



STUDIJŲ KOKYBĖS VERTINIMO CENTRAS

VILNIAUS UNIVERSITETO
PROGRAMŲ SISTEMOS STUDIJŲ PROGRAMOS
(612I30001)
VERTINIMO IŠVADOS

EVALUATION REPORT
OF SOFTWARE ENGINEERING (612I30001)
STUDY PROGRAMME
at VILNIUS UNIVERSITY

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DUOMENYS APIE ĮVERTINTĄ PROGRAMĄ

Studijų programos pavadinimas	<i>Programų sistemos</i>
Valstybinis kodas	612I30001
Studijų sritis	Fizinių mokslų studijų sritis
Studijų kryptis	Programų sistemos
Studijų programos rūšis	Universitetinės studijos
Studijų pakopa	Pirmoji
Studijų forma (trukmė metais)	Nuolatinė (4 m.)
Studijų programos apimtis kreditais	240 ECTS
Suteikiamas laipsnis ir (ar) profesinė kvalifikacija	Programų sistemų bakalauras
Studijų programos įregistravimo data	Lietuvos Respublikos švietimo ir mokslo ministro 2002 m. birželio 14 d. įsakymu Nr. 1093

INFORMATION ON EVALUATED STUDY PROGRAMME

Title of the study programme	<i>Software Engineering</i>
State code	612I30001
Study area	Physical Sciences
Study field	Software Engineering
Kind of the study programme	University Studies
Study cycle	First
Study mode (length in years)	Full-time (4 years)
Volume of the study programme in credits	240 ECTS
Degree and (or) professional qualifications awarded	Bachelor of Software Engineering
Date of registration of the study programme	14 of June 2002, under the order of the Minister of the Ministry of Education and Science of the Republic of Lithuania No. 1093

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I. INTRODUCTION

Vilnius University (VU) has been founded in 1579. The University has 12 faculties, of which the Faculty of Mathematics and Informatics is one of the largest and has ten departments. The departments are organized in such a way that five of them are mainly within mathematics (Differential Equations and Numerical Mathematics, Econometric Analysis, Mathematical Analysis, Mathematical Statistics, Probability Theory and Number Theory), four are within computer science (Computer Science, Computer Science II, Mathematical Computer Science, Software Engineering), and one is in didactics of the two disciplines (Didactics of Mathematics and Informatics).

Senate is the highest governmental authority of VU and approves the structure of the University. The academic activities are managed by the rector who is responsible for the performance of the University. Key issues of the University can also be addressed in the Council. Faculties, institutes and study centres, jointly called “academic divisions”, are responsible for the organization of studies. A faculty is managed by the dean. Departments have autonomy in solving the academic and scientific tasks set by the faculty and the University. Departments are led by their heads.

The Bachelor study programme in *Software Engineering* has been registered in June 2002. The programme belongs to the first level of university studies, and results in the degree Bachelor of Software Engineering. The programme is organized and implemented by the Faculty of Mathematics and Informatics, with the department of Software Engineering having the main responsibility.

The study programme is evaluated according to the *Methodology for Evaluation of Higher Education Study Programmes*, as approved by Order No 1-01-162 of 20 December 2010 of the Director of the Lithuanian Centre for Quality Assessment in Higher Education, and to the *General Requirements of the First Degree and Integrated Study Programmes*, as approved by Order No V-501 of 9 April 2010 of the Minister for Education and Science of the Republic of Lithuania. This evaluation report has been produced by an international Expert Team invited by the Centre for Quality Assessment in Higher Education. The report is based on analysis of the assessment material submitted by VU, and on observations and interviews on a site visit conducted by the Team.

The site visit to the study programme took place on 29 November, 2013. During the visit the Expert Team met and interviewed the administrative staff of the Faculty (on 26 November), the group responsible for the self-evaluation report, teachers and students of the study programme, as well as alumni (graduates), employers and other social partners of the programme. The Team also observed the central support services of the programme (classrooms, library, computer classes and laboratories) and studied the students’ course works and Bachelor’s theses.

At the end of the site visit the Expert Team presented its preliminary findings and general remarks to the staff responsible for the study programme. After the visit the Expert Team discussed its findings and produced this joint evaluation report.

The international Expert Team consisted of its chair, professor Jukka Paakki (University of Helsinki, Finland), professor Rolf Backofen (University of Freiburg, Germany), professor Jerzy Marcinkowski (University of Wrocław, Poland), Vida Juozapavičienė (employer representative – social partner, Lithuania), and Lukas Jokūbas Jakubauskas (student representative, Lithuania).

As a general remark, the Expert Team was impressed by the language skills of the interviewees: all the meetings were held in English and no translator was needed during the visit.

II. PROGRAMME ANALYSIS

1. Programme aims and learning outcomes

The *Bachelor study programme on Software Engineering* has been registered in 2002. The previous external evaluation of the Programme took place in 2006. In 2009, the Programme was accredited until the end of 2014. The Programme has been constantly renewed and improved, the latest renewal being made in 2013 due to changes in the national regulation of study programmes. The renewal was mainly structural and did not affect the aims or learning outcomes of the Programme.

The aims, objectives and learning outcomes of the Programme are well defined, clear and published in the websites of Vilnius University, Faculty of Mathematics and Informatics, and Department of Software Engineering. The information is accessible from the web, but scattered in several locations.

The general objective of the Programme is to educate highly qualified IT specialists who match the needs of the Lithuanian economy, are capable of producing software products and providing software services, and can successfully compete for IT jobs in the European Union and other foreign countries. The learning outcomes and the curriculum meet this objective by being broad enough both in general contents as well as in specialization into software development.

