Information and Financial Engineering: A Further Step to the Interdisciplinary Oriented Computer Science & Software Engineering

Ivan Luković,
University of Novi Sad,
Faculty of Technical Sciences

14th Workshop DAAD

Agenda

- From the last year
- Information and Financial Engineering
- Structure of the study program
- Some references

From the last year

- **A predominant trend in the last years in Computer Science and Informatics (CS&I)**
  - CS&I exists as an independent discipline
  - CS&I curricula are recognized, institutionalized and **self-contained**
  - creating a new curricula – often **as a derivate** of some existing CS&I curricula
  - Faculty of Technical Sciences (FTS) in Novi Sad extended its capacity for CS&I study programs **for 2,5 times** in the last year
    - from 180 to 450 available places for the 1st year of undergraduate studies
    - through three study programs

From the last year

- **Trends in software industry – Novi Sad**
  - a **big explosion** of various software companies
    - from small ones, employing up to 10 IT professionals
    - to those employing more than 1000 IT professionals
  - there is no enough IT professionals ⇒ needs significantly **overcome** available capacities
  - software companies offer a lot of **fellowship opportunities** to students
    - even from early years of their studies
    - a majority of master students already have part time, or even full time jobs
  - large companies declare future needs for new thousands of CS&I professionals

From the last year

- **Initiatives created by individuals**
  - having a curriculum to cover body of knowledge necessary to support **information management in organization systems** (business)
    - applicable in a wide variety of organizations (of any type)
    - covering wide range of aspects of information management
      - typically required by many stakeholders
    - that will nurture both **interdisciplinary** and **formal** approaches
      - typically expected formality: at the level of mathematical rigor, whenever is possible
- **Title: Information Engineering**

From the last year

- **Information Engineering – Main motives**
  - to meet evident needs in business **for interdisciplinary oriented** professionals
- **Current state in various business sectors**
  - a lot of even large projects **in the area of Business Intelligence** are in progress
    - Oil companies, Telecom companies
    - Electrical Power Companies and Distribution Management Systems
    - Banking and insurance companies
  - there is an evident **lack of high educated software engineers**
    - prepared to actively participate in such projects

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Information and Financial Engineering

- Two independent initiatives by individuals during the last year at FTS
  - **Information Engineering**
  - **Financial Engineering**
- Both with practically the same main motives and principal ideas, come simultaneously from
  - Department of Computing and Control **(Inf. Eng.)**
  - Department of Power Systems, Electronics and, Telecommunications and Department of Industrial Engineering and Management **(Fin. Eng.)**

Information and Financial Engineering

- **Information Engineering Body of Knowledge**
  - a not necessarily complete list of required knowledge
  - **Computer Science, Informatics, and Software Engineering**
    - all core CS&I and SE disciplines, including Formal Methods, Computational Intelligence, HCI, Information Systems
  - **Applied mathematics**
    - Calculus, Discrete Mathematics, Algebra, Graph Theory, Combinatorics, Logic, Probability and Statistics, Operational Research and Optimization Methods
  - **Economics, Management and Psychology**
    - basics of: Design of Organization Systems, Management Theory, Decision Theory, Econometrics, Business Intelligence, Industrial and Organizational Psychology

Information and Financial Engineering

- **Information Engineering - Main principles**
  - **Abstraction and Formalization**
    - ability to understand and formalize application domain knowledge, problems, and requirements
    - ability to create meta-models, languages, concepts, or any kind of formalisms necessary to provide modeling of any knowledge in systems being observed
  - **Quantification and Metrics**
    - ability to quantify, measure, analyze, simulate, and optimize anything that is required in any business, by comprehensive methods

Information and Financial Engineering

- **Information Engineering - Main principles**
  - **Specification and Implementation**
    - ability to efficiently specify, develop, implement, and apply any software to address various information management requirements in business
  - **Communication skills**
    - ability to successfully communicate and negotiate with other professionals, having different levels and range of knowledge

