UČNI NAČRT PREDMETA / COURSE SYLLABUS (leto / year 2017/18)

Predmet:	Finančni praktikum
Course title:	Financial lab

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Univerzitetni študijski program Finančna matematika	ni smeri	3	prvi
First cycle academic study programme Financial Mathematics	none	3	first

Vrsta predmeta / Course type	obvezni / compulsory

Univerzitetna koda predmeta / University course code: M0323

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
45	15	30			90	6

Nosilec predmeta / Lecturer:	prof. dr. Janez Bernik, prof. dr. Sergio Cabello Justo, prof. dr. Mihael Perman

Jeziki / Languages:	Predavanja / Lectures:	slovenski / Slovene
	Vaje / Tutorial:	slovenski / Slovene

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Vpis v letnik študija. Opravljen predmet Operacijske raziskave.	Enrolment in the programme. Completed course Operation research.

Vsebina:	Content (Syllabus outline):

Predmet je sestavljen iz dveh delov.

Namen predavanj in seminarja je, da poglobi znanje, pridobljeno pri Operacijskih raziskavah in Finančni matematiki 1 in ga postavi na teoretične osnove, pridobljene pri predmetih iz verjetnostni in statistike (npr. teorija martingalov v diskretnem času) ali/in uporabi pridobljeno znanje pri teh predmetih za seznanitev s stohastičnim modeliranjem v financah in zavarovalništvu (npr. kolektivni modeli, modeli za porazdelitve števila škodnih zahtevkov, modeli za porazdelitve višin škodnih zahtevkov, modeli za porazdelitve donosov).

Pri laboratorijskih vajah študenti dobijo nekaj praktičnih projektov in začno z delom pod nadzorom, dokončajo pa ga sami. Možne teme za projekte so:

Statistični projekt: urejanje podatkov, priprava podatkov za obdelavo, izbira statističnega modela, testiranje modela, ocenjevanje parametrov, interpretacija rezultatov, napovedovanje, preizkušanje zanesljivosti napovedi, preverjanje s simulacijami, Monte-Carlo metode, uporaba probit in logit modelov, uporaba regresijskih modelov za analizo finančnih podatkov.

Finančni projekt: praktično vrednotenje opcij, rekurzivne metode, metode na podlagi simulacij, ocenjevanje "grkov", diferenčne metode, analiza posameznih vrednostnih papirjev, izbira optimalne naložbene strategija in njena numerična implementacija, Monte-Carlo metode, vrednotenje opcij na obrestne mere ali menjalne tečaje.

Aktuarski projekt: določanje premij kompleksnih zavarovalnih produktov, uporaba probit ali logit modelov za ocenjevanje tveganja, ocenjevanje verjetnosti bankrota, računanje matematičnih rezervacij, ocenjevanje

Course consists of two parts.

The aim of the lectures and the seminar is to deepen the understanding of the material learned in Operations Research and Financial Mathematics 1 courses by presenting it in the theoretical framework acquired at the courses in probability and statistics (e.g., the theory of martingales in discrete time) and/or use the

knowledge acquired in the above courses to present stochastic modeling in finance and insurance (e.g. collective models, modeling the number of claims, modeling the size of claims, modeling of returns).

For the practical part students are given a couple of projects that they start to work on under supervision and finish themselves.

Some possible topics for projects with practical objectives:

Statistical project: data collection, data preparation, model selection, model testing,

parameter estimation, interpretation, forecasting, reliability testing, simulations, Monte Carlo methods, probit and logit models, regression models for analysis of financial data.

Finance project: practical evaluations of options, recursive methods, simulation methods, estimation of "greeks", difference methods, single equity analysis, optimal investment strategies and numerical implementations, Monte Carlo methods, interest rate and currency derivatives.

