MATH 404 Loss Models II, Spring 2024, time 11:30-12:45 TuTh EGRA 322

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course webpage: http://parker.ad.siu.edu/Olive/M404.html

Text: Klugman, Panjer and Wilmot (2008), *Loss Models: from Data to Decisions*, 3rd ed., New York, NY, Wiley (ISBN: 978-0-470-18781-4). You may also use the 2nd, 4th or 5th edition. The 2nd ed. is about $10 from www.addall.com or www.amazon.com. The 2nd and 5th edition can be found online. Google loss models from data to decisions pdf.

The *prerequisite* for this class is Math 403, but I will let in students who got a B or higher in Math 483. (I did this for Math 404 twice where Math 403 was the prereq, and the five Math 483 students got the same grade in Math 404 that they got in Math 483.)

Actuaries put a price on risk, and this course considers constructing and analyzing actuarial loss models (risk theory, severity and ruin models). Math 403 and 404 help prepare for SOA Fundamentals of Actuarial Mathematics Short Term FAM-S Exam and the Advanced Short-Term Actuarial Mathematics (ASTAM) Exam. Roughly Math 403 is probability for loss models, and Math 404 is Statistics for loss models: estimation and fitting of models from data and credibility theory. Since a lot of Statistics and Probability is covered, the two courses are also useful for bridging the gap between Math 483 and Math 580.

Becoming an actuary is a potential option after you get your degree. You can be hired after receiving a Bachelor's degree and passing (1 or more likely) 2 exams (SOA Exam P = CAS Exam 1P=Probability exam Math 483 or 480, and the FM Exam Math 400 are common). From (https://www.dwsimpson.com/about/salary-survey/), in 2020 salary was roughly $46000-$56000 for one exam, $34000-$72000 for two exams, $47000-$87000 for three exams, and $50000 - $84000 for 4 exams with less than 1 year of actuarial experience. An ASA (Associate of the Society of Actuaries) makes about $75000-$120000 with 1-3 years of experience while an FSA (Fellow of the Associate of Actuaries) makes about $104000-$165000 with 3-5 years of experience. See (http://money.cnn.com/2013/04/25/news/economy/best-job-actuary/index.html). This course provides some insight on what an actuary does. Useful links are (www.soa.org), (www.casact.org), (www.actexmadriver.com), (https://www.coachingactuaries.com), (https://www.theinfiniteactuary.com), and (www.beanactuary.org).

Math 403 (values below are for 2nd ed., parentheses for the 2008 3rd ed., brackets for 4th ed.) covers 3.1-3.3, 4.3, (3.1,3.2,3.3,3.5) [3.1,3.2,3.3,3.5] Basic Distributional Quantities; 4.1, 4.2 (ch. 4) [ch 4] Characteristics of Actuarial Models; 4.4, 4.5 (5.3,5.4) [5.3,5.4] Continuous Models; 4.6.1-4.6.5, 4.6.7 (6.1-6.5, 6.7) [6.1-6.6] Discrete Distributions; ch. 5 (ch. 8) [ch 8] Frequency and Severity; 12.2-12.3 (15.2-15.3) [13.2-13.4] Maximum Likelihood Models; ch 5 (ch 8) [ch 8] Frequency and Severity; 6.1-6.6, 6.7, 6.11 (9.1-9.3,9.7,9.11) [9.1-9.8] Aggregate Loss Models; 12.5 (15.6) [ch 14] Frequentist Est Discrete Dist ; 16.3 (20.2) [ch 17] Intro to Lim Fl Credibility.

Math 404 covers 4.3, (3.4) [3.4] Basic Distributional Quantities; 4.4, 4.5 (5.1,5.2) [5.1,5.2] Continuous Models; ch 5 (ch 8) [ch 8] Frequency and Severity; ch 6 (9.3-9.7) [9.3-9.7] Aggregate Loss Models; 12.2-12.3 (15.3-15.4) [13.2-13.4] Maximum Likelihood Models ; 12.5 (15.6) [14] Frequentist Est Discrete Dist ; 12.4 (15.5) [15] Bayesian Estimation ;

13 (ch. 16) [ch 16] Model Selection ; 16.4 (20.3) [18] Greatest Accuracy Credibility ; 16.5 (20.4) [19] Empirical Bayes Par Estimation ;

16.3-16.5 (20.2-20.4) [17.2, 18, 19] Credibility is linear Bayesian prediction.

The grading and schedule below are tentative.

2 homeworks may be turned in one class period late (ie on Monday) with no penalty. A third late will be accepted with 25% penalty. 2 quizzes may be taken late before the next class period (ie on Monday). Two sheets of notes are allowed on quizzes more for exams. A calculator is permitted. *Final:* Day and time TBA week of May 6-May 10 in EGRA 222.

Grading: 1 HW and 1 Quiz will be dropped. (Drop paper work Friday March 29 with an advisor, last drop day Sunday, March 31 online.)

