.unipv.it
2. Ingegneria Informatica, PAVIA
3. http://ingegneria.unipv.it/

Università degli Studi di Pavia

1. http://www.unipv.it
2. Ingegneria dei Servizi, PAVIA
3. http://ingegneria.unipv.it/

Università degli Studi di Pisa

1. http://www.unipi.it
2. Ingegneria Informatica, PISA
3. http://www.web.ing.unipi.it/didattica/didattica/lauree_specialistiche

Università degli Studi di Pisa

1. http://www.unipi.it
2. Ingegneria Informatica per la Gestione d'Azienda, PISA
3. http://www.web.ing.unipi.it/didattica/didattica/lauree_specialistiche

Università degli Studi del Sannio

1. http://www.unisannio.it
2. Ingegneria Informatica, BENEVENTO
3. http://www.ing.unisannio.it

Politecnico di Torino

1. http://www.polito.it
2. Ingegneria Informatica, TORINO
3. http://didattica.polito.it/pls/portal30/sviluppo.offerta_formativa.corsi?p_sdu_cds=37:445&p_a_acc=2010&p_header=N&p_lang=IT&p_tipo_cds=2

Politecnico di Torino

1. http://www.polito.it
2. Ingegneria del Cinema e dei Mezzi di Comunicazione, TORINO
3. http://didattica.polito.it/pls/portal30/sviluppo.offerta_formativa.corsi?p_sdu_cds=37:541&p_a_acc=2010&p_header=N&p_lang=IT&p_tipo_cds=2