Actuarial project: determining the premia of complex insurance products, probit and logit models for risk assessment, probability of ruin estimation, loss reserves estimation, long-term

dolgoročnega tveganja zavarovalnice. Študent mora obvezno naredite tudi projekt, povezan s predmetom Operacijske raziskave. Teme bodo izbrane iz ustreznih knjig ali člankov v revijah, kot so na primer European Journal of Operational Research, INFORMS Journal on Computing, Computers & Operations Research, itd.	risk estimation. Each student is required to make a project related to Operations Research. The topics of the projects will be based on material from books or articles in specialized journals like for example European Journal of Operational Research, INFORMS Journal on Computing, Computers & Operations Research, etc.

Temeljni literatura in viri / Readings:

P. Wilmott: Derivatives: The Theory and Practice of Financial Engineering, John Wiley & Sons, New York, 1998.

W.N. Venables, B. Ripley: S-programming, Springer, 2004.

D.A. Freedman: Statistical models, Theory and Practice, Cambridge Univ. Press. 2005.

H. P. Schmidli: Risk theory, script freely available on the internet, www.math.ku.dk/~schmidli/rt.pdf .

A. Klenke: Probability Theory, A Comprehensive Course, Springer-Verlag 2006.

V. Batagelj: Operacijske raziskave. Skripta v pripravi. http://vlado.fmf.uni-lj.si/vlado/or/or.htm

D. C. Montgomery: Design and analysis of experiments. John Wiley & Sons, 1997.

F.S. Hillier in G.J. Lieberman: Introduction to operations research. McGraw-Hill Higher Education, 2010.

W.L. Winston: Operation Research, Applications and Algorithms. PWS-KENT, Boston, MA 1991.

Cilji in kompetence:	**Objectives and competences:**
Na eni strani je namen poglobiti teoretične osnove znanj pridobljenih pri Finančni matematiki 1 in uporabiti znanje iz verjetnosti za stohastično modeliranje v financah in zavarovalništvu. Po drugi strani pa koncepti finančne matematike in statistike dobijo svojo pravo	On the one hand the theoretical background of concepts learned in Financial Mathematics 1 course are elucidated and skills acquired in Probability course are used in stochastic modeling in finance and insurance. On the other, the concepts of financial mathematics and statistics only become

vrednost s praktičnimi izkušnjami. Namen praktičnega dela predmeta je spoznavanje z uporabo pridobljenega znanja v praksi. Študenti v okviru predmeta vodeno izvajajo projektne naloge iz statistike ali finančne matematike s pravimi podatki in ustreznimi računalniškimi programi.	apparent through practical experience. This is the goal of the practical part of this course. Students will prepare under tutorship projects in statistics or financial mathematics involving real-life data and computer programs.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Razumevanje teoretičnih osnov verjetnosti, statistike in finančne matematike ter zmožnost neposredne praktične uporabe le-teh na konkretnih primerih s konkretnimi podatki. Brez ustrezne računalniške podpore ostanejo pojmi neoprijemljivi, zmanjša pa se tudi neposredna zaposljivost diplomantov. Uporaba: Sposobnost praktične implementacije konceptov finančne matematike je ključ do neposredne zaposljivosti v finančno zavarovalnem sektorju. Uporaba je neposredna. Refleksija: Praktične izkušnje z vrednotenjem finančnih instrumentov omogočajo globlje in bolj trdno razumevanje bolj teoretičnega dela finančne matematike. Prenosljive spretnosti – niso vezane le na en predmet: Spretnosti so prenosljive na druga področja verjetnosti in slučajnih procesov ter matematičnega modeliranja, še najbolj pa je predmet pomemben zaradi svoje neposredne uporabnosti.	Knowledge and understanding: Understanding of the theoretical concepts in probability, statistics and financial mathematics , and the ability to apply them to concrete real-life examples and data. Without adequate computer equipment these notions remain incomplete, and the skills needed for successful employment are not developed. Application: The ability to implement in practice the concepts of financial mathematics is crucial for the skills development. The applications are straightforward. Reflection: The practical experience in valuation of financial products enables deeper understanding of the underlying theoretical concepts. Transferable skills: The skills obtained are transferable to all areas of probability, stochastic processes and mathematical modelling, but most of all to real-life problems.