The graduates of the Programme establish themselves in the labour market very successfully, and are in most cases employed in accordance with the aims and objectives of the Programme; according to a survey from June 2013, more than 90 % of 4th year students have a job in software development. On the other hand, good employment of the students involves problems as well since the main reason for drop out is starting to work during the studies. Based on the meeting of the Expert Team with social partners, still more Bachelors (and Masters) of Software Engineering would be needed in the Lithuanian labour market.

The Programme is mainly implemented by the Faculty of Mathematics and Informatics and its departments of Software Engineering (main stakeholder), Computer Science, Computer Science II, Mathematical Computer Science, Didactics of Mathematics and Informatics, Differential Equations and Numerical Mathematics, Mathematical Analysis, and Mathematical Statistics. In addition, the Programme involves staff from the faculties of Physics and Economics and from the Institute of Foreign Languages.

On one hand, such a large number of participants makes it possible to provide a broad selection of subjects in the Programme, but on the other hand introduces problems in management and coordination. The Expert Team has noticed clear coordination and responsibility problems in the Programme and finds it necessary to solve them, first of all, by strengthening the role and actual decision power of the Study Programme Committee for ensuring the coherence of the Programme.

From a governmental point of view into higher education in Lithuania, Software Engineering (“main field”) belongs to the group of “study fields” of Mathematics and Computer Science in the “study area” Physical Sciences. This has implications on the nature and profile of the Study Programme which is by its context a member of the academic disciplines in natural and exact

sciences (and not, for instance, in social sciences). In addition to Software Engineering, the Faculty of Mathematics and Informatics offers Bachelor programmes also in the related fields of Informatics, Information Technologies, and Bioinformatics. While there is unavoidable overlap between these programmes, the Programme in Software Engineering has its own distinctive characteristics by concentrating on one of the most relevant sectors in IT industry, software development.

In general, the aims and learning outcomes of the Programme are consistent with the type and (Bachelor) level of the studies and the qualifications provided. Also the name of the Programme, as well as its learning outcomes, content and qualifications are compatible with each other.

2. Curriculum design

The curriculum of the Programme has been designed to comply with the national General Requirements of the First Degree and Integrated Study Programmes (2010), the Regulation for Study Programmes at Vilnius University (2012), and the Organizational Arrangements for Minor Studies at Vilnius University (2012). A student of the Programme has two choices for obtaining a Bachelor degree: (1) to complete the entire Programme according to its requirements and get a (single) Bachelor degree in Software Engineering, and (2) to complete just the compulsory part of the Programme, conduct studies in a “minor” study programme and get a double Bachelor degree with “major” in Software Engineering.

The Study Programme meets the legal requirements as follows:

- the volume of the Programme is 240 credits in ECTS (European Credit Transfer and Accumulation System) (minimum: 210 ECTS, maximum: 240 ECTS)
- the volume of the compulsory and optional “modules” as educational components varies between 10 and 30 ECTS (minimum: 10 ECTS)
- there are 2-6 course units per semester (maximum: 7)
- the volume of General University Studies, GUS, is 15 ECTS (minimum: 15 ECTS)
- the volume of subjects in the study field is 165 ECTS (minimum: 165 ECTS)
- the volume of the final Bachelor’s thesis is 15 ECTS (minimum: 12 ECTS)
- the volume of professional practice as “practical placement” is 15 ECTS (minimum: 15 ECTS)
- student workload per year is 60 ECTS and 1600 hours (60 ECTS, 1600 hours)
- student workload per ECTS varies between 26 and 29 hours (25-30 hours)
- the volume of optional subjects is 60 ECTS (30-60 ECTS)
- about 42 % of teaching is allocated to contact hours (35-60 %)

The curriculum is broad and covers most of the subjects that are internationally considered essential for Software Engineering. There are enough optional subjects (60 credits in total, including GUS) so that students can choose topics that they personally find interesting or relevant for their career. About 1/3 of the subjects (including practice, coursework, and thesis) are in Software Engineering, 1/3 in the more general scope of Computer Science, and 1/3 in other disciplines (mainly Mathematics). The Expert Team considers this as a good balance between the core of the Programme and the closely related and more general topics. Also, the scope of the Programme is sufficient to ensure reaching the learning outcomes.

The compulsory part of the curriculum consists of 25 credits of Mathematics (*Mathematics for Software Engineering I-III, Discrete Mathematics, Mathematical Logic*), 50 credits of general Computer Science (*Computer Architecture, Procedural Programming, Algorithm Theory, Algorithms and Data Structures, Object Oriented Programming, Object Oriented Programming*

II, Database Management Systems, Computer Networks, Internet Technologies, Human Computer Interaction), 50 credits of Software Engineering (*Software Engineering I-II, Software Testing, Software Design, Software Development, Software Projects and Quality Management, Software Process*), 20 credits of transferable subjects (*IT and Communication Skills, English Language I-II, Professionalism and Ethics*), 20 credits of practical work (*Coursework, Professional Practice*), and 15 credits for Bachelor's thesis.

The optional part of the curriculum contains General University Studies, Mathematics, Computer Science, Physics, Management, Accounting, and Law. In principle the selection is large and the Study Programme provides enough room for individual choices. However, when interviewing the students it was found out that all the optional subjects (courses) in the study plan are not necessarily given to all the students: if the number of students enrolled for a course stays below a given threshold, the course will be cancelled, and if there are too many students enrolled, just a limited number of them are actually registered. The Expert Team finds this unacceptable since the curriculum and the plan of the Study Programme shall be considered as a contract between the University and the students, and considers it necessary to regularly give all the courses included in the curriculum.

