VILNIUS UNIVERSITY

MASTER STUDY PROGRAMME
Software Engineering
(State code – **621I30001**)

SELF-EVALUATION REPORT

Acting Rector of Vilnius University   Prof. dr. habil. Jūras Banys

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Head of the self-evaluation group   Prof. dr. Romas Baronas

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Vilnius

2013

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Information on the study programme

Name of the study programme	Software Engineering
State code	621I30001
Study area	Physical Sciences
Group of study fields	Mathematics and Computer Science
Study field	Software Engineering (I300)
Branch of study field	-
Type of the study programme	University studies
Cycle of studies	Second
Study mode and length (years)	Full-time (2 years)
Scope of the study programme (in credits)	120
Language of instruction	Lithuanian, English
Minimal admission requirements	University degree (Bachelor)
Degree and/or professional qualifications awarded	Master of Software Engineering
Date of registration of the study programme	6 March 2006, Order No. 410
Date of accreditation of the study programme	17 August 2009, Order No. 1-73

Self-evaluation group

No.	Pedagogical title (science degree), name, surname	Position	Telephone (office and mobile)	E-mail address
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Contents

1. Introduction

1. Vilnius University, one of the oldest and most famous establishments of higher education in Eastern and Central Europe, was founded in 1579. Functioning for a long time as the only institution of higher education in Lithuania, it has preserved its cultural and scientific traditions and played a significant part in the cultural life not only of Lithuania, but the neighboring countries as well. The University is a unique witness to the history of the Lithuanian state.

2. The mission of the University is a solemn duty and inalienable right, arising from the past, stimulated by the challenges of the present and passed on to the future generations, to strengthen the cognitive and creative powers of Lithuania and the world, to foster academic as well as spiritual and social values, to educate active and responsible citizens and leaders. This mission is based on the imperatives of academic freedom, responsibility to the Lithuanian nation and Lithuanian state, openness and accountability to society. A thorough understanding that during the centuries Vilnius University has become a scientific and cultural centre of national importance imposes special duties on the university community as well as society that this community belongs to[1].

3. According to the Statute, Vilnius University is administered by the Senate and the Rector. The Senate is the supreme self-government body, responsible for general University matters. Certain issues within the competence of the Senate can be delegated by the Senate to the Board of the Senate. The Board consists of the Chairman and Deputy Chairman of the Senate, Rector, Vice Rectors, faculty deans and heads of other academic divisions. According to the Statute, the activities of the University are supervised by the Senate and the Rector's office. The transparency of the University administration is ensured by the University Council.

4. According to the functions exercised, the University divisions are classified into academic and non-academic and, according to their status, to faculties and comparable parent divisions, and branch divisions. The main academic divisions of the University are faculties, institutes and other study centres, which were awarded that status by the Senate. In the academic year 2012-2013, there were 199 study programmes (72 Bachelor, 123 Master and 4 Integrated study programmes) which were carried out by 23 academic divisions (12 faculties, 7 institutes and 4 study and research centres). Vilnius University also offers doctoral and internship studies. Non-academic parent divisions comprise the Library, Botanical garden, Electronic Study and Examination Centre and other divisions, which were awarded that status by the Senate. Those divisions do not carry out academic functions.

5. The Faculty of Mathematics and Informatics is one of the largest among the 12 faculties of Vilnius University. The Faculty is managed by the Dean and five Vice-deans. Research work and studies, education of research workers and academic staff, usage, purchase, and modernization of funds, premises, equipment and other property are coordinated by the Faculty Council. The Faculty consists of 10 Departments:
- Department of Computer Science;
- Department of Computer Science II;
- Department of Didactics of Mathematics and Informatics;
- Department of Differential Equations and Numerical Mathematics;
- Department of Econometric Analysis;
- Department of Mathematical Analysis;
- Department of Mathematical Computer Science;
- Department of Mathematical Statistics;
- Department of Probability Theory and Number Theory;
- Department of Software Engineering.

6. The main strategic goals of the Faculty of Mathematics and Informatics are internationalization of study environment, improvement of quality of teaching/learning process by directing it towards student centred approach and acquiring new technological equipment, fostering collaboration between academic and business environment and participation in national and international academic and scientific initiatives and projects.

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[1] Version of the University Statute approved by the Decision of the Senate S-2012-8-6 on 18 December 2012.

7. The Faculty of Mathematics and Informatics offers:

- nine bachelor study programmes in six fields of studies, including software engineering (study programme of *Software Engineering*), informatics (*Informatics, Information Technologies*), health informatics (*Bioinformatics*), mathematics (*Mathematics and Mathematical Applications, Finance and Actuarial Mathematics*), statistics (*Statistics, Econometrics*) and pedagogy (*Teaching of Mathematics and Informatics*), currently attended by 1660 students.
- eight master study programmes in four fields of studies, including software engineering (study programme of *Software Engineering*), informatics (*Informatics, Computer Modelling*), mathematics (*Mathematics, Finance and Actuarial Mathematics*, *Teaching of Mathematics and Informatics*), statistics (*Econometrics, Statistics*), currently attended by 290 students.
- doctoral studies in the fields of mathematics and informatics. There are 40 doctoral students. Some doctoral students take part in the study process by giving practical classes to students of the bachelor study programmes. Doctoral students are also active participants of the scientific seminars at the Faculty of Mathematics and Informatics.

8. Studies in study field of *Software Engineering* at Vilnius University are available only at the Faculty of Mathematics and Informatics: there is one bachelor study programme of *Software Engineering* and one master study programme of *Software Engineering*. The bachelor study programme of *Software Engineering* was started in 2002 (state code 61209P110)[2], and the master study programme of *Software Engineering* was started in 2006 (state code 62409P101)[3]. Both study programmes were registered as study programmes in the study field of *Informatics*. On 23 December 2009, the Government of Lithuania issued Decision No. 1749 which approved of a new list of study areas and fields for the institutions of higher education. On 19 February 2010, the Minister of Education and Science issued Order No. V-222 approving the list of study branches constituting the study fields. Therefore, in 2010 bachelor and master study programmes of *Software Engineering* were reorganised into study programmes of the main field of *Software Engineering* (state code I300) belonging to the group of study fields of *Mathematics and Computer Science* in the study area of *Physical Sciences*.

9. The bachelor and master programmes of *Software Engineering* (physical sciences, software engineering) are supervised by the Software Engineering Department (established in 1999) at the Faculty of Mathematics and Informatics. Two members of the Department (prof. R. Baronas and assoc. prof. S. Ragaišis) are also members of the Faculty Council, which helps to ensure effective solution of teaching and study problems.

10. The main field of research at the Software Engineering Department includes modelling of computer systems and their development process: software process modelling, assessment and improvement, computer systems modelling and networks modelling. There are 13 doctors of science, including 2 professors and 7 associate professors. 3 doctoral students in the field of informatics are associated with the Department and supervised by the scientists working at the Department. All doctoral students take part in the study process.

11. Subjects in the master study programme of *Software Engineering* are taught by academic staff from three departments of the Faculty of Mathematics and Informatics: Software Engineering Department, Computer Science Department and Mathematical Computer Science Department. Master theses can also be supervised by academic staff from other departments of the Faculty or even academic staff and researchers from other academic divisions of Vilnius University. Such cooperation encourages effective use of study and research opportunities at Vilnius University and helps to ensure the quality of studies.

12. Some attention should be paid on the naming of the programme. Gary Ford from Software Engineering Institute at Carnegie Mellon University noted that a study programme named *Software Engineering* could cause complications in the classic universities having no engineering

[2] Order No. 1093 of 14 June 2002 of the Minister of Education and Science of the Republic of Lithuania
[3] Order No. ISAK-410 of 6 March 2006 of the Minister of Education and Science of the Republic of Lithuania "*Concerning the Registration of the University Study Programmes in Higher Education*".

departments. So, he proposed to use a neutral term *Software Systems* in such cases. Consequently, in 1999 the new department established at Vilnius University and the new study programme have been named in Lithuanian as *Programų sistemos* (*Software Systems*) but in English as *Software Engineering* in order to avoid the need for additional comments. The same approach has been taken by the Government of Lithuania when adjusting the list of study areas and fields: the newly introduced study field has been named *Programų sistemos* (*Software Systems*) but *Software Engineering* in English.

13. A new study programme has to undergo compulsory assessment which is carried out by the experts from Vilnius University and the Centre for Quality Assessment in Higher Education. In order to register a study programme, a positive conclusion by the external experts is required. Later, the quality of studies is ensured by implementing special processes and procedures at Vilnius University[4] as well as by the external evaluation.

14. The external evaluation of the master study programme *Software Engineering* has been carried out in 2006, only when it was registered. In 2009 the study programme was accredited until 31 December 2014[5].

15. Since the start of the study programme in 2006 until now the improvement of the study programme is an on-going process. The master study programme *Software Engineering* was implemented and developed in accordance with the documents issued by the Ministry of Education and Science, Vilnius University and relevant international organisations[6].

16. The self-evaluation report on the master study programme *Software Engineering* covers the period from 1 September 2008 to 30 June 2013.

17. The self-evaluation group whose task was to prepare this self-evaluation report on the master study programme of *Software Engineering* was formed on 18 February 2013 and approved by Oder D-15 of the Dean of the Faculty of Mathematics and Informatics prof. G. Stepanauskas.

Table 1. Division of tasks among the members of self-evaluation group

No.	Group members	Tasks
1.	Romas Baronas	Coordination of the work of self-evaluation group, preparation of parts of the report: 1. Introduction, 2.2. Curriculum design.
2.	Linas Būtėnas	Preparation of 2.4. Material resources.
3.	Aldas Glemža	Presentation of the point of view of business partners in self-evaluation.
4.	Giedrius Graževičius	Presentation of the point of view of students in self-evaluation.
5.	Kristina Lapin	Preparation of 2.3. Personnel and 2.5. Study process and assessment.
6.	Antanas Mitašiūnas	Preparation of 2.6. Programme management.
7.	Saulius Ragaišis	Introduction, 2.1. Aims and learning outcomes of the study programme.

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[4] Vilnius University. Quality of Studies, http://www.vu.lt/lt/studijos/studiju-kokybe

[5] Order No. 1-73 of 17 August 2009 of the Director of the Centre for Quality Assessment in Higher Education "*Concerning the Accreditation of Study Programmes*".

