

University of Manchester
Department of Mathematics
Math48181/68181: Extreme Values and Financial Risk
Semester 1

Timetable: The timetable is as follows

- Week from 27 September 2021 to 1 October 2021
 - Review session, on-line through <https://zoom.us/my/saraleesnadarajah> and in person at Kilburn Theatre 1.4, Wednesday, 29 September 2021, 10:00-11:00;
 - Tutorial, on-line through <https://zoom.us/my/saraleesnadarajah> and in person at Engineering Building B.025 Flat Lecture Room, Friday, 1 October 2021, 12:00-13:00, tutorial sheet in <https://minerva.it.manchester.ac.uk/~saralees/eprob3.pdf>
- Week from 4 October 2021 to 8 October 2021
 - Review session, on-line through <https://zoom.us/my/saraleesnadarajah> and in person at Kilburn Theatre 1.4, Wednesday, 6 October 2021, 10:00-11:00;
 - Tutorial, on-line through <https://zoom.us/my/saraleesnadarajah> and in person at Engineering Building B.025 Flat Lecture Room, Friday, 8 October 2021, 12:00-13:00, tutorial sheet in <https://minerva.it.manchester.ac.uk/~saralees/eprob1.pdf>
- Week from 11 October 2021 to 15 October 2021
 - Review session, on-line through <https://zoom.us/my/saraleesnadarajah> and in person at Kilburn Theatre 1.4, Wednesday, 13 October 2021, 10:00-11:00;
 - Tutorial, on-line through <https://zoom.us/my/saraleesnadarajah> and in person at Engineering Building B.025 Flat Lecture Room, Friday, 15 October 2021, 12:00-13:00, tutorial sheet in <https://minerva.it.manchester.ac.uk/~saralees/eprob4.pdf>
- Week from 18 October 2021 to 22 October 2021
 - Review session, on-line through <https://zoom.us/my/saraleesnadarajah> and in person at Kilburn Theatre 1.4, Wednesday, 20 October 2021, 10:00-11:00;
 - Tutorial, on-line through <https://zoom.us/my/saraleesnadarajah> and in person at Engineering Building B.025 Flat Lecture Room, Friday, 22 October 2021, 12:00-13:00, tutorial sheet in <https://minerva.it.manchester.ac.uk/~saralees/eprob7.pdf>
- Week from 25 October 2021 to 29 October 2021
 - Review session, on-line through <https://zoom.us/my/saraleesnadarajah> and in person at Kilburn Theatre 1.4, Wednesday, 27 October 2021, 10:00-11:00;
 - Tutorial, on-line through <https://zoom.us/my/saraleesnadarajah> and in person at Engineering Building B.025 Flat Lecture Room, Friday, 29 October 2021, 12:00-13:00, tutorial sheet in <https://minerva.it.manchester.ac.uk/~saralees/eprob8.pdf>
- Week from 8 November 2021 to 12 November 2021

- Review session, on-line through <https://zoom.us/my/saraleesnadarajah> and in person at Kilburn Theatre 1.4, Wednesday, 10 November 2021, 10:00-11:00;
- Tutorial, on-line through <https://zoom.us/my/saraleesnadarajah> and in person at Engineering Building B.025 Flat Lecture Room, Friday, 12 November 2021, 12:00-13:00, tutorial sheet in <https://minerva.it.manchester.ac.uk/~saralees/eprob6.pdf>
- Week from 15 November 2021 to 19 November 2021
 - Review session, on-line through <https://zoom.us/my/saraleesnadarajah> and in person at Kilburn Theatre 1.4, Wednesday, 17 November 2021, 10:00-11:00;
 - Tutorial, on-line through <https://zoom.us/my/saraleesnadarajah> and in person at Engineering Building B.025 Flat Lecture Room, Friday, 19 November 2021, 12:00-13:00, tutorial sheet in <https://minerva.it.manchester.ac.uk/~saralees/eprob6.pdf>
- Week from 22 November 2021 to 26 November 2021
 - Review session, on-line through <https://zoom.us/my/saraleesnadarajah> and in person at Kilburn Theatre 1.4, Wednesday, 24 November 2021, 10:00-11:00;
 - Tutorial, on-line through <https://zoom.us/my/saraleesnadarajah> and in person at Engineering Building B.025 Flat Lecture Room, Friday, 26 November 2021, 12:00-13:00, tutorial sheet in <https://minerva.it.manchester.ac.uk/~saralees/eprob10.pdf>
- Week from 29 November 2021 to 3 December 2021
 - Review session, on-line through <https://zoom.us/my/saraleesnadarajah> and in person at Kilburn Theatre 1.4, Wednesday, 1 December 2021, 10:00-11:00;
 - Tutorial, on-line through <https://zoom.us/my/saraleesnadarajah> and in person at Engineering Building B.025 Flat Lecture Room, Friday, 3 December 2021, 12:00-13:00, tutorial sheet in <https://minerva.it.manchester.ac.uk/~saralees/eprob14.pdf>
- Week from 6 December 2021 to 10 December 2021
 - Review session, on-line through <https://zoom.us/my/saraleesnadarajah> and in person at Kilburn Theatre 1.4, Wednesday, 8 December 2021, 10:00-11:00;
 - Tutorial, on-line through <https://zoom.us/my/saraleesnadarajah> and in person at Engineering Building B.025 Flat Lecture Room, Friday, 10 December 2021, 12:00-13:00, tutorial sheet in <https://minerva.it.manchester.ac.uk/~saralees/eprob12.pdf>
- Week from 13 December 2021 to 17 December 2021
 - Review session, on-line through <https://zoom.us/my/saraleesnadarajah> and in person at Kilburn Theatre 1.4, Wednesday, 15 December 2021, 10:00-11:00;
 - Tutorial, on-line through <https://zoom.us/my/saraleesnadarajah> and in person at Engineering Building B.025 Flat Lecture Room, Friday, 17 December 2021, 12:00-13:00, tutorial sheet in <https://minerva.it.manchester.ac.uk/~saralees/eprob11.pdf>

Lecturer: Dr. Saralees Nadarajah

Office: Alan Turing 2.223.

