



Math and Computing Foundations of Software Engineering

May 15-28, 2017

Gleb Radchenko, South Ural State University Andrey Sozykin, Ural Federal University

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There is the place where meteorite fell

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NATIONAL RESEARCH SOUTH URAL STATE UNIVERSITY









Mathematical and computational foundations of software engineering

Courses:

- Modern concepts of distributed software systems engineering
- Mathematical Foundations of Software Engineering
- Fundamentals of Information Security
- Self-Management
- Modern Database Systems
- Data Mining in Software Engineering

Students: School Schedule – week 1

Day	Time	Activity	Responsible person	
SUN 14 th May	Arrival time			
a con a th a c	10:00 - 13:00	Introduce the project and Introduction to School	Gleb Radchenko	
	14:00 - 17:00	Excursion to supercomputer simulation laboratory	Pavel Kostenetskii	
TUE 16th May	9:00 - 17:00	Modern concepts of distributed software systems engineering	Gleb Radchenko	
WED 17th May	9:00 - 17:00	Mathematical Foundations of Software Engineering	Valentin Golodov	
THU - FRI 18-19th May	9:00 - 17:00	Fundamentals of Information Security (I-II)	Franck Leprévost (invited lector, LUX)	
SAT 20th May	Social activity			
SUN 21th May	12:00	Transfer to Ekaterinburg	Gleb Radchenko, Andrey Sozykin	
			5	

Students: School Schedule – week 2

Day	Time	Activity	Responsible person
MON, 22th May	9:00 – 17:00	Self-Management	Ivan Zamoshchansky
	10:00 - 13:00	Meeting with representatives of the IT industry	Andrey Sozykin
TUE, ZSth May	14:00 - 17:00	Transfer to Chelyabinsk	Andrey Sozykin, Gleb Radchenko
WEN, 24th May	9:00 - 17:00	Modern Database Systems	Alina Latipova
THU, 25th May	9:00 - 17:00	Data Mining in Software Engineering	Mikhail Zymbler
FRI, 26th May	9:00 – 16:00	Poster Session joint research	Gleb Radchenko
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School schedule (staff)

Day	Ti	ime	Activity	Responsible person
SAT 20th May		Arrival to C	helyabinsk	Gleb Radchenko
SUN 21th May	12:00	Trans	fer to Ekaterinburg	Andrey Sozykin
MON, 22th May	9:00 – 17:00	Se	Ivan Zamoshchansky	
THE 23th	10:00 - 13:00	Expert group on	national priorities and needs	Andrey Sozykin
May	14:00 – 17:00	Trans	sfer to Chelyabinsk	Andrey Sozykin, Gleb Radchenko
WEN, 24th May	9:00 - 14:00	Quality /	Assurance Committee	Gleb Radchenko
THU, 25th May	9:00 - 12:00 13:00 - 17:00	Administratio Doc	on and Finance Committee toral panel board	Gleb Radchenko
FRI, 26th May	9:00 - 14:00	Poster S	Session joint research	Gleb Radchenko

Modern concepts of distributed software systems engineering

Course is provided by Assoc. Prof. Gleb Radchenko (South Ural State University (SUSU), Chelyabinsk, Russia).

This course is devoted to methods and organizational principles of engineering of modern distributed software systems using microservices architecture on a basis of containerized cloud platforms.



Course timing: May 16, 2017

Mode of study: Lectures: 6 hours, Practice: 4 hours, Total: 10 hours



Modern concepts of distributed software systems engineering

#	Title	Duration	Summary		
Lec	Lectures				
1	Introduction to distributed systems and cloud computing	2 hours	Definitions and types of distributed systems. Classification of distributed computing systems. Centralization and decentralization. Issues of distributed computing systems. Basic algorithms. Modern trends in distributed systems and cloud platforms.		
2	Microservices	2 hours	Microservices architecture. Comparing monolith and microservice architecture approach. Patterns of microservice applications engineering. Distributed data management in microservice systems.		
3	Containerization and DevOps	2 hours	Containerization VS Virtualization. Docker – implementation of containerization approach. Stand-alone containers and container clusters.		
Pra	ctice				
4	Working with distributed computing systems	4 hours	Implementation and deployment of standalone container application. Cloud deployment of containerized applications. Scalability of multi-container applications.		

Mathematical Foundations of Software Engineering

Course is lectured by **Assoc. Prof. Valentin Golodov** (SUSU, Chelyabinsk, Russia). His research interest area includes errorless computing, interval analysis, GPU computing.

This course is devoted to application of the mathematical methods in software engineering. Finite automata software verification technique will be introduced. Model checking software verification method, PROMELA verification modeling language and SPIN verification software package will be seen.



Course timing: May 17, 2017

Mode of study: Lectures: 6 hours, Practice: 4 hours, Total: 10 hours

Mathematical Foundations of Software Engineering

#	Title	Duration	Summary			
Le	Lectures					
1	Introduction to mathematical foundations of software engineering	2 hours	Mathematical foundations of software engineering:Boolean logic, first-order logic, models of first-order logic. Introduction to program verification, applications in Software Engineering. Completeness Theorem. Regular expressions, regular sets, finite-state machines, and applications in Software Engineering. Graph Theory, graph algorithms. Statecharts, Petri Nets and their role in Software Engineering.			
2	Finite state machines	2 hours	Finite State Machines as technique for modeling the states and transitions of a software system.			
3	Verification of software	2 hours	Model checking.PROMELA (Process or Protocol Meta Language).			
Pra	actice					
4	Verifying a model of software	4 hours	Verification of model using model checking technique and SPIN model checker.			