[6] 1) *Law on Science and Studies of the Republic of Lithuania* No.XI-242 of 30 April 2009;

   2) *Description of General Requirements for Master Study Programmes*, Order No.V-826 of 3 June 2010 of the Minister of Education and Science (*Official Gazette*, 2010, No. 67-3375);

   3) *Description of Study Cycles*, Order No. V-2212 of 21 November 2011 of the Minister of Education and Science;

   4) *Study Provisions of Vilnius University*, Decision No. SK-2012-12-8 of 21 June 2012 of the VU Senate Board;

   5) *Regulation of Study Programmes at Vilnius University*, Decision No. SK-2012-12-4 of 21 June 2012 of the VU Senate Board.

   6) Dublin descriptors (2004) http://www.jointquality.nl/ge_descriptors.html

   7) *A Framework for Qualifications of the European Higher Education Area, („EQF for HE")*, http://www.bologna-bergen2005.no/Docs/00-Main_doc/050218_QF_EHEA.pdf

   8) The main documents of Bologna process:
   (http://www.smm.lt/t_bendradarbiavimas/docs/bp/Bolonijos%20proceso%20dokumentai_Bolonijos-Londono%20laikotarpis_1999-2007.pdf, http://www.smm.lt/t_bendradarbiavimas/docs/Leidinys_Svarbiausi%20Bolonijos%20proceso%20dokumentai%202009-2010.pdf).

Table 2. Timetable to the self-evaluation group

No.	Activities	Date
1.	Formation of the self-evaluation group.	18/02/2013
2.	Definition of duties and tasks of group members, drawing up a timetable of activities.	25/02/2013
3.	Collecting opinions of academic staff, students, graduates and social partners about the study programme and its implementation.	27/04/2013
4.	Preparation of the first draft of self-evaluation report and discussion of results in the self-evaluation group.	27/05/2013
5.	Discussion of preliminary self-evaluation results at the seminar and meeting of the Software Engineering Department.	3/06/2013
6.	Preparation of the final draft of self-evaluation report.	24/06/2013

The self-evaluation group was assisted by the academic staff of the Faculty of Mathematics and Informatics who teach the students of the *Software engineering* master study programme, academic staff of the Software Engineering Department, non-academic staff of the Study Office of the Faculty, coordinators of studies in the Software Engineering Department and other departments.

2. Analysis of the study programme

2.1. Aims and learning outcomes of the study programme

18. The aim of the master study programme of *Software Engineering* is to prepare high qualification software engineering specialists that are able to carry out independently research, lead projects of software development, maintenance and process improvement, apply their knowledge in different areas of application, make decisions on the basis of limited information and provide logical, unambiguous and clear arguments both for specialists and non-specialists.

19. The study programme combines practical orientation with the development of research abilities. It takes the knowledge of software engineering acquired during bachelor studies as a basis and aims at providing deeper knowledge.

20. The programme is in conformity with the mission of Vilnius University: "to create, accumulate and disseminate knowledge by ensuring continuity of authentic university culture distinguished by the atmosphere where old traditions and new ideas enrich each other." [7]

21. The graduates of the programme acquire technological and management knowledge and abilities to supervise projects of software development, maintenance and process improvement. They become ready to work as managers of IT projects, managers of software process improvement as well as analysts, designers, programmers and researchers in private and public sectors.

22. The High-tech Development Programme of Lithuania for 2011–2013[8] states: "Information technologies are the main factor of globalization and technological progress and the basis for the creation of information society. Information products make a growing part of GNP of the developed countries. Emphasizing the importance of information technologies to the new information society and striving to increase technological progress, the EU assigned a priority status to technological development and foresaw major investment into their research, application and production". Software engineering is among the fields to be developed.

23. The need for the programme is determined by the shortage and growing demand for highly qualified IT specialists, especially in the field of software engineering:
- a survey carried out in 2011 by the association "INFOBALT" among the major employers in the IT sector and members of the association showed that in the near future the demand for ICT (Information and Communication Technologies) specialists would considerably exceed the supply: at the end of the period of 2011-2016 a shortage of 6000 specialists was predicted. According to the Department of Statistics, during the last 5 years the number of employees in the sector of IT services grew about 30%. The results of the

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[7]Mission and Vision of Vilnius University, http://www.vu.lt/en/about-us/mission-and-vision.
[8]Order No. V-1/4-2 of 4 January 2011 of the Minister of Education and Science and the Minister of Economy.

"INFOBALT" study confirm that the demand for ICT specialists is growing: 21,000 specialists will be needed in 2016. However, the analysis of enrolment trends in Lithuanian higher education institutions showed that by 2016 higher education institutions would be able to train only about 15,000 IT specialists. Taking into account the growing mobility of workers and demand for IT specialists due to foreign investments, this gap may be even greater. The demand for IT specialists in Europe is growing. According to the forecasts of IDC company, the number of vacancies in the IT sector in the EU member states may grow from 100,000 to 700,000[9].

- Employers in the IT business sector claim that project managers in the IT product development sector are among the most needed[10,11].
- According to the National software and services cluster, "admission to master study programmes should be expanded because only IT specialists with a master's degree can meet the growing requirements to IT specialists by IT software development companies or other companies with large information systems. Students of bachelor study programmes usually start working in smaller companies or non-IT companies and can only follow this career path if they get a master's degree or through informal studies".[12]
- Research and experimental development as well as innovation activities are expanding in Lithuanian IT companies and the number of employees is growing. The pace of this development is greater in IT companies than in other businesses[13].

24. By educating masters in *Software Engineering* this study programme helps to increase the potential of research and experimental development in software engineering.

25. The need for the study programme is confirmed by its popularity among the candidates enrolling into university master studies. Though the interest in IT specialisations in Lithuania and many other countries noticeably decreased a few years ago[14], since the registration of the study programme all state-funded places are filled every year. The absolute majority of enrolled bachelors marked this study programme as their first choice, which shows strong motivation of the candidates.

26. The Programme enables graduates of *Software Engineering* bachelor study programme to continue their studies at the master level to gain deeper knowledge in the same study field. This study programme is popular not only among the bachelors of *Software Engineering*, but also among graduates of related study fields at Vilnius University. Graduates of the same group of study fields (Mathematics and Computer Science) at Klaipėda University, Vilnius Gediminas Technical University and Kaunas University of Technology sometimes also apply to *Software Engineering* master study programme.

27. The master study programme *Software Engineering* was registered under the study field of Informatics in the area of *Physical Sciences* in 2006. After the approval of the new *List of Study Areas and Fields for Institutions of Higher Education*[15], the study programme was registered under the study field of *Software Engineering* (state code I300) in the area of *Physical Sciences*.

28. The study programme of *Software Engineering* shares certain similarities with the study programmes in the study fields of *Informatics* (state code I100), *Information Systems* (I200) and *Health Informatics* (I500) in the area of Physical Sciences and with the study programmes in the study field of *Informatics Engineering* (E100) in the area of *Technological Sciences*. The relationship with similar fields is well disclosed by *Computing Curricula 2005*[16] prepared jointly by

[9] Association "INFOBALT", http://archyvas.infobalt.lt/main.php?&i=8204

[10] *Results of the Study of Professional Opportunities in the Study Fied of Informatics: Guidelines for Study Programme Updating*. http://www.ects.cr.vu.lt/Files/File/Informatikos%20technine%20ataskaita.pdf

[11] *Methods of Competence Development in the Study Field of Informatics*. L. Bukauskas *et al*., Vilnius, 2011.

[12] *Feasibility Study of the Complex Programme in the Sector of Information Technologies*, National software and services cluster, Vilnius, 2007.

[13] *Information Technologies in Lithuania in 2012*, Department of Statistics of Lithuania, Vilnius, 2012.

[14] Computing Degree and Enrollment trends: From the 2011-2012 CRA Taulbee Survey. Computing Research Association, http://cra.org

[15] Decision No. 1749 of 23 December 2009 of the Government of Lithuania "*Concerning the Approval of the List of Study Areas and Fields for Institutions of Higher Education*".

[16] Computing Curricula 2005 - The Overview Report, ACM, AIS, IEEE-CS, 2005.

the most authoritative professional organisation in the world: ACM (Association for Computing), AIS (Association for Information Systems) and IEEE-CS (Computer Society).

29. The master study programme of *Software Engineering* complies with concept of Software Engineering discipline in *Computing Curricula 2005*, which clearly shows the commonalities and differences among the computing disciplines. It unites the principles of mathematics and computer science with engineering methods. Compared to the study programmes under the study field of *Informatics Engineering* (E100) in the area of *Technological Sciences*, the study programme of *Software Engineering* puts emphasis on a more abstract (softer) content of Informatics.

30. Competences developed by the study programme and learning outcomes were formulated on the basis of a long-term experience of organising bachelor and master studies in the field of Informatics and later in the field of Software Engineering at Vilnius University, university study programmes in other countries, regulations and recommendations[17], description of study cycles[18], research and projects[19] in Software Engineering, needs of IT businesses[20], analysis of export opportunities for IT products and services, and recommendations for Software Engineering studies by the leading professional organisations ACM, AIS, IEEE[21].

Table 3. Competences and learning outcomes of the study programme

Generic competences		Learning outcomes. Students have to be able to:	
1.	Teamwork and work in interdisciplinary environments.	**1.1**	work and communicate in a team, adapting to the ever-changing professional environment.
		1.2	communicate with representatives of other professional fields of business or science, while solving problems of other fields or interdisciplinary issues, and to act ethically.
2.	Planning and organization.	**2.1**	plan complex activities which consist of various interrelated tasks and organize their implementation.
		2.2	adjust a plan during its implementation process taking into account changes in the situation.
3.	Scientific investigations.	**3.1**	prepare specific investigation plans or projects, select methods and resources for the investigation.
		3.2	bring, develop, defend, and apply original ideas.
		3.3	estimate investigation results, determine their reliability, and appropriately document them.
Subject-specific competences		Learning outcomes. Students have to be able to:	
4.	Software requirements and design	**4.1**	practically use the most important methods of software requirements and design.
		4.2	conceptually and formally design objective field and evaluate the designed model.
		4.3	design the logical and technical architecture of software and to integrate design activities into software construction process.
5.	Software construction	**5.1**	construct software systems using heuristic and formal methods and tools of software engineering.
		5.2	evaluate methods and tools of software engineering and chose appropriate ones for construction of particular software.

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[17] Euro-Inf Framework Standards and Accreditation Criteria for Informatics Degree Programmes, European Quality Assurance Network for Informatics Education, 2012.

[18] *Description of Study Cycles*, Order No. V-2212 of 21 November 2011 of the Minister of Education and Science.

[19] *Methods of Competence Development in the Study Field of Informatics*. L. Bukauskas *et al.*, Vilnius, 2011.