Metode poučevanja in učenja:	**Learning and teaching methods:**

Predavanja, seminar in vodeno izvajanje projektov.	Lectures, seminar and projects under supervision

Načini ocenjevanja:	**Delež (v %) / Weight (in %)**	**Assessment:**
Način (pisni izpit, ustno izpraševanje, naloge, projekt): kvaliteta oddanih projektov, ustni zagovor ocene: 1-5 (negativno), 6-10 (pozitivno) (po Statutu UL)	50% 50%	Type (examination, oral, coursework, project): quality of a submitted projects, oral defense grading: 1-5 (fail), 6-10 (pass) (according to the Statute of UL)

Reference nosilca / Lecturer's references:

Janez Bernik:

BERNIK, Janez, MASTNAK, Mitja. Lie algebras acting semitransitively. Linear Algebra and its Applications, ISSN 0024-3795. [Print ed.], 2013, vol. 438, iss. 6, str. 2777-2792. [COBISS.SI-ID 16553561]

BERNIK, Janez, MARCOUX, Laurent W., RADJAVI, Heydar. Spectral conditions and band reducibility of operators. Journal of the London Mathematical Society, ISSN 0024-6107, 2012, vol. 86, no. 1, str. 214-234. [COBISS.SI-ID 16357721]

BERNIK, Janez, MASTNAK, Mitja, RADJAVI, Heydar. Positivity and matrix semigroups. Linear Algebra and its Applications, ISSN 0024-3795. [Print ed.], 2011, vol. 434, iss. 3, str. 801-812. [COBISS.SI-ID 15745625]

Sergio Cabello:

CABELLO, Sergio, ROTE, Günter. Obnoxious centers in graphs. SIAM journal on discrete mathematics, ISSN 0895-4801, 2010, vol. 24, no. 4, str. 1713-1730. [COBISS.SI-ID 15762265]

BUCHIN, Kevin, CABELLO, Sergio, GUDMUNDSSON, Joachim, LÖFFLER, Maarten, LUO, Jun, ROTE, Günter, SILVEIRA, Rodrigo I., SPECKMANN, Bettina, WOLLE, Thomas. Finding the most relevant fragments in networks. Journal of graph algorithms and applications, ISSN 1526-1719, 2010, vol. 14, no. 2, str. 307-336. [COBISS.SI-ID 15629401]

CABELLO, Sergio, DÍAZ-BÁÑEZ, José Miguel, LANGERMAN, Stefan, SEARA, Carlos, VENTURA, Inma.

Facility location problems in the plane based on reverse nearest neighbor queries. European journal of operational research, ISSN 0377-2217. [Print ed.], 2010, vol. 202, iss. 1, str. 99-106. [COBISS.SI-ID 15160921]

Mihael Perman:

KOMELJ, Janez, PERMAN, Mihael. Joint characteristic functions construction via copulas. Insurance. Mathematics & economics, ISSN 0167-6687, 2010, vol. 47, iss. 2, str. 137-143. [COBISS.SI-ID 16242777]

HUZAK, Miljenko, PERMAN, Mihael, ŠIKIĆ, Hrvoje, VONDRAČEK, Zoran. Ruin probabilities and decompositions for general perturbed risk processes. Annals of applied probability, ISSN 1050-5164, 2004, vol. 14, no. 3, str. 1378-1397. [COBISS.SI-ID 13168985]

HUZAK, Miljenko, PERMAN, Mihael, ŠIKIĆ, Hrvoje, VONDRAČEK, Zoran. Ruin probabilities for competing claim processes. Journal of Applied Probability, ISSN 0021-9002, 2004, vol. 41, no. 3, str. 679-690. [COBISS.SI-ID 13207641]