Fundamentals of Information Security

Course is lectured by Prof. Dr. Franck Leprevost (University of Luxembourg) His research interest area includes Algorithmic number Theory, Cryptology.

This course is devoted to Introduction to Information Security, Risk Management, Operating System Security, Access Control, Encryption, Application Security.

Course timing: May 18-19, 2017

Mode of study: Lectures: 10 hours, Practice: 10 hours, Total: 20 hours



Self-Management

Course is lectured by business couch and candidate of philosophical sciences **Ivan** Zamoshchansky (Ural State University, Ekaterinburg, Russia)

This course is devoted to methods and fundamentals of organization of scientific and everyday activity.

Course timing: May 22, 2017

Mode of study: Seminar: 10 hours



Self-Management

#	Title	Duration	Summary
1	Freedom and self- organization in everyday life	1 hours	Productive activities. Freedom, authenticity, and proactivity. The relationship of discipline and freedom. Articulating life's mission and core social roles. Exercise: «Build the plan of your research career».
2	Technology planning	2 hours	Pitfalls and time sinks. Quantification and the laws of time. Features of the scientific career. Exercise: «Planning of the week» (individual presentation and feedback).
3	Software for planning	2 hours	Overview of software for planning and organizing your work. Using the software to create the week plan.
4	Communica tion in the group	2 hours	Group dynamics. The structure of a small social group. The laws of social communications. Techniques of self-presentation in the group. Ways of organizing work in a small social group. Negotiation and conflict situation in professional activity and communication. Technology of conflict solution in communication. Case studies: 1) «Conflict in a team» 2) «The conversation with a supervisor» 3) Business game for the group interaction.

Modern Database Systems

Course is lectured by Assoc. Prof. Alina Latipova (SUSU, South Ural State University, Chelyabinsk, Russia). Her research interests include enterprise information systems and operation research.

Course is devoted to modern technologies of database management systems (NoSQL, parallel, columnoriented, graph databases) which can be beneficially used in Software Engineering.

Course timing: May 24, 2017

Mode of study: Lectures: 6 hours, Practice: 4 hours, Total: 10 hours



Modern Database Systems

#	Title	Duration	Summary
Lec	tures		
1	Overview of modern	2 hours	Classification of modern DBMS, market analysis,
Ŧ	DBMS		challenges of modern times
		2 hours	Fundamentals of database and schema design for
	Deletionalus NaCO		relational DBMS, schema normalization, properties
2	Relational vs. NoSQL DBMS		of transactions. Overview of modern NoSQL
			DBMS, pros and cons of NoSQL, classification of
			NoSQL DBMS, CAP theorem, ACID vs. BASE
า	Document,column-	2 hours	Main features, advantages and drawbacks
3	oriented, graph DBMS	Znours	
Pra	ctice		
			Developing different types of data structure
1	Modern DBMS	4 hours	(normalized relational, JSON/BSON, XML),
			retrieving data using queries

Data Mining in Software Engineering

Course is lectured by Assoc. Prof. Mikhail Zymbler (South Ural State University, Chelyabinsk, Russia). His research interests include parallel algorithms for data mining, parallel database systems.

Course devoted to methods, algorithms and software to discover hidden knowledge from data involved in Software Engineering.

Course timing: May 25, 2017

Mode of study: Lectures: 4 hours, Practice: 6 hours, Total: 10 hours



Data Mining in Software Engineering

#	Title		Duration	Summary
Leo	ctures			
1	Introduction to data mining	1 hour	Big Data phenc as a process. A Engineering.	menon. Notion of Data Mining. Data Mining oplications of Data mining in Software
2	Mining frequent patterns	1 hour	Market basket rules. Generati	problem, support, confidence, association ng association rules from frequent itemsets.
3	Classification	1 hour	Learning step, classifier accur Classification.	classification step, training set, test set, acy. Decision trees. k-Nearest-Neighbor
4	Clustering	1 hour	k-Means cluste clustering.	ring. Agglomerative and divisive hierarchical
Pra	actice			
1	KNIME basics	1 hour	Basics of KNIM mining.	E, open-source stand-alone package for data
2	Data mining in Software Engineering	5 hours	Solving typical scope of Softw	data mining problems on given datasets from are Engineering using KNIME package. 18

Preparation and School Schedule

#	Activity	Deadline
1	Acquire a list of participants from all partner universities (students and staff)	February 28
2	Issue formal invitations for participants	March 15
3	Provide information for traveling and accommodation	March 15
3	Acquire Russian visa	April 15
4	Arrival to Chelyabinsk	May 14
5	Transfer to Yekaterinburg	May 21
6	Transfer back to Chelyabinsk	May 23
7	School Ends	May 26



Transfer to Chelyabinsk

The best way to get to Chelyabinsk, is to book a flight through Moscow or Saint Petersburg

South Ural State University Location

http://www.susu.ru/en/university-campus

Accomodation

Челябинский зоопарк 🌱

PYAa

ul. Enge

See you in May!

CHELYABINSK

YEKATERINBURG