[20] *Results of the Study of Professional Opportunities in the Study Fied of Informatics: Guidelines for Study Programme Updating*. http://www.ects.cr.vu.lt/Files/File/Informatikos%20technine%20ataskaita.pdf

[21] Computing Curricula 2005 - The Overview Report, ACM,AIS, IEEE-CS, 2005.

6.	Software engineering process	**6.1**	easily and purposefully operate with the concepts of software engineering process.
		6.2	apply methods of development and process capability evaluation in developing results of the activity.
7.	Software engineering project management	**7.1**	plan, manage, and evaluate software engineering projects.
		7.2	manage software development, maintenance, and development projects.
8.	Software quality, security, acquisition, and maintenance	**8.1**	organize, perform, and evaluate software security, acquisition, and maintenance.
		8.2	apply models of software quality evaluation and methods of quality assessment and maintenance.

31. A very important place among the competences of the study programme is taken by generic competences. According to the pyramid of the IT sector competence model constantly updated by the association "TechAmerica"[22], generic competences make the basis for all competences. The fact that generic competences are an indispensable part of the description of the qualification provided by a higher education institution is indicated in Dublin descriptors[23].

32. Subject-specific competences and learning outcomes were formulated taking into account the concept of software engineering and the description of knowledge and abilities necessary for software engineers which was compiled by the participants of SWEBOK project carried out on the initiative of IEEE Computer Society[24]. Subject-specific competences comply with the requirements for the second cycle (master) study programmes[25,26].

33. Since the study programme has not only practical professional orientation, but includes scientific research activities, the development of subject-specific competences takes into account modern trends of software engineering and strategies and challenges formulated by research community[27]. Learning outcomes provide future specialists with scientific research methodologies and qualitatively deeper new software engineering knowledge and abilities (compared to bachelor study programme of *Software Engineering*).

34. An important role in identifying subject-specific competences was allocated to the opinions of employers in the IT sector and graduates of *Software Engineering* and other study programmes in the field of Informatics. Their views helped to take into account the needs of the country and its regions as well as the latest trends of the local labour market. Surveys of employers and graduates conducted in 2010 confirmed the need for the identified subject-specific competences in the graduates' professional activity[28]. The content of study subjects takes into account the competences which were prioritised during the surveys. These priorities also influence the topics chosen for the master theses.

35. The set of knowledge and abilities necessary for software engineering specialists is dynamic. The participants of SWEBOK project are planning to present an updated description of knowledge and abilities. The situation in labour market is constantly changing. These and other

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[22] *Information Technology Competency Model*. The Employment and Training Administration (ETA). TechAmerica. 2013. http://www.careeronestop.org/competencymodel/pyramid.aspx?it=Y

[23] Dublin descriptors, 2004, http://www.jointquality.nl/ge_descriptors.html

[24] Guide to the Software Engineering Body of Knowledge (Eds: A. Abran, J.W. Moore), IEEE Computer Society, 2004, http://www.computer.org/portal/web/swebok/htmlformat

[25] Graduate Software Engineering 2009 (GSwE2009): Curriculum Guidelines for Graduate Degree Programs in Software Engineering, 2009, Stevens Institute of Technology

[26] *Description of Study Cycles*, Order No. V-2212 of 21 November 2011 of the Minister of Education and Science.

[27] *Feasibility Study of the Complex Programme in the Sector of Information Technologies*, National software and services cluster, Vilnius, 2007.

[28] *Results of the Study of Professional Opportunities in the Study Fied of Informatics: Guidelines for Study Programme Updating*. http://www.ects.cr.vu.lt/Files/File/Informatikos%20technine%20ataskaita.pdf

factors determine periodical revision of learning outcomes and improvement of the whole study programme.

36. Learning outcomes are achieved when students listen to lectures, participate and make presentations in seminars, carry out laboratory work, read professional and research literature, do professional practice in enterprises, conduct scientific research and write a graduation thesis.

37. Aims and learning outcomes of the study programme are available on the webpage of the Software Engineering Department[29]. Relevant information is disseminated through Faculty publications, Open Door events organised by the University, annual exhibition "Learning. Studies. Career", social networks on the internet, meetings with pupils at schools.

Strengths, weaknesses and opportunities for improvement

38. The competences and learning outcomes of the study programme are in agreement with generic and Software Engineering competences and learning outcomes defined by international organisations (IEEE CS, ACM, AIS, etc.).

39. The priorities and concepts of the competences and learning outcomes are changing. The changes already announced in the SWEBOK guide (which will be published in V3 version officially) are not yet included in the study programme. It is important to ensure the agreement of competences and learning outcomes not only with the recommendations of international organisations, but also to take into account changes in the Lithuanian labour market.

40. The changes in the development trends of software engineering and labour market are exploited to offer students relevant topics for their graduation theses.

2.2. Curriculum design

41. The last five years saw important changes taking place in the Lithuanian higher education system. On 30 April 2009, a new Law of the Republic of Lithuania on Science and Education was adopted, on 23 December 2009 the Lithuanian government approved a new List of Study Areas and Fields for Institutions of Higher Education (Decision No. 1749), in 2011 Lithuania adopted the ECTS, in 2012 new Study Provisions of Vilnius University were approved. These documents had an impact on the changes in *Software Engineering* master study programme.

42. In 2012, after the new Regulation for Study Programmes at Vilnius University came into force which requires that "2.4.1. the scope of the study subject in the second cycle study programmes cannot be smaller than 5 ECTS credits"[31], the scope of three subjects (one compulsory subject *Parallel and Distributed Computing* and two optional subjects *Software Quality* and *Information Security*) was increased from 4.5 to 5 ECTS credits. In order not to exceed the overall scope of the curriculum, the scope of two compulsory subjects (*Requirements Engineering* and *Software Engineering Methods and Tools*) was reduced from 7.5 to 7 ECTS credits. Course descriptions were updated to take these changes into account.

2.2.1. Compatibility of curriculum design with legal requirements

43. The curriculum design complies with the Description of General Requirements for Master Study Programmes approved by the Minister of Education and Science[30] and the Regulation for Study Programmes at Vilnius University[31].

Table 4. Compatibility of curriculum design with legal requirements

Criterion	Unit	Requirements	Curriculum
Scope of curriculum	ECTS	90–120	120
Subjects of study field (for more in-depth knowledge)	ECTS	≥ 60	72
Professional practice	ECTS	≤ 30	18

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[29] Description of the Master Study Programme Software Engineering, http://www.mif.vu.lt/se/Programs/pradzia_programsMAG.htm

[30] *Description of General Requirements for Master Study Programmes*, Order No.V-826 of 3 June 2010 of the Minister of Education and Science (*Official Gazette*, 2010, No. 67-3375)

[31] *Regulation of Study Programmes at Vilnius University*, Decision No. SK-2012-12-4 of 21 June 2012 of the VU Senate Board.

Scope of the graduation thesis	ECTS	≥ 30	30
Optional subjects	ECTS	≤ 30	17
Number of subjects per semester	Subject	≤ 5	1–5
Part of student's self-study work in the scope of a subject	%	≥ 30	45–97.5
Smallest scope of the subject	ECTS	5	5
Student workload per year	ECTS	60	60
Student workload for one ECTS credit	Hour	25–30	25–30

2.2.2. Study plan

44. A detailed curriculum with all subjects presented according to semesters and related to competences and learning outcomes is presented in Table 5.

45. Student workload amounts to 3200 hours, including 720 contact hours (22.5 %) and 2480 hours of autonomous work (77.5 %).

46. Student workload is divided equally (400 hours per semester) through four semesters (30 credits each).

47. Study subjects are divided into compulsory and optional. Students can choose optional subjects (17 ECTS credits) in the second (two optional subjects, 11 ECTS credits) and third semesters (one optional subject, 6 ECTS credits).

48. In the third semester students take professional practice (18 ECTS credits) in a profit or non-profit organisation.

49. Master studies are completed by the graduation thesis in the fourth semester.

50. The subject descriptions are presented in Annex 1 of the Self-evaluation Report.

51. The list of subjects has not changed during the analysis period. However, some updates have been made in subject topics and their distribution, study methods, tasks for laboratory work, etc. The topics of applied subjects (*Project Management*, *Software Systems Testing and Configuration Management* in particular) were updated to stay at the forefront of the modern business practices and requirements. The topics of some subjects (*Human Computer Interaction Design, Software Systems Testing and Configuration Management* in particular) were amended to build up the knowledge gained in *Software Engineering* bachelor study programme more effectively. Many subjects were enhanced with innovative teaching methods (case studies, discussions, presentations in particular). Assessment strategies and criteria were specified in more detail. The tutorial schedule was explicitly defined in the subject descriptions. After the new Regulation for Study Programmes at Vilnius University[32] came into force, the scope of three subjects (*Parallel and Distributed Computing*, *Software Quality*, *Information Security*) was increased from 4.5 to 5 ECTS credits, while the scope of two subjects (*Requirements Engineering*, *Software Engineering Methods and Tools*) was reduced from 7.5 to 7 ECTS credits.

52. During the implementation of the project *Quality Improvement of the Study Programmes of Informatics and Software Engineering* (No. VP1-2.2-ŠMM-07-K-02-039) the teaching material of the following six subjects have been updated: *Software Systems Architecture and Design, Software Engineering Methods and Tools, Software Process Assessment and Improvement, Software Acquisition and Maintenance, Human Computer Interaction Design, Software Quality.* The project was supported by European Social Fund. The methodological resources of the subjects were improved and translated to English. The topics and teaching resources were improved according to recommendations of Prof. Algirdas Pakštas (London Metropolitan University, UK) who visited the Department of Software Engineering in December, 2012. In order to achieve greater internationalisation of studies methodological resources of other subjects will be translated to English in the nearest future.

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[32] *Regulation of Study Programmes at Vilnius University*, Decision No. SK-2012-12-4 of 21 June 2012 of the VU Senate Board.