The first year of studies does not contain Software Engineering at all but is devoted to more general subjects, while the share of Software Engineering – as well as optional subjects – increases and the share of general subjects decreases in the study years 2-4. This arrangement follows the traditional pedagogical approach of gradually moving from general knowledge into more specialized and practical skills, and is quite natural for software engineering as well. The content of the Programme is in line with the latest achievements in software engineering and software development technologies. The study subjects are spread evenly over the semesters in the programme plan, and their themes are not repetitive; that is, there is no significant overlap in the subject descriptions.

Some of the courses in Mathematics are tailored especially for this Programme. This programme in Software Engineering is not the first one with specific mathematical content, but in this case the tailoring has not been completely successful: the courses in Mathematics are too shallow and exclude some of the central mathematical topics each student in Physical Sciences has to master. Therefore the Expert Team strongly recommends to immediately revise the mathematical part of the curriculum by bringing the courses into a form which is considered standard in Mathematics. As a detail, the subject *Mathematical Analysis* should be made compulsory.

These improvements in Mathematics will provide the students with better abilities to reach the conceptual, analytical and foundational competences included in the learning outcomes of the Programme. The core content of the curriculum, with the exception of Mathematics addressed above, is consistent with the type and (Bachelor) level of the Programme, and the content and methods of the subjects are appropriate for the achievement of the intended learning outcomes.

During the site visit, the Expert Team has noticed, however, that the courses – and even the exercises – are in many cases too much teacher-based: often the teacher not only presents the theory (in lectures) but also the solutions of exercises to the students (in exercise sessions). This is pedagogically not the best direction so teaching must in general be made more student-centred and interactive, and especially the exercises have to be solved more by the students who also shall present and explain their solutions to the teacher and to other students.

The number of Bachelor's theses is reasonably high: 84 in 2012 and 86 in 2013. Based on the final grades and the theses that were shown to the Expert Team, the quality seems to be good.

However, most theses are not within the field of the Programme, Software Engineering, but on topics such as applied mathematics, databases, GSM networks, face recognition, colour modelling, security, electronic and Internet commerce, communication protocols, biosensors, speech synthesis, video games, computer tomography, neurocomputing, dynamic algorithms, image analysis, and geometric modelling. This needs to be changed such that the topics of most Bachelor's theses are in the core of Software Engineering.

3. Staff

According to Annex 2 of the self-evaluation report, the Programme involves 56 teachers: 7 professors, 17 associate professors, 26 lecturers, and 6 assistants. According to Annex 3, most teachers have practical experience in the field, either from primary occupation or a "second job" in a software company. The combination of academic background and practical experience of the staff is acknowledged by the Expert Team. The close relationship of the Programme with a prominent industrial sector could, however, be exploited even more, for instance by inviting more experts from industry to give optional courses in their special areas of expertise. Clearly, there are enough teachers in the Programme to ensure its learning outcomes.

The Programme has teachers from 11 departments or other academic divisions of the University, most of them from the Department of Software Engineering. Individual teachers in similar subject areas of the Programme seem to meet and discuss the content and learning outcomes of their courses, but in general the coordination of the Programme with such a high number of stakeholders is weak; as the self-evaluation report admits, "the Study Programme Committee and Department of Software Engineering that is responsible for the implementation of the Programme have no direct impact on the lectures of other academic divisions, except cases when a problem occurs". The Expert Team finds such a diffusion of responsibilities unacceptable and strongly recommends strengthening the role of the Study Programme Committee in coordination and quality assurance of the Programme.

About 64 % of the subjects (calculated in credits) are taught by scientists with PhD degree, so the minimum legal requirement of 50 % is met. Most teachers have publications from the years 2008-2013. However, just a couple of teachers have research background (publications) in the scientific field of the Programme, Software Engineering. This problem is more severe on Master's level where research activities play a central role, but the lack of scientific substance of the teaching staff in Software Engineering introduces some problems even on Bachelor's level, at least in the supervision of thematic Bachelor's theses.

A related problem that seems to be common for all the Computer Science programmes at Vilnius University is the high age of staff. There are 12 teachers in this Programme who are more than 60 years old, and four teachers are already over 70 years of age. Moreover, turnover of the teaching staff is rather low. Software Engineering is a constantly and rapidly changing discipline, so it is crucial to ensure that the staff of the Programme always has those qualifications that match the current state of the art and practice in the field. Personal planning of the Faculty must make sure that retiring teachers will be replaced by younger professionals and active researchers in Software Engineering.

Concerning staff evaluation, the crucial factor seems to be the number of publications listed in the ISI Web of Science. This choice, while not being made by the Faculty of Mathematics and Informatics, is unfortunate for a couple of reasons. First, the mere number of publications can hardly be seen as a proxy of the quality of research. Second, in general the ISI Web of Science is losing – due to inflation in impact factors – its usefulness as a tool to measure scientific achievements. And third, the ISI Web of Science has never been a proper tool to measure

scientific achievements in Computer Science where many of the most prestigious venues of publication (such as conferences) are excluded from it. At the moment, the primary source for measuring scientific value of publication venues in Computer Science is the Microsoft Academic Search service, so it is recommended to use that service in addition to the ISI Web of Science.