Information and Financial Engineering

- **Financial Engineering - Definition**
  - by Columbia Financial Engineering, NY, USA
  - A **multidisciplinary field** involving
    - **financial theory**
    - **the methods of engineering**
    - **the tools of mathematics and**
    - **the practice of programming**
  - Designed for students who wish to obtain positions in
    - securities, banking, and financial management and consulting industries, or
    - as quantitative analysts in corporate treasury and finance departments of general manufacturing and service firms

Information and Financial Engineering

- **Financial Engineering Body of Knowledge**
  - a not necessarily complete list of required knowledge
  - **Finances**
  - **Applied mathematics**
  - **Mechanics**
  - **Computer Science, Informatics, and Software Engineering**
  - **Theory of Signal (Data Series) Processing**

Information and Financial Engineering

- Unified efforts to create study programs
  - in Information and Financial Engineering
- Resulted in a formal approval of the Education and Research Council of FTS
  - to create the following programs:
    - **Information and Financial Engineering**, undergraduate (B.Sc.) level, 4 years (8 semesters), 240 ECTS
    - **Information Engineering**, master (M.Sc.) level, 1,5 year (3 semesters), 90 ECTS
    - **Financial Engineering**, master (M.Sc.) level, 1 year (2 semesters), 60 ECTS
- Programs are created and ready to enter into the formal accreditation procedure

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Structure of the study program

- Taking into considerations various strategies and parameters
  - cover body of knowledge in a best possible way
    - create logical educational tracks, satisfying all prerequisites
  - reference already existing courses at FTS, whenever is possible
    - not to overcharge education staff
    - huge combinatorial problem, since there is no uniform size of the courses
  - offer enough elective courses
    - at least 30% of courses at B.Sc. level must be elective
  - offer a possibility for longer M.Sc. studies
    - 4 + 1.5, while keeping a "common" model 4 + 1

Structure of the study program

Year I – B.Sc.	Sem.	Class / Week
Algebra	1	4+4
Programming Languages and Data Structures	1	4+4
Introduction to Information and Financial Engineering	1	2+2
Communicology	1	2+2
Mechanics	1	2+2
English Language – Elementary	1	2+0
Analysis 1	2	4+4
Computer Architecture	2	4+4
Theory of Algorithms	2	3+3
Fundamentals of Financial Engineering 1	2	3+3
English Language – Upper Intermediate	2	2+0

Structure of the study program

Year II – B.Sc.	Sem.	Class / Week
Analysis 2	3	3+3
Fundamentals of Graph Theory and Combinatorics	3	3+3
Object Oriented Programming	3	4+4
Logic Design of Computer Systems 1	3	3+3
English in Engineering 1	3	2+0
Probability and Stochastic Processes	4	2+2
Operating Systems	4	4+4
Digital Signal Processing	4	3+2
Web Programming	4	3+3
Fundamentals of Financial Engineering 2	4	3+2

Structure of the study program

Year III – B.Sc.	Sem.	Class / Week
Optimization Methods	5	4+4
Numerical Algorithms and Numerical Software	5	2+2
Databases 1	5	4+4
Introduction to Information Theory	5	2+3
Elective Course IFI31	5	2+3
- Compilers		
- Risks in Investment Management		
Fundamentals of Computer Intelligence	6	4+4
Parallel Programming	6	2+2
Practicum in Statistics	6	1+1

Structure of the study program

Year III – B.Sc. (Continued . . .)	Sem.	Class / Week
Elective Course IFI32	6	2+2
- Human Computer Interaction		
- Biomechanics and Sports Mechanics		
Elective Course IFI33	6	≤ 4+4
- Software Specification and Modeling		
- Computer Communication		
Elective Course IFI34	6	≤ 2+4
- Internet Networks		
- IP Technology		