Table 5.   THE PLAN OF THE STUDY PROGRAMME (full-time studies)
(CORRELATION BETWEEN THE SUBJECTS (UNITS), COMPETENCES, AND THE LEARNING OUTCOMES)

Code	Study subjects (units) according to groups	Credits	Student's workload in total	Contact work	Self-study work	1.1	1.2	2.1	2.2	3.1	3.2	3.3	4.1	4.2	4.3	5.1	5.2	6.1	6.2	7.1	7.2	8.1	8.2
	YEAR I	**60**	**1600**	**614**	**986**																		
	SEMESTER 1	**30**	**800**	**316**	**484**																		
Compulsory subjects (units)		**30**	**800**	**316**	**484**																		
PMRI7124	*Requirements Engineering*	7	190	84	106	X							X	X		X							
PMPV7124	*Project Management*	6	160	66	94		X	X	X											X	X		
PMAP7124	*Software Systems Architecture and Design*	6	160	84	76	X							X	X	X	X							
PMLS7124	*Parallel and Distributed Computing*	5	130	66	64											X		X					
PMTD7124	*Research work*	6	160	16	144			X		X													
	SEMESTER 2	**30**	**800**	**298**	**502**																		
Compulsory subjects (units)		**19**	**520**	**157**	**363**																		
PMKM7124	*Software Engineering Methods and Tools*	7	190	82	108							X		X		X	X					X	X
PMKV7124	*Software Process Assessment and Improvement*	6	160	65	95			X	X									X	X				X
PMTD7224	*Research Work*	6	170	10	160					X	X	X	X	X									
Optional subjects (units) A		**6**	**150**	**74**	**76**																		
PMIP7134	*Software Acquisition and Maintenance*	6	150	66	84			X					X							X		X	
PMZP7134	*Human Computer Interaction Design*	6	150	82	68		X			X				X			X			X			
Optional subjects (units) B		**5**	**130**	**67**	**63**																		
PMSK7134	*Software Quality*	5	130	66	64			X									X						X
PMIS7134	*Information Security*	5	130	68	62			X							X					X			

Code	Subject					W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13	W14	W15	W16	W17
YEAR II		**60**	**1600**	**106**	**1494**																	
SEMESTER 3		**30**	**800**	**86**	**714**																	
Compulsory subjects (units)		**24**	**640**	**20**	**620**																	
PGPR7124	*Professional Practice*	18	490	10	480	X	X	X	X								X	X	X	X	X	X	X
PMTD7324	*Research Work*	6	150	10	140					X	X	X	X	X	X	X	X	X	X			X
Optional subjects (units) C		**6**	**160**	**66**	**94**																	
PMSM7134	*Statistical Analysis in Software Engineering*	6	160	66	94											X		X	X			X
PSTV7134	*Software Systems Testing and Configuration Management*	6	160	66	94												X	X	X			X
PSEP7134	*Electronic Signature Infrastructure and Electronic Commerce*	6	160	66	94		X	X									X		X		X	
SEMESTER 4		**30**	**800**	**20**	**780**																	
Compulsory subjects (units)		**30**	**800**	**20**	**780**																	
MD7124	*Master's Thesis*	30	800	20	780					X	X	X	X	X	X	X	X	X	X			X

2.2.3. Logic behind the curriculum design

53. Curriculum design is determined by the developed competences and learning outcomes.

54. The basis for all competences developed by the study programme is generic competences (competence model of the association "TechAmerica" [33], Dublin descriptors[34]). Master students of *Software Engineering* acquire the following generic competences: to work in a team and in an interdisciplinary environment, plan activities and organise their implementation, carry out scientific research. Generic competences are developed by studying the subjects of the study field, doing professional practice, carrying out research and preparing a graduation thesis. It means that generic competences are developed together with subject-specific competences: to formulate requirements for software, design and engineer software, evaluate and improve software engineering process, manage software projects, assure software quality and safety, organise acquisition and maintenance.

55. Competences are developed by three subject groups: theoretical and applied subjects (for more in-depth knowledge of the subject), professional practice, research work and graduation thesis.

Table 6. Subject groups in the study programme

No.	Subject group	ECTS	%
I	Theoretical and applied subjects (for more in-depth knowledge)	54	45
I.1	Compulsory subjects	37	30.8
I.2	Optional subjects	17	14.2
II	Professional practice	18	15
III	Research work and graduation thesis	48	40
	Total	**120**	**100**

56. Subjects of the study field include the theoretical and applied subjects (compulsory as well as optional), research work and Master's thesis, in total worth 102 ECTS credits (72 ECTS credits if the Master's thesis is not included). A few optional subjects, e.g. *Information security*, *Electronic Signature Infrastructure and Electronic Commerce*, probably could be classified as non-core software engineering subjects (not essential to ensure developed competences and learning outcomes of the study programme). Nevertheless, we think that the competences and skills in all the optional subjects are requested by employers[35] and are important to have for graduates of *Software Engineering* master programme.

57. Individual subject descriptions including their timing, ECTS credits and lecturers are presented in Table 7.

58. The choice of subjects ensuring the achievement of learning outcomes and formulation of subject titles was guided by SWEBOK[36] guide for software engineering, also known as "Technical Report ISO/IEC TR 19759", the preparation of which was initiated by the association IEEE Computer Society. All the SWEBOK knowledge areas are covered by the subjects in the Software Engineering programme. More important for Lithuanian labour market knowledge areas are covered by the compulsory subjects, while others - by the optional subjects. The number of subjects and their scope was chosen in accordance with legal requirements for master studies.

59. The curriculum includes optional subjects (17 ECTS credits) aimed at deeper specialisation. Students can choose specific subjects taking into account the topics of their research work and the needs of future professional activities.

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[33] Information Technology Competency Model. The Employment and Training Administration (ETA). TechAmerica. 2013. http://www.careeronestop.org/competencymodel/pyramid.aspx?it=Y

[34] Dublin descriptors, 2004, http://www.jointquality.nl/ge_descriptors.html

[35] *Results of the Study of Professional Opportunities in the Study Fied of Informatics: Guidelines for Study Programme Updating*. http://www.ects.cr.vu.lt/Files/File/Informatikos%20technine%20ataskaita.pdf

[36] Guide to the Software Engineering Body of Knowledge (Eds: A. Abran, J.W. Moore), IEEE Computer Society, 2004, http://www.computer.org/portal/web/swebok/htmlformat

60. The purpose of the professional practice is to strengthen and improve the knowledge, competencies and skills gained during the studies, to gain professional skills as well as to apply and develop the abilities to solve problems arising in practice.

61. Students with good academic record have an opportunity to make individual study plans which allow to substitute optional subjects by subjects from related study programmes. This helps students to better prepare themselves for doctoral studies in specific topics. Individual study plans are approved by the Study Programme Committee.

Table 7. Groups of subjects and distribution according to semesters

Subject	ECTS				Lecturer
	I	II	III	IV	
I. Theoretical studies (for more in-depth knowledge)					
I.1. Compulsory subjects – 45 credits					
Requirements Engineering	7				Prof. dr. A. Čaplinskas, Assoc. prof. dr. A. Lupeikienė
Project Management	6				Dr. G. Slivinskas, Dr. E. Drąsutis
Software Systems Architecture and Design	6				Lect. D. Čiukšys**
Parallel and Distributed Computing	5				Prof. dr. R. Vaicekauskas
Software Engineering Methods and Tools		7			Prof. dr. R. Baronas
Software Process Assessment and Improvement		6			Assoc. prof. dr. A. Mitašiūnas
I.2. Optional subjects – 17 credits					
A* Software Acquisition and Maintenance		6			Assoc. prof. dr. V. Undzėnas
A* Human Computer Interaction Design					Assoc. prof. dr. K. Lapin
B* Software Quality		5			Assoc. prof. dr. S. Dapkūnas
B* Information Security					Lect. dr. G. Skersys
C* Statistical Analysis in Software Engineering					Prof. dr. M. Bloznelis
C* Software Systems Testing and Configuration Management				6	Lect. A. Adamonis**
C* Electronic Signature Infrastructure and Electronic Commerce					Assoc. prof. dr. V. Undzėnas
II. Professional practice – 18 credits					
Professional Practice			18		
III. Research Work and Master's Thesis – 48 credits					
Research Work	6				(individual choice)
Research Work		6			(individual choice)
Research Work			6		(individual choice)
Master's Thesis				30	(individual choice)
Total programme	30	30	30	30	
	120				

* Optional subjects.
** Lecturers-practitioners (without science degree) who have acquired at least 3 years of professional experience related to the applied subjects they are teaching during the last 7 years.[37] (Both lecturers have professional experience of 7 years during the last 7 years).

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[37] *Regulation of Study Programmes at Vilnius University*, 4.5 subsection, Decision No. SK-2012-12-4 of 21 June 2012 of the VU Senate Board

2.2.4. Study methods, contact work and self-study

62. In teaching the subjects of the curriculum traditional methods (lectures, seminars, laboratory work, reading of subject literature) are combined with innovative methods (problem-based teaching, case studies, discussions, presentations, comparative analysis, group work, project work). Course descriptions indicate study methods used for each subject (Annex 1).

63. Student workload consists of 3200 hours, including 720 contact hours and 2480 hours for self-study work. Contact work takes place during lectures, seminars, laboratory work, consultations, examinations and thesis defence. During the hours for self-study work students read literature, prepare for laboratory work, seminars, prepare presentations, implement projects, carry out research, do written assignments, prepare Master's thesis.

64. Students' self-study work makes up 77.5% of their total workload. Time devoted to self-study work differs in different subjects. The largest part of self-study work (90–97.5 %) is devoted to research work and preparation of Master's thesis. The part of self-study work in different subjects is smaller and varies from 45.3 to 58.8 %. Self-study work indicated in the curriculum under "Professional Practice" (Table 5) is, in fact, student's work time in the place of professional practice (enterprise, institution or organization).

65. The programme is delivered in Lithuanian. In addition, from this year, the Programme is already ready for delivering in English for the foreign students.

2.2.5. Requirements for Master's thesis

66. Requirements for Master's thesis are defined in the *Procedures for Preparation, Defence and Safekeeping of Graduation Theses*[38], the *Provisions for the Preparation of Software Engineering Master's Thesis*[39] and the description of this subject (Annex 1).

67. Master's thesis must be based on independent scientific research work or applied research. In their Master's theses students must demonstrate their level of knowledge and understanding, ability to select and use scientific literature (present, analyse, etc.), apply and modify research methods, independently solve the identified problems, formulate hypotheses, conclusions, recommendations, present research results in a consistent and orderly way, in correct language in writing and orally, according to set requirements and complying with academic ethics. Graduation thesis develops the competence of scientific, critical and creative thinking.

68. Master's thesis is performed in the final (4th) semester. According to our vision, students must have acquired some research experience in the Master's thesis topic, before starting the preparation of the graduation thesis. Therefore the following procedure has been established:

- Topics offered for Master's theses are announced by the Software Engineering Department. Master students can choose other topics not included in the list. Such requests are discussed separately. Beside the person who suggested the topic (university lecturer or employee of another organisation), the student may be assigned a second supervisor from the academic staff of the department of Software Engineering.
- In the first three semesters, students conduct research (Research Work I, II and III) on the topic of Master's thesis: prepare a preliminary research plan, perform a preliminary literature review and obtain principle solutions for the problem of the Master's thesis.
- In the fourth semester, students perform the Master's thesis with the same supervisor and on the same or slightly revised topic as the research work.