4. Facilities and learning resources

The premises provided by the Faculty for the Programme are adequate both in their size and quality. Teaching takes place in two locations, at Naugarduko g. 24 / Šaltinių g. 1a (two buildings next to each other) and at Didlaukio g. 47. The two locations are reachable by public transport which, however, takes some time (roughly 30-40 minutes). However, the timetable of the Programme is organized in such a way that the teachers and students in most cases do not need to travel between the locations on the same day, and they reassured the Expert Team that this is indeed the case. The problem of two separate locations will hopefully be solved in the near future since the Faculty is supposed to get a new building in 2017. If possible, the (new) facilities should be adapted better for persons with a disability.

The Programme is well equipped with modern computing infrastructure and resources. The Faculty has four special laboratories (Mobile Application Development Laboratory, Robotics Laboratory, Networking Laboratory, Science and Business Communication Laboratory) with specialized hardware and software, as well as a supercomputer with 2000 cores and 600 TB of disk space. The buildings have wireless Internet connection that is also available to students and their personal devices. The Faculty invests around 200 000 LTL annually for renewal and updating of the IT equipment, and, for instance, eight new computer classes have been set up in recent years.

Each year, the Faculty invests between 17 000 and 28 000 LTL on material in its library. The library is equipped well enough with literature in Computer Science, and there seems to be enough up-to-date text books in Software Engineering for the students of the Programme. It can also be positively noted that the library has access to the ACM and IEEE digital libraries, which gives the students the possibility to read the most recent journals and conference proceedings in Computer Science (and Software Engineering). Students have reported that most of the material they need is accessible to them on-line.

As mandated by the general legal requirements, the curriculum of the Programme includes 15 credits of professional practice. The practice is adequately and effectively organized: students have enough options to choose their practice placement from lists announced by local IT companies, the Faculty and the company sign an agreement for the practice, two supervisors (one from the Faculty, one from the company) are assigned for each student, and the student has to write a report and give a public presentation of the practice after it has been completed. Some of the students carry out their professional practice abroad under the Erasmus mobility programme. According to the self-evaluation report and the group that has produced it, the professional practice is pedagogically rather useless in those cases when a student carries it out in the same company (and tasks) where he/she is already working; this problem is, however, more severe in the Master's programme.

5. Study process and student assessment

There is no entrance examination to the Programme. Admission follows the standard system set by the Ministry of Education and Science and organized by the Joint Admission Network Association of Lithuanian Higher Education. In this system, the applicants to the Programme are

rated according to their “competition score” which is comprised of two main factors, the state maturity examination (in this Programme: marks in Mathematics, Information Technologies, and Lithuanian Language and Literature), and annual marks in the school (in the first foreign language). Being based on national standards, the admission requirements are well-founded.

According to the data on student admission and competition, there have been between 113 and 135 students annually admitted to the Programme during the years 2008 to 2012, somewhat less than the number of first-request applicants. Most students are admitted to state-funded study places, and the number of self-funded students is very small (from 1 to 6 admitted in 2008-2012). Since the total number of applicants has been around 500 in these years, the Programme is quite competitive. According to the self-evaluation report, the Programme is in top-5 among the largest study programmes in Lithuania. When compared to many other Lithuanian study programmes in Computer Science, the popularity of this particular Programme seems quite stable and encouraging since both the number of state-funded study places and the number of applicants have stayed roughly the same for the last five years.

On the average, about one third (34 %) of the students enrolled to the Programme in 2008-2012 have dropped out. The main reason for drop-out and termination of studies is the high demand of software developers in IT companies, which tempts students to get a job already during (the beginning of) their studies. Other reasons for drop-out include difficulties in studies at University level and problems with health. From the positive side it can be concluded that the professional activities of the majority of graduates – and even of the majority of “drop-outs” – without doubt meet the expectations of the Programme providers and the employers.

The University provides the following forms of social support to the students (of this Programme): incentive scholarships for particularly good study results; social scholarships for students from the needy families or living alone, for those receiving social allowance, for those with 45 % or higher level of disability, and for those below 25 years of age who are granted care or whose both parents (or one of the parents) are dead; one-time social scholarships in cases of death of a family member, natural or other kind of disaster, disease or other similar case; and one-time target scholarships for students who have achieved good results either in sports or in cultural, research or public activities.

Disabled students can receive social support from the Faculty, and they can study according to an individual plan. Students can get psychological help and services from the VU Psychological Innovation and Experimental Research and Training Centre and from the Youth Psychological Help Centre, and they can get advice for career planning from the VU Career Centre.

All the students have a right to get accommodation in the Students’ Residence. The Student Representation Office of the Faculty is involved in numerous activities and organizes cultural and sports programmes to the students.

The assessment of study results follows the publicly available general procedures approved by the University Senate. The assessment criteria applied in the Programme are given at the beginning of each course by the teacher, and they are specified in subject descriptions. Students are informed of the reasons for their examination grades, and they can make a formal appeal to the Appeals Committee if they do not agree with the grade or the assessment process. The students get a written review of the Bachelor’s thesis. In general, the assessment system is clear, adequate, and publicly available.

According to the general University regulations, the results of examinations shall be entered into the Studies Information System of VU within five working days after the examination. The

Expert Team finds this time requirement too tight, especially for a programme with more than 100 potential students attending an examination and for a study field (Software Engineering) where the essential problems are of such abstract and manifold nature that they usually require a lengthy essay-type solution. In order to enabling more adequate examinations (in Software Engineering), the Faculty should make a statement to the University for extending the current 5-days deadline of examination results.