Structure of the study program

Year IV – B.Sc., Information Eng.	Sem.	Class / Week
Mathematical Logic	7	2+2
Internet Software Architectures	7	2+2
Databases 2	7	2+2
Decision Theory	7	2+2
Operational Research	7	2+2
Elective Course II41	7	≤ 4+3
- Soft Computing		
- Pattern Recognition		
- Algorithms and Complexity		
- Risks in Investment Management		
- Corporate Restructuring		
Professional Training	7	0+3

Structure of the study program

Year IV – B.Sc., Information Eng. (Continued . . .)	Sem.	Class / Week
Elective Course II42	8	4+4
- XML and Web Services		
- Logic Design of Computer Systems 2		
Elective Course II43	8	3+3
- Information System Engineering		
- Business Informatics		
Elective Course II44	8	3+3
- E-Business Systems Security		
- Database Systems		
- Agent Technologies		
- Software Patterns and Components		
- Entrepreneurship in ICT		
B.Sc. Thesis	8	0+9

Structure of the study program

Year IV – B.Sc., Financial Eng.	Sem.	Class / Week
Corporate Restructuring	7	2+2
Compilers	7	2+3
Databases 2	7	2+2
Elective Course FI41	7	≤ 4+3
- Pattern Recognition		
- Soft Computing		
Elective Course FI42	7	≤ 3+3
- Algorithms and Complexity		
- Mathematical Logic		
Professional Training	7	0+3

Structure of the study program

Year IV – B.Sc., Financial Eng. (Continued . . .)	Sem.	Class / Week
Entrepreneurship in ICT	8	2+2
Elective Course FI43	8	2+3
- Public Sector Management		
- Automatic Identification Systems		
Elective Course FI44	8	≤ 3+3
- Information System Engineering		
- Business Informatics		
- Inform. Syst. for Measur., Monitoring and Control		
Elective Course FI45	8	3+3
- E-Business Systems Security		
- Database Systems		
- Agent Technologies		
- Software Patterns and Components		
B.Sc. Thesis	8	0+9

Structure of the study program

- M.Sc. study programs in IE and FE
  - a pool of more than 50 elective courses, covering various aspects of Information and Financial Engineering
    - many possibilities for students to profile themselves, according to their wishes, or already having jobs
    - **specific courses, created for IE and FE**
    - courses referenced from other study programs
      - **Computing and Control, Software Engineering and Information Technologies**
      - **Mathematics in Engineering**
      - **Power Systems, Electronics and Telecommunications**
      - **Engineering Management**
  - Practical Training
  - M.Sc. Thesis

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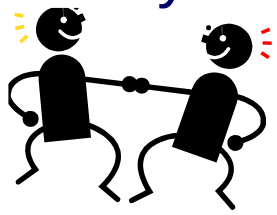
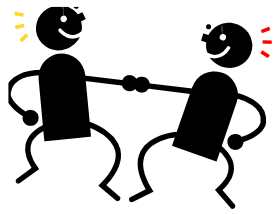
- **Related (Referenced) study programs**
  - Sapienza Universita di Roma, Faculty of Information Engineering, Informatics and Statistics, Rome, Italia
  - School of Engineering and Applied Sciences, Columbia University, New York, USA
    - MS in Financial Engineering
  - Technische Universitat Munchen, Fakultät für Informatik, Germany
    - B.Sc. and M.Sc. in Information Systems
  - University of Mannheim, School of Business Informatics and Mathematics, Mannheim, Germany
    - B.Sc. and M.Sc. in Business Informatics



Some references

- **Related (Referenced) study programs**
  - TU Wien, Fakultät für Informatik, Wien, Austria
    - B.Sc. and M.Sc. in Business Informatics
  - University of Vienna, Faculty of Computer Science, Vienna, Austria
    - B.Sc. and M.Sc. in Business Informatics
  - University of Edinburgh, School of Informatics, Edinburgh, UK
    - B.Sc. and M.Sc. in Computer Science and Management Science



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End of Presentation

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