69. The offered topics are closely related to the research interests of Masters' thesis supervisors. The vast majority of the topics are also related to labour market development trends and are relevant to software engineering. It is desirable that the topics originate from the core software engineering areas.

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[38] *Procedures for Preparation, Defence and Safekeeping of Graduation Theses* approved by the VU Senate Board meeting on 2 June 2005, Minutes No. SK-2005-9
[39] *Provisions for the Preparation of Software Engineering Master's Thesis* approved by the Software Engineering Department meeting on 5 September 2011,
http://www.mif.vu.lt/katedros/se/Studentams/MAGISTRO%20BAIGIAMOJO%20DARBO%20RENGIMO%20NUOS TATOS%202011.htm

70. Master's theses are defended at the meeting of the Graduation Theses Defence Committee, set up by the Rector's order on the proposal of the Dean of the Faculty of Mathematics and Informatics.

2.2.6. Professional practice

71. Professional practice is part of the study programme during which students apply and improve knowledge and abilities acquired in the study programme in performing professional practical assignments according to the needs of enterprise/institution.

72. Professional practice is allocated 18 ECTS credits in the study plan.

73. Professional practice is organized in accordance with the *Professional Practice Provisions* approved by the Council of the Faculty of Mathematics and Informatics on 15 December 2009, Minutes No. 3. The Faculty's information system *Profesional Practice*[40] provides all the necessary information about the arranging process of the professional practice. The system is design not only for students, but also for employers and practice supervisors.

74. At the end of professional practice students prepare a report according to the requirements approved by the meeting of Software Engineering Department[41]. The results of practice are defended at the meeting of the defence committee of Department of Software Engineering.

75. Finding host organizations for professional practice is usually not an issue for students. Most of them are employed during their studies and choose to perform the professional practice at their workplace. Student survey showed that 100% of them combine Master studies with employment (sample included 16 1st year students and 23 2nd year students; survey conducted in June 2013).

76. Students willing to do professional practice abroad can participate in the Erasmus pratice mobility programme.

2.2.7. Strengths, weaknesses and opportunities for improvement

77. The study programme includes practically all areas of software engineering knowledge defined in SWEBOK guide. However, some of them are included as optional subjects. Therefore, it is possible that some graduates will miss the opportunity to gain deeper knowledge in several areas. On the other hand, this provides an opportunity for students to specialise in specific fields according to their needs.

78. The study programme has been internationalised: methodological resources of six subjects already translated to English, the other subjects will be translated in the nearest future.

79. Not every year all optional subjects in the study programme can be offered to students due to teaching staff turnover. Curriculum design could be improved by increasing the number of optional subjects to provide better opportunities for student specialisation.

80. The participants of SWEBOK project are planning to present an updated description of knowledge and abilities. The situation in the labour market is constantly changing. It is necessary to observe these and other changes and in turn improve the study programme. Changes in the development trends of software engineering and labour market should be regularly exploited to offer students relevant topics for their graduation theses.

2.3. Teaching staff

2.3.1. Staff composition and its conformity with legal requirements

81. In the master study programme of *Software Engineering* lectures are given by 13 lecturers: 4 professors, 6 associate professors and 3 lecturers. The complete list of lecturers is included in Table 7. Two lecturers who teach applied subjects do not have doctoral degrees; however, they have an extensive professional experience directly related to the subjects taught. Lect. A. Adamonis has 13 years and lect. D. Čiukšys has 17 years of relevant professional experience. Both lecturers have

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[40] *Professional Practice*, https://kedras.mif.vu.lt/prakt-vld/
[41] *Requirements for the Report on Professional Practice*,
http://www.mif.vu.lt/katedros/se/Studentams/ReikalavimaiPraktikosAtaskaitai_10.htm

finished doctoral studies several years ago and are currently working on their doctoral dissertations. Academic staff composition satisfies legal requirements[42,43].

Table 8. Compatibility of teaching staff conformity with legal requirements[27,28]

Criterion	Unit	Requirement	Programme
Teaching staff with science degree	*%*	≥ 80	85.7
Teaching staff with science degree whose research is directly related to the subject taught	*%*	≥ 60	85.7
Scope of study field subjects taught by professors of Vilnius University	*%*	≥ 20	20.8

2.3.2. Teaching staff: employment, assessment and turnover

82. Employment and assessment of academic staff is organised according to the *Temporary Provisions for the Organisation of Assessment and Competitions for Positions of Teaching and Research Staff* (approved by the VU Senate Board meeting on 23 February 2010, Decision No. SK-2010-5-34) which regulate the procedures for competition for vacancies and assessment and qualification requirements for the VU teaching and research staff. Competitions for vacancies are announced in the VU Information Bulletin, internet websites of VU and Research Council of Lithuania.

83. 10 lecturers (71.4%) work in the Department of Software Engineering, others work in different departments: 2 in the Department of Computer Science (prof. R. Vaicekauskas, dr. G. Skersys), 1 in the Department of Mathematical Computer Science (prof. M. Bloznelis) and 1 in the Department of Software Engineering of the Institute of Mathematics and Informatics (prof. A. Čaplinskas).

84. VU Quality Management Centre conducts regular student surveys aiming to find out student opinion on the studies and the quality of teaching. Students are encouraged to express their opinion about the quality of teaching of the subject studied. The subject lecturer is acquainted with the student opinion. The study programme committee has an opportunity to get acquainted with the survey results related to all subjects. The results are discussed in the study programme committee and department meetings to improve the quality of teaching by taking into account student expectations. For example, subject assessment criteria were defined in more detail, and some topics of *Software Systems Testing and Configuration Management* were linked more precisely to the related subjects of the bachelor study programme of *Software Engineering* as suggested in the surveys.

85. Three (21.4%) lecturers are over 60 years old, four (28.6%) are between 51 and 60, three (21.4%) between 41and 50, the age of the remaining four (28.6%) does not exceed 40 years.

86. At present the Software Engineering Department has 3 doctoral students in the science field of Informatics. All doctoral students are supervised by prof. R. Baronas. One doctoral dissertation was defended in 2013 (D. Šimelevičius, academic supervisor prof. R. Baronas), one dissertation - in 2012 (L. Savičienė, supervisor assoc. prof. V. Čyras), two dissertations were defended in 2011 (E. Gaidamauskaitė and K. Petrauskas, academic supervisor prof. R. Baronas). In this way new teaching staff for the study programme is prepared.

87. All teaching staff have professional experience directly related to the subjects in the study programme. Five lecturers combine their work at the University with activities in IT business organisations. All of them work on software system development which gives them valuable experience to help teach practical courses effectively.

88. Detailed information on academic staff (date of birth, science degree, position, subjects taught, scientific, pedagogical and practical experience) is presented in Annex 2. CVs of academic staff are presented in Annex 3.

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[42] *Description of General Requirements for Master Study Programmes*, Order No.V-826 of 3 June 2010 of the Minister of Education and Science (*Official Gazette*, 2010, No. 67-3375)

[43] *Regulation of Study Programmes at Vilnius University*, 4.5 subsection, Decision No. SK-2012-12-4 of 21 June 2012 of the VU Senate Board

89. There is a low teaching staff turnover. The turnover is influenced by their age and opportunities to combine teaching with their other academic activities or work at profit or non-profit organisations. Prof. R. Baronas, prof. M. Bloznelis, lect. D. Čiukšys, assoc. prof. A. Mitašiūnas, prof. R. Vaicekauskas and assoc. prof. V. Undzėnas were involved in teaching since the programme was launched. The involvement of other lecturers is shown in Table 9. During the past few years prof. A. Čaplinskas has not been giving lectures, but is still coordinating *Requirements Engineering* and working at Vilnius University.

Table 9. Teaching staff turnover

Position, name	Subjects taught, 2008-2013
Prof. A. Čaplinskas	Requirements Engineering (from 2008 to 2010)
Assoc. prof. A. Lupeikienė	Requirements Engineering (since 2011)
Lect. I. Naujikas	Software Systems Testing and Configuration Management (from 2008 to 2011)
Lect. A. Adamonis	Software Systems Testing and Configuration Management (since 2012)
Dr. E. Drąsutis	Project Management (from 2008 to 2012)
Dr. G. Slivinskas	Project Management (since 2013)

2.3.3. Qualifications of teaching staff and conditions for professional development

90. Lectures, seminars and laboratory work are supervised by qualified teaching staff, i.e. professors, associate professors and lecturers.

91. All teaching staff of the Department of Software Engineering are involved in state-funded research work *Modelling of Computerized Systems and Their Development Process* (2012-2016, project leader prof. R. Baronas). Earlier, together with the staff of Computer Science Department they were involved in state-funded research work *Methods of Software Systems Modelling, Development Automation and Quality Improvement* (2007-2011, led by prof. R. Baronas and Prof. R. Vaicekauskas). Lecturers of other departments are involved in implementation of some other state-funded research projects.

92. Teaching staff take part in different research projects supported by competitive funding. Teaching staff of the department head some projects: prof. R. Baronas is a head of the project supported by EU Social fund under the Global Grant measure[44], assoc. prof. A. Mitašiūnas is a leader the project partner in the EU INTERREG programme[45].

93. Teaching staff publish their research results in scientific journals, proceedings of prestigious international and national conferences. Since 2008, 43 articles have been published in publications included in the database "*Thomson Reuters Web of Knowledge*" and possessing a citation index (R. Baronas – 16, M. Bloznelis – 12 , A. Čaplinskas – 5, R. Vaicekauskas – 10 articles).

94. Prof. R. Baronas supervises 3 doctoral students (Department of Software Engineering), prof. M. Bloznelis – 1 doctoral student (Department of Mathematical Computer Science), and prof. A. Čaplinskas – 3 doctoral students (Institute of Mathematics and Informatics). Prof. R. Vaicekauskas supervises one post-doctoral researcher (Department of Computer Science).

95. Prof. R. Vaicekauskas is a co-author of two patents in the USA (No. 8436526 in 2013 and No. 7990045 in 2011).

96. Many lecturers are members of editorial boards of international scientific journals, e.g.:
- R. Baronas – *Baltic Journal of Modern Computing*, *Advances in Internet of Things*;

- M. Bloznelis – *Theoretical Computer Science*;
- A. Čaplinskas – *Computer Science and Information Technology*, *Computer Science Applied Computer Systems*;
- A. Lupeikienė – *Scientific Journal of Riga Technical University* (*Computer Sciences* division);
- A. Mitašiūnas – *The Tamkang Journal of Science and Engineering*, etc.