Office Phone: 0161 275 5912.

Zoom link is <https://zoom.us/my/saraleesnadarajah>, you are most welcome to Zoom me 24 / 7.

Skype id is “saraleesan”, you are most welcome to skype me 24 / 7.

E-mail: mbbssn2@manchester.ac.uk, you are most welcome to email me 24 / 7.

I am also happy to meet you in person anywhere 24 / 7 for tutoring.

WWW: <https://minerva.it.manchester.ac.uk/~saralees/extremes6.html>

Unit code: MATH48181/68181.

Credit rating: 15.

Pre-requisite units: Introduction to Statistics (Math10282).

Aims: To introduce probabilistic fundamentals and some statistical models in extreme value theory with applications to finance.

Brief description: The course will give some probabilistic and statistical details of univariate and bivariate extreme value theory. The topics covered will include: fundamental of univariate extreme value theory, the three extreme value distributions, various models for univariate extremes, fundamentals of bivariate extreme value theory, and various models for bivariate extremes. The course will contain a great deal material on applications of the models to finance. Software in R will be used.

Intended learning outcomes: On successful completion of this unit students will: 1) have some understanding of the probabilistic fundamentals of univariate and bivariate extreme value theory; 2) be able to choose and fit appropriate extreme value models for a given data (univariate and bivariate); 3) be able to calculate probabilities associated with total portfolio loss, maximum portfolio loss and minimum portfolio loss; 4) be able to estimate financial risk measures; 5) be able to fit copulas to real data sets; 6) be able to fit GARCH type models to real data sets.

Course Contents: I plan to cover all of the following topics:

1. Fluctuations of univariate maxima: the theory (4),
2. Fluctuations of univariate upper order statistics: the theory (2),
3. Some statistical models for univariate extremes (4),
4. Real data applications for univariate extremes using the R software (1),
5. Portfolio theory (2),
6. Real data applications (1),
7. Financial risk measures and their estimation (3),
8. Real data applications (1),

9. Models for stock returns (2),
10. Real data applications (1),
11. Some models for bivariate extremes (4),
12. Real data applications for bivariate extremes using the R software (1),
13. Copulas (2),
14. Real data applications (1),
15. GARCH type models (2),
16. Real data applications (1).

The total number of lectures is 32.

Textbooks:

Embrechts, P., Klüppelberg, C. and Mikosch, T. (1997) *Modelling Extremal Events: for Insurance and Finance*, Springer-Verlag, Berlin.

Leadbetter, M.R., Lindgren, G. and Rootzén, H. (1983) *Extremes and Related Properties of Random Sequences and Processes*, Springer-Verlag, Berlin.

Resnick, S.I. (1987) *Extreme values, Regular Variation and Point Processes*, Springer-Verlag, Berlin.
Coles S. (2001) *An Introduction to Statistical Modelling of Extreme Values*, Springer-Verlag, London.

Kotz, S. and Nadarajah, S. (2000) *Extreme Value Distributions: Theory and Applications*, Imperial College Press, London.

Learning and teaching processes: Three lectures and one example class each week. In addition students are expected to do at least four hours private study each week on this course unit.

Assessment: There will be ten quizzes due at the following times:

<https://minerva.it.manchester.ac.uk/~saralees/ext2021quizz1.pdf> due by 11:00am on Wednesday, 13 October 2021

<https://minerva.it.manchester.ac.uk/~saralees/ext2021quizz2.pdf> due by 11:00am on Wednesday, 20 October 2021

<https://minerva.it.manchester.ac.uk/~saralees/ext2021quizz3.pdf> due by 11:00am on Wednesday, 27 October 2021

<https://minerva.it.manchester.ac.uk/~saralees/ext2021quizz4.pdf> due by 11:00am on Wednesday, 10 November 2021

<https://minerva.it.manchester.ac.uk/~saralees/ext2021quizz5.pdf> due by 11:00am on Wednesday, 17 November 2021

<https://minerva.it.manchester.ac.uk/~saralees/ext2021quizz6.pdf> due by 11:00am on Wednesday, 24 November 2021

<https://minerva.it.manchester.ac.uk/~saralees/ext2021quizz7.pdf> due by 11:00am on Wednesday, 1 December 2021

<https://minerva.it.manchester.ac.uk/~saralees/ext2021quizz8.pdf> due by 11:00am on Wednesday, 8 December 2021

<https://minerva.it.manchester.ac.uk/~saralees/ext2021quizz9.pdf> due by 11:00am on Wednesday, 15 December 2021

<https://minerva.it.manchester.ac.uk/~saralees/ext2021quizz10.pdf> due by 11:00am on Wednesday, 5 January 2022

Each quiz will be worth 1 percent.

There will be an in-class test on **Friday 17 December 2021, 12:00-12:40pm** accounting for 10 percent. The formulas you will need to remember for this test are in

<https://minerva.it.manchester.ac.uk/~saralees/cwformula20212022.pdf>

The final exam for this course will be in January 2022, the formulas you will need to remember for this exam are in

<https://minerva.it.manchester.ac.uk/~saralees/formula20212022.pdf>

The final exam will account for 80 percent of your final mark.