The University has a plagiarism detection system that is used in the Programme for checking that there is no direct and non-refereed plagiarism in the Bachelor's theses. The system only checks overlap with the theses made at Vilnius University, so it is currently restricted to a rather local context only; most notably, the system cannot detect a piece of text that has been copied from the Internet.

For supporting teacher and student mobility, the Faculty has signed 76 Erasmus exchange agreements with foreign universities and other higher educational institutes. Unfortunately, the students do not take advantage of such wide opportunities: for instance, in 2008-2013 the number of Bachelor students in Software Engineering who have been in Erasmus exchange has varied between 7 and 17, with 10 students being the annual average. The main reason for low participation in Erasmus exchange is that most students have a job that they cannot quit or interrupt for the internship period. Since international experiences and contacts are important for all students, and especially for those studying in fields with international job markets, the students of the Programme should be encouraged to more exploit their possibilities for Erasmus exchange. It can be noted, however, that there are more students in Erasmus exchange in this Programme than in other similar programmes in Lithuania.

6. Programme management

The Study Programme Committee has the main responsibility of managing the content and quality of the Programme. The Committee has seven members: three professors, two associate professors, one representative of social partners, and one student representative. Four of them are also members in the Study Programme Committee of the Master Programme in Software Engineering, which makes it easier to coordinate the two programmes. While having common members in these two closely related programmes is in general a good solution, it is, however, rather strange that also the student member is shared since now there is no representative of Bachelor students in the Bachelor-level Study Programme Committee.

When meeting the different stakeholders of the Programme, the Expert Team found that the Study Programme Committee does not have or take full responsibility of the Programme. Coordination of the curriculum and its coherence, the learning outcomes, and the content of the subjects is too much left to individual teachers, in which case quality assurance of the pieces may work well but quality assurance of the whole is imperfect. It is therefore recommended that the Study Programme Committee takes a stronger role in decision making, monitoring, implementation, and coordination of the Programme by regularly checking that the plans, selections and decisions of the many different stakeholders (departments and institutes) fit together and are consistent with the aims and objectives of the Programme. At the moment, the internal quality assurance measures are not as effective and efficient as they should and could be.

The VU Quality Management Centre carries out regular student surveys about the study process and the study subjects. Students can also give direct feedback to teachers, for instance by email. Unfortunately, just a small number of students (roughly 15–20 %, based on interviews with students) give any kind of feedback on their studies. While there are official feedback channels, the general feeling among the students seems to be that their comments and suggestions are not

really taken into account when changing or improving the Programme – or the students are not aware of such measures. Therefore, the Study Programme Committee should encourage the students to give more feedback, for instance by explicitly, publicly and regularly notifying how the suggestions from the students have been processed and whether any changes have been made due to them.

The social partners of the Programme have a representative in the Study Programme Committee and the Bachelor's theses defence committee. Based on the meeting between the Expert Team and social partners, they seem to be quite satisfied with their possibilities to influence the contents and implementation of the Programme. This also applies to the graduates who have been invited to the Faculty to discuss the Programme and its improvements.

The previous external evaluation of the Programme took place in 2006. The outcomes of that evaluation have been taken into account when improving the Programme in the following ways: the Programme has been focused more on Software Engineering and made clearly different from the Bachelor Programme in Informatics; more teamwork, project work and practical training have been included; subjects in Mathematics and Physics have been replaced by fundamental subjects in Informatics and Software Engineering; and the library has now more text books and journals in English (as well as access to the ACM/IEEE digital library).

III. RECOMMENDATIONS

1. The education of Mathematics in the Programme should be immediately improved by revising the subjects into a form which is considered standard in Mathematics. The subject *Mathematical Analysis* should be made compulsory.
2. All the subjects, both compulsory and optional ones, included in the curriculum and in the plan of the Study Programme shall be regularly given to all the students of the Programme.
3. Teaching and studying, especially in the exercise sessions, shall be made more student-centred and interactive.
4. The majority of Bachelor's theses shall be made more specifically in the actual field of the Programme, Software Engineering.
5. The role of the Study Programme Committee in coordination and quality assurance of the Programme shall be strengthened.
6. In order to attack the relatively high age of the staff, young professionals and active researchers in Software Engineering should be recruited to the Programme.
7. When evaluating quantity and quality of scientific publications of the staff, Microsoft Academic Search should be used in addition to the ISI Web of Science.

IV. SUMMARY

The Bachelor study programme in Software Engineering operates in one of the most central areas of IT industry, software development. The graduates of the Programme are employed well, and in most cases in positions that match the aims and objectives of the Programme. According to national surveys and comments from industry, still more Bachelors in Software Engineering will be needed in the labour market in the future. In addition to market relevance, also the popularity of the Programme among new students seems quite stable and encouraging since both the number of state-funded study places and the number of applicants have stayed stable and quite high for the last five years.

The curriculum of the Programme is broad and covers most of the subjects that are internationally considered essential for Software Engineering. There are enough optional subjects so that students can choose topics that they personally find interesting or relevant for their career. About 1/3 of the subjects (including practice, coursework, and thesis) are in Software Engineering, 1/3 in the more general scope of Computer Science (Informatics), and 1/3 in other disciplines (mainly Mathematics). This is a good balance between the core of the Programme and the closely related and more general topics.