97. Teaching staff get actively involved in organizational and scientific committees of international conferences, e.g.:
- R. Baronas – *Joint Conference on Knowledge-Based Software Engineering* (JCKBSE10), *Baltic Conference on Data Bases and Information Systems* (BalticDB&IS'2012);
- A. Čaplinskas – *East European Conferences on Advances in Databases and Information Systems* (ADBIS), *Central and Eastern European Conferences on Software Techniques* (CEE-SET), *Baltic Conferences on Data Bases and Information Systems* (BalticDB&IS);
- A. Mitašiūnas – *International Workshop on Intelligent Educational Systems and Technology-enhanced Learning*, etc.

98. Two professors have been awarded the Lithuanian State Science Prize: prof. R. Baronas (2012) and prof. A. Čaplinskas (2006). R. Baronas was awarded the University Rector's Science Prize in 2004 and in 2010. R. Baronas' presentation at the 3rd International Conference on Advances in System Simulation (2011, Spain) got the Best Paper Award.

99. Prof. R. Vaicekauskas and prof. R. Baronas run subject-specific Informatics seminar, and prof. R. Baronas runs the seminar of the Department of Software Engineering. They organise around 10 seminars annually. Teaching staff make presentations on their research and teaching subjects in those seminars.

100. The regular methodology seminar led by prof. E. Stankus (Department of Didactics of Mathematics and Informatics) help the teaching staff improve their didactic competences.

101. Six lecturers of the study programme were improving their subject and didactic competences in 2011-2013 by participating in the project *Quality Improvement of Informatics and Software Engineering Study Programmes* (No. VP1-2.2-ŠMM-07-K-02-039) and its training sessions.

102. Teaching staff are required to improve their qualifications. The University Provisions for Assessment of Teaching and Research Staff require them to submit a report on academic activities during their term of contract which must include qualification upgrading. The academic activities are discussed at the Department's meeting to help the teaching staff plan their progress. During the analized period the teaching staff have upgraded their qualifications as required.

103. Research activities of the teaching staff are related to the subjects taught. Teachers' research activities are reflected in the supervised Master's theses. Detailed information on competences and professional development of the teaching staff is presented in Annexes 2 and 3.

2.3.4. Teaching staff mobility

104. Teaching staff of the master study programme *Software Engineering* participate in academic exchange. Prof. R. Vaicekauskas gave lectures at Bournemouth university (UK, 2013) as part of his participation in ERASMUS IP programme Network Security and Digital Investigations. Prof. M. Bloznelis went on academic visits to Helsinki University (Finland, 2008, 2009), Bielefeld University (Germany, 2008, 2009), Poznan A. Mickewicz University (Poland, 2010, 2011, 2012), Heriot-Watt University (UK, 2010). M. Bloznelis has been awarded a scientific-pedagogical title of associate professor of Helsinki University.

105. Prof. R. Baronas, prof. M. Bloznelis, prof. A. Čaplinskas, assoc. prof. K. Lapin, assoc. prof. A. Lupeikienė, assoc. prof. A. Mitašiūnas and prof. R. Vaicekauskas have participated in many scientific conferences, congresses, exhibitions, seminars and symposiums abroad. Results of the visits are regularly discussed in the seminars and meetings of the Department of Software Engineering. Science events help to stay updated with the best international practices and amend the

courses respectively. Nevertheless, teaching staff mobility opportunities are not exploited to a satisfactory extend.

106. Prof. Algirdas Pakštas (London Metropolitan University, UK) visited the Department of Software Engineering in 2012 and reviewed the study program description as well as topics of the subjects. Improvements were discussed in a meeting at the Department. The visit was supported by the European Social Fund (Project *Quality Improvement of Informatics and Software Engineering Study Programmes*, No. VP1-2.2-ŠMM-07-K-02-039).

2.3.5. Student/teacher ratio in the study programme

107. Faculty Council has set the following annual teaching workload guidelines: 320 academic hours for professors and associate professors, 360 academic hours for lecturers and assistants. The remaining time is devoted to research and methodological activities of teaching staff. Assoc. prof. S. Dapkūnas, assoc. prof. K. Lapin and assoc. prof. V. Undzėnas have temporarily exceeded the suggested workload by 25%.

108. The Faculty average student/lecturer ratio is consistent with the University's ratio which is 11.4.

2.3.6. Strengths, weaknesses and opportunities for improvement

109. The teaching staff of the programme are highly qualified. Therefore, the accumulative scientific achievements are also high. However, some teachers should participate in research more actively. Possibilities for different research are regularly discussed at the Department's meetings to help the teaching staff plan their progress.

110. The teaching staff of the study programme as well as the academic staff of the Software Engineering Department conduct research in the field of Informatics (09P) in the area of Physical Sciences. However, the research topics tend to be rather broad; the staff are planning to focus more on software engineering.

111. All lecturers have professional experience, which is very important in teaching applied subjects. They know well what is expected of students when they enter a job market, therefore, they tailor the courses accordingly.

112. There are two lecturers among all without a doctoral degree. All doctoral students are encouraged to join the Department of Software Engineering. It is expected that all teachers will have doctoral degrees in the future.

113. Three lecturers (A. Adamonis, E. Drąsutis, G. Slivinskas) work at the University part-time on the side to working at business organisations. While the courses are always up to date to the modern business practices, there are less prospects for research opportunities because of the extensive lecturers' workload.

114. Opportunities of academic exchange for teaching staff are not exploited satisfactorily. More teachers should participate in international academic exchange programmes.

115. There are two lecturers (prof. A. Čaplinskas and assoc. prof. V. Undzėnas) who are over 65 years old. The Department ensures that their courses are taken over by younger lecturers and there is an extensive transformational period so that the quality is maintained. Assoc. prof. A. Lupeikienė is already giving lectures and getting prepared to take full responsibility of the course supervised by prof. A. Čaplinskas when needed.

2.4. Material Resources

2.4.1. Facilities

116. The Faculty of Mathematics and Informatics (MIF) is situated in two locations in Vilnius: two buildings are next to each other in Naugarduko Str. 24 and Šaltinių Str. 1a, and another building is located in Didlaukio Str. 47. Both places of the Faculty are reachable by public transport. Information on the average preoccupation of the facilities is presented in Table 10.

Table 10. Premises of the Faculty.

No.	Address	Area, m^2	Preoccupation of learning areas in autumn/spring semesters (%)
1.	Naugarduko Str. 24 and Šaltinių Str. 1A	6,818 (5,715+1,103)	85/70
2.	Didlaukio Str. 47	6,907	80/70
	In total:	13,725	

117. The academic timetable is designed in a way that most of the lectures of Software Engineering study programme take place in the building in Didlaukio Str. 47. It depends on a semester and study year, but approximately one or two days per week lectures take place in Naugarduko Str. 24 and Šaltinių Str. 1A. All lectures are placed in one location on the same day, except for the case when students have chosen to attend some lectures in other faculties.

118. Most auditoria for lectures have 22-25 seats. Several larger auditoria have 200, 150, 100 or 80 seats. Computer laboratories have from 8 to 20 seats with stationary computers/terminals, and additional 4-8 places as mobile work places. Part of the auditoria has stationary projectors and screens. There are also 2-3 portable laptops and projectors for use at each building.

119. Students can individually study the subject material in the Faculty library located in the building in Naugarduko Str. The library has 92 seats. The working hours of the library: 9:00-18:00. The occupation of the library varies during the study year: in July-August it is approximately 1-5%, in September it reaches 70%, and in December and May it rises to 95%, and during the remaining time it ranges between 30-70%.

120. There is also a spare-time room in Naugarduko Str. building where students usually study, relax or use self-service cafeteria. There are several self-study and relaxation areas in Didlaukio Str. building, having even a table tennis board.

2.4.2. Equipment for studies

121. Computer laboratories are located in the building in Šaltinių Str. and in Didlaukio Str. The building in Šaltinių Str. accommodates 14 laboratories with 132 computers. The building in Didlaukio Str. 47 accommodates 7 laboratories with 94 computers. Also new laboratories are being equipped in the building in Didlaukio str. 47: there will be 60 newly equipped seats with computers. The average occupation of laboratories is 80%. When laboratories are not used for practice classes in Šaltinių Str., students can use them for self-study. The laboratories enable students to work on two different operating systems (*Windows* and *Linux*). There are several open access computer work places in each building.

122. The Faculty has 4 specialised laboratories: Mobile Application Development Laboratory, Robotics Laboratory, Networking Laboratory and Science and Business Communication Laboratory. Mobile Application Laboratory is equipped with laptop computers, tablets and smart phones. It is a meeting and working point for students interested in mobile applications development. Robotics laboratory is used by students interested in robot building projects and as an after school children education facility. Science and Business Communication laboratory is equipped with interactive table, interactive whiteboard and video conferencing equipment. Networking Laboratory provides special networking equipment for learning purposes.

123. Students and academic staff can also use the super computer located in the Faculty of Mathematics and Informatics for scientific research purposes or educational activities. They can use Cloud services, get direct access to some super computer resources or use GRID computing capabilities.

124. Wireless internet connection is present in all three Faculty buildings (MIF Open network). In almost all Faculty and in parts of other Vilnius University buildings students can also use a wireless EDUROAM internet connection (international network of wireless internet access for academic organizations). Students can use additional electronic resources of the Faculty: every student gets 250 MB of space in servers for study purposes and can create, and publish his or her

own websites. In both locations printing service is available for students and academic staff. Faculty is part of Microsoft DreamSpark and Cisco Networking Academy.

125. Vilnius University Centre of Information Technology Development provides various core IT services for staff and students (e-mail, e-mail conferences, wireless academic network EDUROAM, internet websites creation capabilities, web page hosting, etc.). Vilnius University E-learning and Examination Centre provides Virtual Learning Environment for lecturers and students and enables examination of large groups of students simultaneously in large computer classes in Saulėtekio Str. buildings.

126. Each year the Faculty assigns around 200'000 LTL for IT equipment renewal budget. Part of this budget comes from EU projects and Lithuanian national funds.

2.4.4. Practice basis

127. The study plan includes professional practice done by students in enterprises and institutions. The majority of students do their professional practice in Vilnius. A small number of students go abroad according to Erasmus programme. During professional practice students communicate with their VU practice supervisors most frequently via e-mail or internet telephone.

2.4.3. Learning Resources

128. The Faculty library owns around 65500 various resources and publications (books, journals, textbooks) on mathematics, statistics, probability theory, computer science, information technologies, database management systems, cryptology, and other themes in different languages (mostly in English and Lithuanian). Students can also use resources and self-study environment in the new Vilnius University library (MKIC) located in Saulėtekio Str.

