Outline

1. Introduction to Course

- Description
- Objectives and Expected output
- References
- Evaluation
- Schedule

2. Introduction to Mathematical Modelling

Course description

- Provide a view, knowledge and skills of modeling different realities in nature and society using mathematical methods and languages so that computation can be performed on computers with those models.

- Two main approaches to mathematical modeling with deterministic and stochastic models.

- Many examples on modeling of the population, of social networks, of HIV, of the age of Universe, of global warming, of spreading disease ...

Objectives and expected output

- Master the mathematical modelling process

- Identify and classify mathematical models

- Solve completely the original problems by proposed mathematical models and computation techniques

- Analyze and prove the outputs returned from the proposed models

References

- Mark M. Meerschaert, Mathematical Modelling, Elsevier, ISBN 978-0-12-386912-8, 4th Edition, 2013
- Frank R. Giordano et al., A First Course in Mathematical Modeling, Thomson Learning, ISBN 0-534-38428-5, 3th Edition, 2002

Evaluation

- Homework: 20%
- Group projects: 30%
- Final evaluation: 50%

Schedule

1. Introduction to the course and the mathematical modelling
2. One variable optimization
3. Multivariable optimization
4. Multi-objective optimization
5. Introduction to computational methods for optimization
6. Project announcement
7. Introduction to dynamic models
8. Analysis of dynamic models
9. Simulation of dynamic models
10. Introduction to probability models
11. Stochastic models I
12. Stochastic models II
13. Simulation of Stochastic models
14. Project presentation I
15. Project presentation II

VIỆN CÔNG NGHỆ THÔNG TIN VÀ TRUYỀN THÔNG
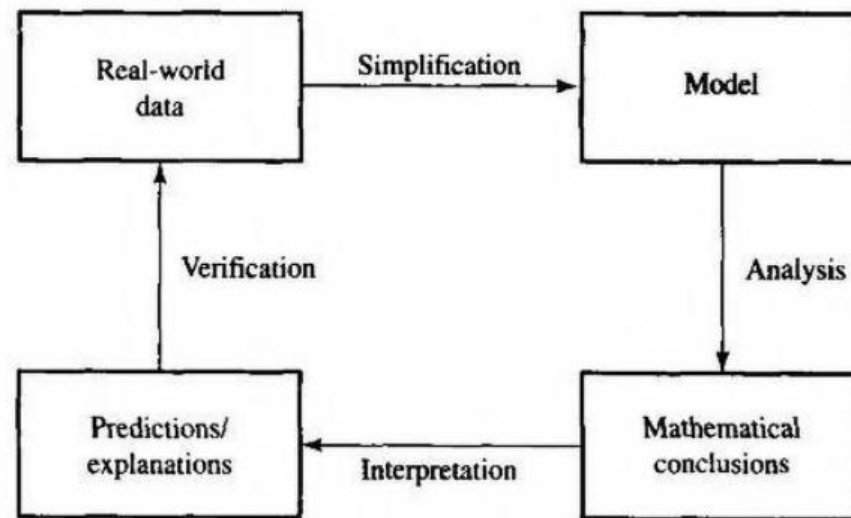
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2. Introduction to Mathematical Modelling

What is Mathematical Modelling?

- Models describe our beliefs about how the world functions. In mathematical modelling, we translate those beliefs into the language of mathematics.

What is Mathematical Modelling?

- Advantages:
  - Mathematics is a very precise language. This helps us to formulate ideas and identify underlying assumptions
  - Mathematics is a concise language, with well-defined rules for manipulations.
  - All the results that mathematicians have proved over hundreds of years are at our disposal.
  - Computers can be used to perform numerical calculations.

What are its objectives?

- Developing scientific understanding:
  - Through quantitative expression of current knowledge of a system (as well as displaying what we know, this may also show up what we do not know);
- Test the effect of changes in a system;
- Aid decision making, including
  - tactical decisions by managers;
  - strategic decisions by planners