However, all the optional subjects in the study plan are not necessarily taught: if the number of students enrolled to a course stays below a given threshold, the course will be cancelled, and if there are too many students enrolled, just a limited number of them are actually accepted in. In order to make it possible to follow and fully exploit the official study plan of the Programme, it

is necessary to regularly give all the courses included in the curriculum and make sure that all the students of the Programme can attend them.

The major drawback of the Programme is the education in Mathematics. The subjects in Mathematics – partly tailored for this Programme – are far too shallow and exclude some of the central mathematical topics each student in Physical Sciences has to master. Therefore it is strongly recommended to revise the mathematical part of the curriculum by bringing the subjects into a form and content which is considered standard in Mathematics.

Also, there is some pedagogical deficiency in the Programme with courses that are too much teacher-based: often the teacher not only presents the theory (in lectures) but also the solutions of exercises to the students (in exercise sessions). This shall be changed by making teaching and studying made more student-centred and interactive, and especially the exercises have to be revised such that they are solved by the students who also present and explain their solutions to the teacher and to other students.

The Programme has 56 teachers from 11 departments or other academic divisions of the University, most of them from the Department of Software Engineering. The coordination of the Programme with such a high number of stakeholders and teachers should be stronger. For achieving this, it is recommended strengthening the role of the Study Programme Committee in coordination, decision making and quality assurance of the Programme.

Most teachers of the Programme have publications from the years 2008-2013. However, just a few teachers have research background in the scientific field of the Programme, Software Engineering. This has consequences, most notably, on Bachelor's theses whose topics are usually not in the core of Software Engineering. Other related problems are high age and low turnover of the staff: there are 12 teachers in this Programme who are more than 60 years old, and four teachers are already over 70 years of age. It is therefore recommended to recruit young active researchers in Software Engineering to the Programme.

The premises provided by the Faculty for the Programme are adequate both in their size, quantity and quality. Also, the Programme is well equipped with modern computing infrastructure and wireless Internet connections. The library has enough literature in Computer Science, and there seems to be enough up-to-date text books in Software Engineering for the students of the Programme. It can also be acknowledged that the library has access to the central on-line sources of scientific literature in Computer Science, the digital libraries of ACM and IEEE.

There is no entrance examination to the Programme. Admission follows the standard system of competition scores set by the Ministry of Education and Science and organized by the Joint Admission Network Association of Lithuanian Higher Education. The Programme is one of the largest in Lithuania: there have been around 500 applicants and between 113 and 135 students annually admitted to the Programme during the years 2008 to 2012. In these years, the average drop-out rate has been 34 % which is relatively high but still lower than in other similar study programmes. The main reason for drop-out and termination of studies is that students get a job already during their studies.

The Programme follows the general regulations of Vilnius University which state that the results of examinations shall be entered into the Studies Information System within five working days after the examination. Such a short deadline is too tight, especially for this Programme with more than 100 potential students attending an examination and with typical examination questions being of such manifold nature that they usually require a lengthy essay-type answer. In order to enabling more adequate examinations (in Software Engineering), it is recommended that the

Faculty makes a statement to the University for extending the 5-days deadline of examination results.

For supporting student mobility, the Faculty has signed 76 Erasmus exchange agreements with foreign universities and other higher educational institutes. Unfortunately, the students do not take advantage of such wide opportunities: for instance, in 2008-2013 the number of Bachelor students in Software Engineering who have been in Erasmus exchange has varied between 7 and 17, with 10 students being the annual average. Since international experience and contacts are important for the students of this Programme, they should be encouraged to more exploit their possibilities for Erasmus exchange.

Regular student surveys are conducted about the study process and the study subjects. Students can also give direct feedback to teachers, for instance by email. Unfortunately, just a small number of students of the Programme give any kind of feedback on their studies. Therefore, the Study Programme Committee should encourage the students to give more feedback, for instance by publicly notifying how the suggestions from the students have been processed and whether any changes in the Programme have been made due to them.

The social partners of the Programme have a representative in the Study Programme Committee and the Bachelor's theses defence committee. The employers and other social partners seem to be quite satisfied with their possibilities to influence the content and implementation of the Programme. This also applies to the graduates who have been invited to the Faculty to discuss the Programme and its improvements.

V. GENERAL ASSESSMENT

The study programme *Software Engineering* (state code – 612I30001) at Vilnius University is given **positive** evaluation.

Study programme assessment in points by evaluation areas.

No.	Evaluation Area	Evaluation Area in Points*
1.	Programme aims and learning outcomes	3
2.	Curriculum design	3
3.	Staff	3
4.	Material resources	4
5.	Study process and assessment (student admission, study process student support, achievement assessment)	3
6.	Programme management (programme administration, internal quality assurance)	3
	Total:	19

*1 (unsatisfactory) - there are essential shortcomings that must be eliminated;

2 (satisfactory) - meets the established minimum requirements, needs improvement;

3 (good) - the field develops systematically, has distinctive features;

4 (very good) - the field is exceptionally good.

Grupės vadovas:
Team leader:

Prof. Jukka Paakki

Grupės nariai:
Team members:

Prof. Rolf Backofen

Prof. Jerzy Marcinkowski

Vida Juozapavičienė

Lukas Jokūbas Jakubauskas

**VILNIAUS UNIVERSITETO PIRMOSIOS PAKOPOS STUDIJŲ PROGRAMOS
PROGRAMŲ SISTEMOS (VALSTYBINIS KODAS – 612I30001) 2014-03-21
EKSPERTINIO VERTINIMO IŠVADŲ NR. SV4-99 IŠRAŠAS**

<...>

V. APIBENDRINAMASIS ĮVERTINIMAS

Vilniaus universiteto studijų programa *Programų sistemos* (valstybinis kodas – 612I30001) vertinama **teigiamai**.