129. Resources of the Faculty library are constantly updated according to the plan of central library of the University and teachers' requests. Usually teachers send their requests to the library staff. Books or journals are ordered after the list of requested resources is approved by the vice-dean for financial matters. Each year the amount spent on faculty library resources renewal varies from 17000 LTL to 28000 LTL.

130. Students of *Software Engineering* study programme can use various learning materials, textbooks and other resources from the Faculty library, especially on mathematics and informatics. Lecture notes of most of the subjects are available for students in lecturers' web pages, in virtual learning environments, tutorials on the Internet, and electronic data bases (via Vilnius University library): ACM Digital Library, IEEE, *Springer Link*, *ISI Web of Science*, *JSTOR*, *Science Direct*, *Taylor&Francis*, *Wiley Online Library*, or others locations. Thus, students have access to the state-of-the-art learning and scientific materials.

131. In overall view, it is sufficient of material resources for successful learning process. During last 5 years Faculty has obtained 4 new laboratories (Mobile Application Development Laboratory, Robotics Laboratory, Networking Laboratory and Science and Business Communication Laboratory). The super computer was substantially upgraded expanding its capabilities and making it one of the most powerful super computers in Lithuania. An Information Technology Open Access Centre was established as a gateway for super computer resources and scientific services of the Faculty. The building at Didlaukio Str. was renovated and 8 new computer classes were installed, having 70 work places. Currently faculty is renovating 3 more computer classes at Didlaukio Str., each having 20 work places. This step will give the ability to create more effective and convenient academic timetable as well as to allow less overcrowded classes where computer is shared by several students.

132. In 2013, the National Open Access Scholarly Communication and Information Centre at VU Library was opened. The working hours of the Centre are 24/7. Most important for the students of *Software Engineering* study programme are reading halls for Physical and Technological Sciences and book stock. Students can reserve rooms for individual and group work, but they are not numerous.

133. The main book stock necessary for master students of *Software Engineering* was accumulated during the implementation of the ESF funded project "Introduction of the Master

Study Programme of *Software Engineering*" (BPD2004-ESF-2.5.0-01-04/0015, 2005-2008). The book stock is regularly supplemented by new books.

134. Teaching material for many subjects can be accessed in lecturers' websites in the virtual learning environment. Teachers of six subjects updated their teaching material quantitatively and qualitatively during the implementation of the ESF funded project "*Quality Improvement of Informatics and Software Engineering Study Programmes*" (VP1-2.2-ŠMM-07-K-02-039, 2011-2013).

135. The Faculty is currently not adapted for people with disabilities. Faculties' buildings in Naugarduko Str. and Šaltinių Str. only ground floors are accessible for disabled students. Faculties building in Didlaukio Str. has several possible entrances for disabled students (ground, 2nd, 3rd floors), but usage of different entrances is not acceptable. There is a plan to install an elevator in Didlaukio Str., which would improve the situation.

2.4.5. Strengths, weaknesses and opportunities for improvement

136. Material resources are sufficient for the successful implementation of the study programme. Premises are sufficient and their quality is appropriate but they are located in different places around the town. Since September 2012 Software Engineering Department and teachers' offices are located in Didlaukio Str., but students have classes in both locations: in Naugarduko Str. and in Didlaukio Str. Different locations make individual consulting of students complicated. There is also no student administration office in Didlaukio Str.

137. Currently there is a lack of private group working areas, where students could do group projects and activities. Instead they accommodate themselves in open areas. The administration is planning to implement reservation system for small offices and this step will solve the problem.

138. The number of textbooks on software engineering topics could be bigger in order to allow the students not only to read the books in the library but to borrow and take them home.

139. There is no intranet at the Faculty. This restricts the dissemination of specific teaching and personalised information. However, this problem should be solved soon.

140. The Faculty is currently not adapted for people with disabilities. There is a plan to install an elevator in Didlaukio Str., which would improve the situation.

2.5. Study process and students' performance assessment

2.5.1. Admission requirements, admission statistics and trends

141. Admission procedures to the second cycle studies and the composition of competitive score are announced every year in VU Information Bulletin, in websites of the University and Faculty.

142. Bachelors of *Software Engineering* as well as graduates from other study fields can be admitted to the master study programme of *Software Engineering*. There is a formal entrance examination to ensure the necessary knowledge and abilities of all prospective master students. The following subjects are examined: Programming, Database Management Systems, Algorithms and Data Structures, Operating Systems, Software Engineering, Software Process, and Internet Technologies.

143. The competitive score is formed according to the formula: $E + 10(VS/VS_v) + P$, where E is the grade for the entrance examination, VS – mean average of all grades in the Diploma Supplement, except the grade for the graduation thesis, VS_v – mean average of all grades in the Diploma Supplement, except the grade for the graduation thesis, of that year. VS_v is calculated according to the methodology described in Admission Rules. Additional points are given on submission of appropriate certificates as indicated in Admission Rules.

144. A decreasing number of state funded places, decreasing popularity of physical and technological sciences caused a decrease in a number of applications and enrolled students. The number of students is restricted by the admission plans only, there have always been more applicants than state funded places (see Table 11).

Table 11. Summary of applications to the study programme, ranking invited candidates and their competitive scores

Year	Plan	No. of applic.	Mean average	Invited	Admitted	Competitive ranking		Entrance score	
						first	last	first	Last
2008	sf-46	83	0.93	46	46	1	59	32.33	14.68
	snf-5	18	0.79	3	3	11	16	15.55	13.44
2009	sf -37	60	0.91	37	37	1	39	22.77	15.21
	snf-10	18	0.34	0	0	0	0	0	0
2010	sf -37	64 (39)	0.97	39	38	1	54	22.44	14.17
	snf-2	7	0.62	0	0	0	0	0	0
2011	sf -43	73 (48)	0.94	42	42	1	52	22.51	14.97
	snf-2	9	0.52	1	1	7	7	13.93	13.93
2012	sf 34	50 (37)	0.96	34	34	1	41	22.29	15.50
	snf-3	6	0.34	0	0	0	0	0	0

*in brackets: number of applications which indicated *Software Engineering* as first choice, if this is known

sf – state funded,

snf – non-state funded.

145. Candidates applying for this study programme are very motivated, 90-100% of enrolled students indicated *Software Engineering* as their first choice. This makes *Software Engineering* one of the most popular and motivating second cycle study programmes implemented by the Faculty of Mathematics and Informatics.

2.5.2. Changes in student numbers: reasons for "drop out"

146. During the last 5 years the number of enrolled students fluctuated between 34 and 49, however, the number of students who completed or were continuing their studies fluctuated considerably less: between 24 and 30. Detailed figures are presented in Table 12. 201 students were admitted to the study programme during 2008-2012. 135 students (67.2%) have completed or are still continuing their studies, 66 students (32.8%) dropped out.

Table 12. Number of enrolled students who completed or are continuing their studies

Year of admission	No. of enrolled students	No. of students who completed or are continuing their studies	No. of "drop-outs"	"Drop-out" rate, %
2008	49	28	21	42.9
2009	37	30	7	18.9
2010	38	28	10	26.3
2011	43	25	18	41.9
2012	34	24	10	29.4

147. Reasons why students "drop out" vary. The most frequent reason is trying to coordinate studies and work in business enterprises, state or public institutions or organisations. This coordination proves to be an enormous challenge for some students, because master studies require considerable effort. Due to material difficulties students give priority to work and voluntarily drop out. Every year a few students (1-3 students) have to leave the study programme due to unsatisfactory academic record.

148. Academic achievements of master students are similar to the Faculty average. Results of examination sessions are presented in Table 13.

Table 13. Average grade of exam sessions of enrolled students

	Year of admission				
	2008	**2009**	**2010**	**2011**	**2012**
No. of enrolled students	49	37	38	43	34
Average grade of exam sessions					
Semester 1	8.25	8.4	8.36	7.21	7.84

Semester 2	7.68	8.38	7.78	7.32	8
Semester 3	8.65	8.61	8.77	8.44	
Semester 4	8.75	8.52	8.67	8.33	

149. One of the possible drop out reasons analysed was the admission of bachelors from other study fields to the master study programme of Software Engineering. In 2011, three bachelors of Physics and one bachelor of Russian Philology were enrolled into the study programme. All had some practical knowledge acquired during work in IT companies and are successfully continuing their studies or have already completed them. V. Lubys, who completed his bachelor studies at the Faculty of Physics, has successfully defended his Master's thesis and is among the best graduates of 2013. Thus, bachelors from other study programmes who have practical IT skills and have passed the entrance examination are able to complete the master study programme of *Software Engineering*.

2.5.3. Academic support for students

150. Students receive different kinds of academic support: information on the study process is provided by the Study Office of the Faculty, the University Directorate of Studies, the University Centre of Scholarly Communication and Information, Department of Software Engineering, administration of the Faculty, and Student Representative Office. Students can get individual consultations or look for information in the webpages. Support concerning the issues of IT application is provided by the Digital Research and Computing Centre of the Faculty and the University IT Application Centre.

151. The issues of examination and re-examination procedures at the Faculty Council are discussed with the representatives of the Student Representative Office. Students have a representative in the Appeals Committee of the Faculty.

152. The Student Representative Office delegated G. Graževičius as an observer in the Study Programme Committee. He takes part in discussion concerning the study programme, updating of subjects and quality of teaching.

2.5.4. Student research and artistic activities

153. Every semester students carry out research work. In the first semester they choose research topics and supervisors who help students to realise themselves in research activity. Students are encouraged to write research articles and prepare themselves for doctoral studies. Students are involved in research projects implemented by the department. In 2013, V. Karpavičius, a graduate of the programme, together with his supervisor assoc. prof. R. Krasauskas prepared an oral presentation "Real-time visualization of Moebius transformations in space using Quaternionic-Bezier approach" for the International Conference in Central Europe on Computer Graphics, June 24-27, 2013, Plzen, Czech. Their article was accepted for publication in the conference proceedings. V. Karpavičius was presented for a Magna Cum Laude diploma. In 2012, another graduate Š. Ledas together with foreign co-authors submitted an article "Sensory Media: Multidisciplinary Approaches in Designing a Situated & Mobile Learning Environment for Past Topics" which was published in the International Journal of Interactive Mobile Technologies (vol. 6, no. 3, 2012). Š. Ledas' application "Bear Care" for mobile devices was awarded the "Best App Award" in the world competition "Mobile Premier Awards 2012" (Barcelona, Spain).