HW	300		Quizzes	100	
exam1	100	exam 2	100	exam 3	100
final	300			total	1000
min. grade	points	min. grade	points	min. grade	points
A	900-1000	B	800-899	C	700-799
D	550-699				

15.1 and 15.2 are also Math 403 review

Week of	Tu	Th
Jan 15	M403 rev	rev
Jan 22	rev	15.1, HW1, Q1
Jan 29	15.1,15.2, HW2	15.2, Q2
Feb 5	15.2, HW3	15.3, Q3
Feb 12	EXAM 1	15.3,15.5
Feb 19	15.5, HW4	15.5,16.1, Q4
Feb 26	16.1,16.2,16.3, HW5	16.4, Q5
March 4	16.4, HW 6	16.4, Q6
March 11	no class	no class
March 18	16.4,15.5	Exam 2
March 25	15.5, HW7	15.5,15.6, Q7
April 1	20.3, HW8	20.3,20.4, Q8
April 8	20.4, HW9	20.4, Q9
April 15	3.4,5.1, HW10	5.1, Q10
April 22	5.1,5.2	EXAM3
April 29	rate making, HW11, Q11	rev

References: Lorayne and Lucas (2000), *The Memory Book* for **memorization**.

Klugman, Panjer and Wilmot (2004, 2012, 2018), *Loss Models: from Data to Decisions*, 2nd, 4th, and 5th ed., New York, NY, Wiley.

Weishaus, A. (2011), *ASM Study Manual Exam C/Exam 4*, 13th ed,
(see www.studymanuals.com).

Kellison, S.G. and London, R.L. (2011), *Risk Models and Their Estimation*, ACTEX Publications, Winsted, CT.

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M403 FAMS	Klugman 5th	Klugman 4th	Klugman 3rd
Basic Distributional Quantities	3.1,3.2,3.3,3.5	3.1,3.2,3.3,3.5	3.1,3.2,3.3,3.5
Characteristics of Actua Models	4	4	4
Continuous Models	5.3,5.4	5.3,5.4	5.3,5.4
Discrete Distributions	6	6	6.1-6.5,6.7
Frequency and Severity	8.1-8.5	8.1-8.5	8.1-8.5
Aggregate Loss Models	9.1-9.3,9.7,9.8	9.1-9.3,9.7,9.8	9.1-9.3,9.7,9.11
Maximum Likelihood Models	11.1-11.4	13.2-13.4	15.2-15.3
Frequentist Est Discrete Dist	12.1-12.4	14	15.6
Intro to Lim Fl Credibility	16	17.2	20.2
M404 ASTAM	Klugman 5th	Klugman 4th	Klugman 3rd
Basic Distributional Quantities	3.4	3.4	3.4
Continuous Models	5.1,5.2	5.1,5.2	5.1,5.2
Frequency and Severity	8	8	8
Aggregate Loss Models	9.3-9.7	9.3-9.7	9.3-9.7
Maximum Likelihood Models	11.5-11.7	13.2-13.4	15.3,15.4
Frequentist Est Discrete Dist	12.4	14	15.6
Bayesian Estimation	13	15	15.5
Model Selection	15	16	16
Greatest Accuracy Credibility	17	18	20.3
Empirical Bayes Par Estimation	18	19	20.4

M404 ASTAM
Loss Models: From Data to Decisions, (Fifth Edition), 2019,
by Klugman, S.A., Panjer, H.H. and
Willmot, G.E., Wiley, ISBN: 978-1-119-52378-9
Chapter 3 (Sections 4.2-4.6)
Chapter 5 (Sections 1, 2)
Chapter 8
Chapter 9 (Sections 3.1-2, 4 (Theorem 9.7 & Example 9.9 only),
5, 6 (except 6.1), 7)
Chapter 11 (Sections 5-7)
Chapter 12 (Section 4)
Chapter 13
Chapter 15 (except Section 4.2)
Chapter 17
Chapter 18
Introduction to Ratemaking and Loss Reserving for Property
and Casualty Insurance (4th or 5th Edition), 2015,2022,
Chapter 4 (Section 8)
Chapter 5 (Sections 3, 4)

Math 403 Short-Term (FAM-S):
Loss Models: From Data to Decisions, (Fifth Edition), 2019,
by Klugman, S.A., Panjer, H.H. and Willmot, G.E., Wiley, ISBN: 978-1-119-52378-9
Chapter 3 (Sections 1, 2, 4.1, 5)
Chapter 4
Chapter 5 (Sections 3, 4)
Chapter 6
Chapter 8 (Sections 1-5)
Chapter 9 (Sections 1, 2, 3.1, 3.2, 7, 8.1, 8.2)
Chapter 11 (Sections 1-4)
Chapter 12 (Sections 1-3)
Chapter 16
Introduction to Ratemaking and Loss Reserving for Property
and Casualty Insurance (Fifth Edition), 2022 by
Brown and Lennox, ACTEX, ISBN: 978-1-64756-787-3
[Candidate may also use Fourth Edition, 2015, (same
chapters) ACTEX, ISBN: 978-1625424747]
Chapter 1 (background only)
Chapter 2
Chapter 3 (Sections 1-6.4)
Chapter 4 (Sections 1-8.1)
Chapter 5 (Section 3 (background reading only), Section 5)