Eil. Nr.	Vertinimo sritis	Srities įvertinimas, balais*
1.	Programos tikslai ir numatomi studijų rezultatai	3
2.	Programos sandara	3
3.	Personalas	3
4.	Materialieji ištekliai	4
5.	Studijų eiga ir jos vertinimas	3
6.	Programos vadyba	3
	Iš viso:	19

* 1 - Nepatenkinamai (yra esminių trūkumų, kuriuos būtina pašalinti)

2 - Patenkinamai (tenkina minimalius reikalavimus, reikia tobulinti)

3 - Gerai (sistemiškai plėtojama sritis, turi savitų bruožų)

4 - Labai gerai (sritis yra išskirtinė)

<...>

IV. SANTRAUKA

Programų sistemų bakalauro studijų programa yra susijusi su viena pagrindinių IT pramonės šakų – programinės įrangos vystymu. Programos absolventai lengvai randa darbą ir daugeliu atveju užima tokias pareigas, kurios atitinka Programos tikslus ir siekius. Pagal nacionalinius tyrimus ir pramonės atstovų teikiamus atsiliepimus, ateityje darbo rinkai reikės dar daugiau programų sistemų bakalauro. Programa ne tik atitinka rinkos poreikius, bet ir jos populiarumas tarp naujų studentų, atrodo, yra gana stabilus ir skatinantis, nes per paskutinius penkerius metus valstybės finansuojamų studijų vietų ir stojančiųjų skaičius išliko stabilus ir gana didelis.

Programos studijų turinys yra platus ir apima daugelį dalykų, kurie tarptautiniu mastu laikomi Programų sistemų studijų programos pagrindiniais dalykais. Siūloma pakankamai pasirenkamųjų dalykų, kad studentai galėtų pasirinkti jiems patiems įdomias ar naudingas būsimai profesinei veiklai temas. Maždaug trečdalis dalykų (įskaitant praktiką, kursinį darbą ir baigiamąjį darbą) yra susiję su Programų sistemomis, trečdalis yra bendresnio kompiuterijos mokslo (informatikos) pobūdžio ir trečdalis – su kitais dalykais (daugiausia matematika). Tai geras balansas tarp esminių studijų programos dalykų ir artimai susijusių bei bendresnių temų.

Tačiau visi pasirenkamieji dalykai studijų plane nebūtinai yra dėstomi: jei į studijų dalyką mokytis užsirašo mažiau studentų nei reikalaujama, toks dalykas atšaukiamas, o jei užsirašo per daug studentų – dalykas dėstomas tik ribotam jų skaičiui. Siekiant suteikti galimybę laikytis oficialaus programos studijų plano ir visiškai jį įgyvendinti, svarbu reguliariai dėstyti visus studijų dalykus, kurie yra įtraukti į studijų turinį, ir užtikrinti, kad visi programos studentai galėtų juos lankyti.

Pagrindinis programos trūkumas – matematikos mokymas. Matematikos dalykai (iš dalies pritaikyti šiai studijų programai) yra pernelyg paviršutiniški ir į juos nėra įtrauktos kai kurios esminės matematinės temos, kurias kiekvienas fizinių mokslų studentas turėtų turėti. Todėl labai rekomenduotume iš naujo apsvarstyti matematinę studijų turinio dalį ir pertvarkyti dalykus bei jų turinį taip, kad jis atitiktų matematikos dalyko standartus.

Taip pat programoje pastebimas šioks toks pedagoginis trūkumas tuose dalykuose, kurie per daug paremti dėstytojų darbu: dažnai dėstytojas studentams ne tik pristato teoriją (paskaitų metu), bet taip pat ir uždavinių sprendimus (pratybų metu). Tai derėtų keisti labiau orientuojant mokymą ir mokymąsi į studentą ir darant jį labiau sąveikaujantį, o ypač uždavinių sprendimo užsiėmimus reiktų pakeisti taip, kad patys studentai juos spręstų ir pristatytų bei aiškintų savo sprendimus dėstytojui ir kitiems studentams.

Programoje dėsto 56 dėstytojai iš 11 katedrų ar kitų universiteto akademinių padalinių, dauguma jų iš Programų sistemų katedros. Programos koordinavimas, kai esama tiek daug socialinių dalininkų ir dėstytojų, turėtų būti stipresnis. Norint to pasiekti, rekomenduojama stiprinti Studijų programos komiteto vaidmenį koordinuojant, priimant sprendimus ir užtikrinant programos kokybę.

Dauguma programoje dėstančių dėstytojų teikė publikacijas 2008–2013 metais Tačiau tik keli dėstytojai turi mokslinių tyrimų patirties programos srityje – Programų sistemose. Tai ypač turi įtakos bakalauro baigiamiesiems darbams, kurių temos dažnai nėra susijusios su esminiais Programų sistemų dalykais. Kitos su personalu susijusios problemos yra vyresnis amžius ir maža personalo kaita: šioje programoje yra 12 dėstytojų, kuriems daugiau nei 60 metų, o keturiems dėstytojams jau per 70 metų. Todėl rekomenduojama programoje įdarbinti jaunų aktyvių mokslininkų, dirbančių Programų sistemų srityje.

