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A Program for Self-Study on

Info-Gap Theory for Financial Risk Analysis and Decision Making

Developed for Cardano
Rotterdam, The Netherlands

This document outlines a self-study program on info-gap theory that is intended to give you a basic competence in info-gap analysis of robustness for financial risk assessment and decision making under severe uncertainty. This entails both reading and, most importantly, working out exercises. I am happy to help with questions as they arise. Questions can be posed by email, and we can have periodic skype conversations with the entire group of participants. My skype address is yakovbenhaim.

After completing the self-study program, the next stage is that small groups of typically 1 to 3 people will each formulate and work out a mini-project. Each mini-project is the info-gap analysis of a highly simplified version of a problem that that group is really interested in working on. I will assist you in the mini-projects during my 1 1/2 day visit to Cardano on 18–19 May 2017.

Finally, with the skill you have acquired through self-study and the mini-project, you are ready to begin developing a full-scale info-gap robust-satisficing decision analysis of problems of interest. I will be happy to answer questions throughout this on-going stage as well.

How to use this document in the self-study program?
Page 2 contains a detailed list of source materials, including textbooks on info-gap theory, links to relevant background literature, lecture notes and exercise files.

Page 3 contains a detailed outline of 14 self-study activities, each of which should take one or two hours. Each activity cites one or two sources from page 2.

Assuring success. The participants are welcome to work together on the self-study stage, helping each other to master the material. Skype and e-mail interaction with me is also possible, as mentioned before. The success of the subsequent mini-project stage depends entirely on the successful mastery of the material outlined in the self-study stage. In order for the 1 1/2 days that we will be together to be fruitful, leading to real-world applications, it is essential that the Cardano team fully internalize the self-study material before I arrive.

A link to this file is on this page: http://info-gap.technion.ac.il/workshops/

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Source material.

1. http://info-gap.com: many citations on info-gap theory and its applications in diverse disciplines.

2. **Background reading material.** Gives an intuitive introduction to info-gap theory.
   (a) Barry Schwartz, Yakov Ben-Haim, and Cliff Dacso, 2011, What makes a good decision? Robust satisficing as a normative standard of rational behaviour, *The Journal for the Theory of Social Behaviour,* 41(2): 209–227.
   (b) Yakov Ben-Haim, 2012, Doing our best: Optimization and the management of risk, *Risk Analysis,* 32(8): 1326–1332.
   (c) Yakov Ben-Haim, 2012, Why risk analysis is difficult, and some thoughts on how to proceed, *Risk Analysis,* 32(10): 1638-1646.

   Links to these articles here: http://info-gap.technion.ac.il/foundations-and-philosophy/

3. **Textbooks on info-gap theory.**
   (a) Yakov Ben-Haim, 2010, *Info-Gap Economics: An Operational Introduction,* Palgrave-Macmillan. (Subsequently referred to as *IGE*.)

   As the sub-title indicates, this book contains detailed derivations and explanations of explicit info-gap analyses in a range of economic applications. The following chapters would be of special interest:

   Chapter 1. Info-Gap Theory in Plain English

   Chapter 2. A First Look: Stylized Example

   Chapter 4. Financial Stability

   Chapter 6. Estimation and Forecasting
   (b) Yakov Ben-Haim, 2006, *Info-Gap Decision Theory: Decisions Under Severe Uncertainty,* 2nd edition, Academic Press.

   Some of the simple examples in chapter 3 are relevant.

4. **Lecture notes.** You will find many examples worked out in detail in the lecture notes for a course that I teach at the Technion called Economic Decision Making for Engineers. The focus of this course is on managing severe uncertainty in decisions involving basic economic concepts. There are lecture notes on the following topics:
   (a) Money-Time Relationships and Their Applications
   (b) The Benefit-Cost Ratio
   (c) Price Changes: Inflation and Foreign Exchange
   (d) Portfolio Management
   (e) Forecasting

   Here is the link:

   http://yakovbh.net.technion.ac.il/courses/introduction-to-economic-decision-making-for-engineers/

5. **Exercise files.**

   There are two files of homework exercises that will give you a chance to develop your skill in info-gap analysis. These are:
   (a) "Problem Set on Economic Decision Making for Engineers" (subsequently PS-EDM). Here is the link:

   http://yakovbh.net.technion.ac.il/courses/introduction-to-economic-decision-making-for-engineers/
   (b) "Problem Set on Robustness and Opportuneness" has many exercises that will give you a chance to develop your skill in info-gap analysis. Here is the link:

   http://yakovbh.net.technion.ac.il/courses/info-gap-analysis-of-risk-and-reliability/

Program of study. Do the activities in sequence, from 1 to 14.

1. **Study the following material.**

   Activity 1. Background article on robust-satisficing, item 2a.

   Activity 2. Background article on optimization, item 2b.

   Activity 3. Background article on risk management, item 2c.

   Activity 4. Section 4.1 of *IGE* (item 3a): Structured Securities: Simple Example.

   Activity 5. Section 4.2 of *IGE* (item 3a): Value at Risk in Financial Economics.

   Activity 6. Section 6.1 of *IGE* (item 3a): Regression Prediction.

   Activity 7. Section 6.2 of *IGE* (item 3a): Auto-Regression and Data Revision.

2. **Solve the following exercises.**

   Activity 8. Solve problems 10 and 11 in PS-EDM (item 5a): Uncertain interest.[1]

   Activity 9. Solve problem 12 in PS-EDM (item 5a): Investment with uncertain costs and returns.[2]

   Activity 10. Solve problem 13 in PS-EDM (item 5a): Investment with uncertain probabilistic returns.[3]

   Activity 11. Solve problem 34 in PS-EDM (item 5a): Great idea for a start-up.[4]

   Activity 12. Solve problem 37 in PS-EDM (item 5a): Investment and uncertain expected returns.[5]

   Activity 13. Solve problem 20 in PS-EDM (item 5a): Salary erosion from inflation.[6]

   Activity 14. Solve problem 31 in PS-EDM (item 5a): Uncertain random returns with uncertain exchange rate.[7]

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[1] Related problems solved in Lecture Notes on Time Value of Money (item 4a), section 7.

[2] Related problems solved in Lecture Notes on Time Value of Money (item 4a), sections 8 and 9.

[3] Related problems solved in Lecture Notes on Time Value of Money (item 4a), section 10.

[4] Related problems solved in Lecture Notes on Time Value of Money (item 4a), section 10.

[5] Related problems solved in Lecture Notes on Time Value of Money (item 4a), section 10.

[6] Related problems solved in Lecture Notes on Price Changes: and Inflation Foreign Exchange (item 4c), section 3.

[7] Related problems solved in Lecture Notes on Price Changes: and Inflation Foreign Exchange (item 4c), section 3.