154. Students have many opportunities to join arts and sports groups. The University has a Sports and Health Centre and a Cultural Centre. The Sports and Health Centre organises sports activities for students and staff. The Cultural Centre supports activities of 10 arts groups of students and staff.

2.5.5. Student participation in exchange programmes

155. Vilnius University provides enough wide opportunities for student exchange. Master students of *Software Engineering* who want to study or do an internship abroad for a certain period use the opportunities offered by ERASMUS student exchange programme and go to different countries in Europe and Australia. However, there is a low participation rate for this programme (3 students in 2009, 2 in 2010, 2 in 2011, none in 2012 and 2 in 2013) due to the fact that most of the

master students already have jobs. Student survey showed that 100% of them combine Master studies with employment (sample included 16 1st year Master students and 23 2nd year Master students; survey conducted in June 2013).

2.5.6. Social support

156. The university students can get several kinds of student grants. Grants are awarded for extraordinary achievements in research, academic results, relative ranking to other students, and other activities. The procedures for awarding those grants are set by VU Grant Provisions[46] approved by the Board of the Senate.

157. Social grant is paid to students who meet at least one criterion set by the Lithuanian legal acts for identifying socially supported persons. Extraordinary social grant (500 to 1,500 LT) is paid in case of death or illness of family members, natural disasters or similar reasons. Extraordinary special purpose grant (500 to 2,000 LT) is paid for sports, cultural, research or social activities.

158. The Faculty provides opportunities for disabled students. They can receive social support, study according to individual study plans, etc.

159. Vilnius University has a large number of student hostels offering accommodation services to students. VU Career Centre provides advice concerning career issues. Students can receive psychological help at the VU Psychological Innovation and Experimental Research and Training Centre. Psychological services are also provided by the Youth Psychological Help Centre.

2.5.7. Assessment of student achievements

160. Student knowledge and abilities are assessed in accordance with the VU Statute, Study Provisions, Procedures for Assessment of Study Results[47]. Assessment is performed objectively, in conformity with the principle of goodwill. During the semester continuous assessment (participation in seminars and practical classes, home assignments, presentations) and formative assessment (tests, quizzes, written assignments) of study results are used.

161. The 10-point assessment system is used during examination with a passing grade of 5. Research work during the first and second semester is assessed as "pass" or "fail". Students get a "pass" if they have acquired more than 50% of knowledge an abilities indicated in the course description. Lecturers introduce the course requirements, assessment criteria and forms of assessment in the first lecture. Assessment and the grade composition are defined in the course description. The final grade can be cumulative or complex. Its compositions are calculated as specified in the course description. During the examination session the results of examinations are announced within 5 working days after the examination.

162. Students are acquainted with the results of formative assessment and examinations and receive explanations for the given grades. Reviews on Master's theses are submitted in writing. Students can address the Appeals Committee if they do not agree with their assessment, the only exception being the assessment of the Master's thesis.

163. Regular attention is devoted to feedback. Students are asked to express opinions about the study programme, study subjects and teaching quality. At the end of each semester students are asked to fill in a detailed questionnaire and evaluate the subjects and the work of academic staff. Regular student opinion surveys are carried out on the VU webpage and administered by the VU Quality Management Centre. Provided answers are analysed anonymously. Students' opinions are regularly discussed and the problems determined are solved by the Department and the study programme committee to improve course descriptions, the procedures of assessment, to change the ways methodological resources are presented, etc. Student remarks are taken into account, e.g. in order to eliminate duplication of knowledge in different subjects. Student feedback initiated the decision to change the lecturer of the optional subject *Software Systems Testing and Configuration Management* in 2012.

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[46] VU Grant Provisions approved by the Senate Board Decision No. SK-2012-5-5 on 8 March 2012.
[47] VU Study Results Assessment Procedures approved by the Senate Board meeting on 22 June 2006 (Minutes No. SK-2006-11)

2.5.8. Professional activities of the graduates of the study programme

164. The majority of students combine their Master studies with work activity. They are usually employed by enterprises in the IT sector or IT divisions of other enterprises. Surveys of IT sector employers and data of the Lithuanian Labour Exchange show that the demand for software engineering specialists already exceeds the supply, therefore, graduates do not encounter any difficulties in finding employment.

2.5.9. Ensuring honest studies

165. The staff of the department implement the principles of honest study. VU has an Electronic Document Plagiarism Recognition System which is available to academic staff. The System is used to check written assignments, including Master's theses, for plagiarism.

2.5.10. Strengths and weaknesses

166. Though all state funded places in the study programme are filled every year, the competition for places is low. As a result, some less motivated students are enrolled, which is reflected in their academic results and causes considerable "drop out" ratio.

167. The international mobility of students is relatively low. VU provides opportunities for student exchange, but students are not active because they are often committed to employment and cannot combine studies abroad with their jobs. In the future students should be encouraged to study abroad for a certain period of time in some of the best universities of Europe and other countries.

168. The system of academic and social support for students is functioning well.

169. Student articles get published relatively rarely. Research supervisors should encourage students to publish their work. Due to poor financial motivation, students are forced to combine their studies with work, which often has a negative impact on students' academic results.

170. Graduates of the study programme are appreciated in the job market and have no major problems finding employment.

2.6. Programme management

2.6.1. Regulation of study quality assurance

171. Quality of studies is one of the important priorities of Vilnius University. The University quality culture as a culture of constant improvement and positive change is fostered on the basis of values established in the mission of the University, provisions of study quality assurance of the European Higher Education Area, principles of social responsibility and partnership. VU Study Committee is checking study programmes according to a set plan. The aspects include monitoring and evaluation of the qualifications provided by the study programme, student learning outcomes, student survey results, updating of pedagogical competences of the academic staff, material resources, academic, cultural and social support for students, feedback from the participants of the study process, etc. The Council of the Faculty of Mathematics and Informatics is responsible for the internal evaluation of the study programmes.

172. Student opinions about the study programme and the study process is a very important factor in the study programme implementation control. Therefore, after the examination session the VU Quality Management Centre carries out student surveys about study subjects and study process. The chairperson of the study programme committee is acquainted with student opinions concerning teaching staff, subjects and teaching. The study programme committee regularly discusses this information as well as information on examination results, professional practice and defence of graduation theses and presents the annual report to the Faculty Council.

173. The quality of studies is assured through:
- Internal study quality assurance processes and procedures;
- Information related to study quality, including various measures (external valuation results, requirements for accreditation of the study programmes, student and academic staff satisfaction surveys, etc.);
- Design and implementation of internal study quality management system;
- Close cooperation with students and social partners.

2.6.2. Study programme management

174. The study programme of *Software Engineering* is administered by the Study Programme Committee. The Committee since the introduction of the study programme has been headed by prof. dr. R. Baronas, members of the Committee are as follows: prof. dr. habil. Remigijus Leipus (Vice-dean of the Faculty), assoc. prof. dr. Antanas Mitašiūnas, assoc. prof. dr. Saulius Ragaišis, dr. Aldas Glemža (social partner, director of business development of UAB „Blue Bridge Baltic"), student representative Giedrius Graževičius, master student of *Software Engineering*. The Committee, headed by the chairperson, is fully responsible for the implementation of the study programme.

175. The Study Programme Committee is cooperating with other members of the Faculty and social partners. Important questions related to the programme are solved in the following way: when the Committee receives feedback from academic staff and students, it considers legal acts regulating higher education studies, then observes changes in the labour market and developments in the field of software engineering and subject didactics. Any proposals arising in response to this information are discussed in the Study Programme Committee and Department of Software Engineering, and then submitted to faculty Council for approval.

176. At the end of every semester the Study Programme Committee discusses the issues that arose during the period, suggests solutions, and prepares documents for the implementation of changes. Once a year the Study Programme Committee reports to the Faculty Council.

2.6.3. Feedback

177. Student opinion surveys about the quality of the study programme are not made public, because it could have a negative effect on the study process and relationships between academic staff and students. However, the participants of the teaching process have opportunities to get acquainted with this information.

178. Survey results are used to improve the quality of programmes and study process. All suggestions are carefully considered but some of them have to be denied. Social partners sometimes propose practical disciplines which are important for the activities of their companies but contradict the aims of the study programme.

179. Student academic records are kept in the Study Office of the Faculty. This information is used for the analysis of the study process.

180. Students are also directly involved in improving the quality of studies by discussing important issues related to the study programme. Student representatives in the Study Programme Committee and Faculty Council raise questions concerning examinations and formative assessment and make proposals about improvement of teaching.

2.6.4. Cooperation with employers

181. Cooperation with employers is one of the main measures of study quality assurance. Dr. Aldas Glemža, director of business development of UAB "Blue Bridge Baltic", is representing social partners as a member of Study Programme Committee. The Master's Theses Defence Committee is always headed by a representative of employers. This year it was social partner dr. Evaldas Drąsutis, deputy general manager at „Sintagma" group of companies. Social partner dr. Julija Pragarauskaitė, department head at Barclays Technology Centre, is also a member of the Master's Theses Defence Committee.

182. Representatives of social partners UAB „Sintagma", UAB „MitSoft", UAB „Blue Bridge", UAB „Neurotechnology", AB „LESTO" and others work part-time at the Department of Software Engineering and supervise graduation theses. Some of them are graduates of the *Software Engineering* study programme. This way direct contacts are maintained between teachers, students and social partners, potential employers of students.

183. Employer feedback is also collected when the students perform professional practice. The representatives of employers propose the grade for the practice as well as assess the students' knowledge, abilities, and personal characteristics. Table 14 provides the grades proposed by the employers. The detailed assessment of the students is presented in Annex 6.

Table 14. Assessment of students' professional practice by employers (numbers of students)

Year	Grade					
	10	**9**	**8**	**7**	**6**	**5**
2012	100% (29)					
2011	93% (25)	7% (2)				
2010	83% (19)	13% (3)			4% (1)	
2009	89% (25)	7% (2)	4% (1)			
2008	88% (30)	8% (3)	3% (1)			

184. Feedback from social partners and employers helps to relate competences and learning outcomes of the study programme to practical work, and professional practice becomes more useful for future employment.

2.6.5. Strengths, weaknesses and opportunities for improvement

185. The study programme committee and the department maintain close relationships with social partners. These contacts help to assure the quality of studies.

186. Graduates of the Programme work in a number different enterprises and it is hard to maintain close relationships with all of them. Feedback from graduates of the study programme is too weak.

187. Strengthening of relationships with employers and graduates is yet an underexploited measure of quality improvement. The relationship could be improved by establishing the system for feedback collecting.