Fakulteto programai skiriamų patalpų dydis, skaičius bei kokybė yra tinkama. Taip pat teikiama moderni kompiuterinė infrastruktūra ir belaidis interneto ryšys. Bibliotekoje pakanka literatūros apie kompiuterijos mokslą ir, atrodo, kad yra užtektinai modernių Programų sistemų vadovėlių šios programos studentams. Taip pat pagirtina, kad bibliotekoje yra prieiga prie centrinių internetinių mokslinės literatūros išteklių apie kompiuterijos mokslą, skaitmeninių ACM ir IEEE bibliotekų.

Stojantiems į šią programą nereikia laikyti stojamojo egzamino. Priimama pagal standartinę konkursinio balo sistemą, kurią nustatė Lietuvos švietimo ir mokslo ministerija, o įgyvendina Lietuvos aukštųjų mokyklų asociacija bendrajam priėmimui organizuoti. Programa yra viena didžiausių Lietuvoje: nuo 2008 m. iki 2012 m. pageidaujančių įstoti buvo apie 500, o kasmet priimta nuo 113 iki 135 studentų. Šiuo laikotarpiu vidutinis asmenų, nebaigusiu studijų, skaičius siekė 34 proc., o tai palyginti yra daug, bet vis tik mažiau nei kitose panašaus profilio studijų programose. Pagrindinė studijų nebaigimo ir nutraukimo priežastis ta, kad studentai pradeda dirbti studijų metu.

Vykdamt šią programą vadovaujamasi bendrais Vilniaus universiteto nuostatais, kuriuose numatyta, kad egzamino įvertinimas į studijų informacinę sistemą įkeliamas per penkis darbo dienas nuo egzamino laikymo. Toks laikotarpis yra per trumpas, ypač šiai programai, kurioje laikyti egzamino ateina daugiau nei 100 potencialių studentų, o standartiniai egzaminų klausimai būna įvairūs, į kuriuos paprastai reikia parašyti ilgą, rašinio pobūdžio atsakymą. Norint vykdyti adekvatesnį egzaminavimą (programų sistemų studijų programos), rekomenduojame fakultetui prašyti Universiteto pailginti penkių dienų terminą egzaminų rezultatams įvesti.

Skatindamas studentų judumą fakultetas su užsienio universitetais ir kitais aukštojo mokslo institutais yra pasirašęs 76 *Erasmus* mainų sutartis. Deja, studentai nepasinaudoja tokiomis plačiomis galimybėmis; pavyzdžiui, 2008–2013 m. *Erasmus* mainų programose dalyvavusių

programų sistemų bakalauro studentų skaičius svyravo tarp 7 ir 17, vidutiniškai 10 per metus. Kadangi tarptautinė patirtis ir ryšiai šios programos studentams yra svarbūs, jie turėtų būti skatinami aktyviau naudotis savo galimybėmis dalyvauti *Erasmus* mainų programose.

Studentų apklausos apie studijų procesą ir studijų dalykus vykdomos reguliariai. Studentai taip pat gali tiesiogiai išreikšti atsiliepimus dėstytojams, pavyzdžiui, elektroniniu paštu. Deja, tik maža dalis programos studentų teikia kokio nors pobūdžio grįžtamąjį ryšį apie savo studijas. Todėl Studijų programos komitetas turėtų skatinti studentus teikti daugiau atsiliepimų, pavyzdžiui, viešai skelbdamas, kaip studentų pasiūlymai buvo priimti ir ar dėl jų programoje buvo įgyvendinti kokie nors pokyčiai.

Programos socialiniai partneriai turi savo atstovus Studijų programos komitete ir Bakalauro baigiamųjų darbų gynimo komitete. Darbdaviai ir kiti socialiniai partneriai yra gana patenkinti galimybe daryti įtaką programos turiniui ir įgyvendinimui. Taip pat, patenkinti ir absolventai, kurie buvo kviečiami į fakultetą aptarti programos ir kaip būtų ją galima tobulinti.

III. REKOMENDACIJOS

1. Matematikos mokymas studijų programoje turėtų būti kuo greičiau pagerintas persvarstant dalykus taip, kaip tipiškai yra priimtina matematikos studijoms. *Matematikos analizės* dalykas turėtų būti privalomas.
2. Visi į studijų turinį ir studijų programos planą įtraukti privalomieji ir pasirenkamieji dalykai turi būti reguliariai dėstomi visiems studijų programos studentams.
3. Mokymas ir studijavimas, ypač per pratybų sesijas, turi būti labiau nukreiptas į studentus ir labiau sąveikaujantis.
4. Dauguma baigiamųjų bakalauro darbų turėtų būti labiau specifiniai, glaudžiau susiję su realia programos sritimi – Programų sistemomis.
5. Turėtų būti sustiprintas studijų programos komiteto vaidmuo koordinuojant programą ir užtikrinti jos kokybę.

6. Norint išspręsti personalo santykinai didelio amžiaus klausimą, programoje reikia įdarbinti jaunų profesionalų ir aktyvių programų sistemų mokslininkų.
7. Vertinant personalo mokslinių leidinių kokybę ir kiekybę, greta „ISI Web of Science“ platformos reiktų naudotis ir „Microsoft Academic Search“ sistema.

<...>

Paslaugos teikėja patvirtina, jog yra susipažinusi su Lietuvos Respublikos baudžiamojo kodekso¹ 235 straipsnio, numatančio atsakomybę už melagingą ar žinomai neteisingai atliktą vertimą, reikalavimais.

Vertėjos rekvizitai (vardas, pavardė, parašas)

¹ Žin., 2002, Nr.37-1341.