This exercise sheet contains the second of two project works, which needs to be handed in separately by each student signed-up for the course in order to obtain the ECTS credits for it. Your solution shall consist of the following:

- A written report as a PDF file containing solutions in the form of results, textual interpretations and graphs of your project. Note: plagiarism or other forms of cheating is a serious act – your work must be made made in accordance with the Rules for Written Exams at Stockholm University. For further information about possible consequences see also the Guidelines for Disciplinary Matters at Stockholm University.
- Your hand-in is to be uploaded as a bundle consisting of a) scanned copy[1] of your signed `Confirmation.pdf`, b) a PDF file `<lastname>.pdf` containing your report c) your commented R/Rmd, Python, Python Notebook, Matlab, Julia, ... file containing the code of your analysis.

  Final Deadline: **Tuesday 25 Aug 2025 at 18:00 o'clock**. All files are to be uploaded before the deadline to the Moodle project 2 task on the course home page. Please note that there is a 20Mb file limit when uploading files. Delayed hand-ins are not accepted.

  Note: As a service to improve your project, there is an initial deadline on 2020-08-14, where you can upload the PDF of your preliminary project report to `peergrade.com` (details to be announced on the web-page). Each student who turns something in at this deadline gets three other student projects to peer review. Deadline for peer review 2020-08-20. Please make sure that your reviews are written constructive and positive, for example by following the recommendations from the Science Education Resource Center at Carleton College. A good review is between 1/2 - 1 page, not longer. Once your reviews are done you will get access to the reviews for your project and can modify your project accordingly until the final deadline.

A total of 25 points can be reached for the 2nd project. Note: A penalty is imposed on reports longer than **8 pages**. Your final grade for the project module of the course is determined by your sum of points in the two project works – see the grading criteria of the course for further details.

Exercise 1 (25 points)

The second project is to be specified by you and has to deal with a topic involving Mathematical and Statistical Methods for Infectious Disease Outbreak data. Examples of such work could, e.g., be an attempt to deal and reproduce parts of a scientific paper, conduct an analysis of infectious disease data or perform simulations from a suitable mathematical model.

- As inspiration for scientific papers to consider:
  - Fraser et al. (2004)
  - Wallinga and Teunis (2004) and the associated implementation in the R package `R0` or `EpiEstim`
  - Kretzschmar et al. (2020)
  - Britton et al. (2020)
  - Funk et al. (2010)
- Examples of infectious disease data analysis could, e.g., be any aspect of the COVID-19 outbreak, for example visualization of time series, differences between countries/regions, effects of interventions, etc. Data sources:
  - Data from Johns Hopkins University
  - ECDC data
  - Covid-19 data for Sweden by Folkhälsomyndigheten

  Examples:
  - Delay-adjusted case fatality ratio to estimate under-reporting

[1] Picture taken with a mobile phone is also ok.

  - Rapid drop in the reproduction number during the Ebola outbreak in the Democratic Republic of Congo

- Simulations:
  - Simulate trajectories for some model with potential application for covid-19, ebola, malaria, ... addressing some important aspect of the considered disease.

In all cases please make sure to interpret your results and findings - not only mathematically, but also from an applied point of view.

In terms of volume the project accounts for 2 ECTS and is thus expected to be about 60 hours of work. To help you limit the scope of your analysis, a page limit of 8 pages is induced on the reports. No code is to be included in the report, instead this is to be included in a separate notebook or source code file.

The projects are evaluated in the following five categories

1. Compliance with the course goals to better understand, estimate and predict epidemic outbreaks. A project need not cover all these aspects, but all project should contain numerics, simulations and/or data analysis and address question(s) of relevance to the course content.
2. Technical difficulty and novelty of the chosen approach
3. Clarity of the programming
4. Readability and clarity of the report (this includes interpreting your results)
5. Reproducibility of the report

Each of the categories gets between 0-5 points and the total sum of points determines the points for the 2nd project.

Lycka till!

References

Tom Britton, Frank Ball, and Pieter Trapman. A mathematical model reveals the influence of population heterogeneity on herd immunity to SARS-CoV-2. Science, 2020. doi: 10.1126/science.abc6810.

Christophe Fraser, Steven Riley, Roy M. Anderson, and Neil M. Ferguson. Factors that make an infectious disease outbreak controllable. Proceedings of the National Academy of Sciences, 101(16):6146–6151, 2004. doi: 10.1073/pnas.0307506101.

Sebastian Funk, Marcel Salathé, and Vincent A. A. Jansen. Modelling the influence of human behaviour on the spread of infectious diseases: a review. Journal of the Royal Society Interface, 7:1247–1256, 2010. doi: 10.1098/rsif.2010.0142.

Mirjam E Kretzschmar, Martin C J Bootsma Ganna Rozhnova, Michiel van Boven, Janneke H H M van de Wijgert, and Marc J M Bonten. Impact of delays on effectiveness of contact tracing strategies for covid-19: a modelling study. Lancet Public Health, 2020. doi: 10.1016/ S2468-2667(20)30157-2. Online first.

J. Wallinga and P. Teunis. Different epidemic curves for severe acute respiratory syndrome reveal similar impacts of control measures. American Journal of Epidemiology, 160(6):509–516, 2004. doi: 10.1093/aje/kwh255.