MASTER'S PROGRAM IN

QUANTITATIVE DECISION MAKING IN ECONOMICS & MANAGEMENT

JOHANNES GUTENBERG UNIVERSITÄT MAINZ

JG|U

HEADS OF THE PROGRAM

Prof. Dr. Stefan Irnich

Dr. Constantin Weiser

Prof. Dr. Thorsten Schank

Prof. Dr. Florian Hett

Daniela Maier, M.Sc.

LECTURERS INVOLVED

Prof. Dr. Franz Rothlauf

Prof. Dr. Reyn van Ewijk

Dr. Stefanie Brilon

Prof. Dr. Klaus Wälde

Prof. Dr. Daniel Schunk

Prof. Dr. Christopher Koch

Prof. Dr. Andrej Gill

Prof. Dr. Oliver Emrich

Prof. Dr. Andranik Tumasjan

Prof. Dr. Olga Zlatkin-Troitschanskaia

LECTURERS INVOLVED

Prof. Dr. Natascha Nisic
(FB02)

Jun.-Prof. Dr. Panagiotis Bouros (FB08)

Prof. Dr. Susanne Singer
(Uni-Medizin)

Prof. Dr. Matthias Bäcker
(FB03, Rechtswissenschaften)

Prof. Dr. Stefan Bender
(Bundesbank)

Dr. Andreas Berg
(Destatis)

THIS PROGRAM IS APPROPRIATE FOR YOU IF …

- you have fun using **computers to analyze data** and to **write up** your own **programs**
- you are interested in **strategic decision making** based on **empirical evidence** regarding **behavioral** and **microeconomic** mechanisms
- you want to increase your toolkit of **formal methods** to make data-driven decisions

WHAT IS THE PROGRAM ABOUT?

- The program combines three domains:
    1. **Econometric methods**
    2. **Management Science & Business Intelligence**
    3. **Economic Behavior & Strategy**

- Graduates will have profound knowledge in both…
    1. **Analyzing data**
    2. **Solving decision problems** in complex economic environments

- This meets an **increasing demand** on the labor market

EXAMPLES OF EMPLOYMENT POSSIBILITIES

Google Careers

Data Scientist, Ads Metrics

Google In-office: Zürich Switzerland

- Master's degree in a quantitative discipline (e.g., Statistics, Operations Research, Bioinformatics, Economics, Computational Biology, Computer Science, Mathematics, Physics, Electrical Engineering, Industrial Engineering) or equivalent practical experience.
- Experience with statistical software (e.g., R, Python, MATLAB, pandas) and database languages (e.g., SQL)
- Experience with statistical data analysis such as multivariate analysis, stochastic models, sampling methods

Dassault Systemes Deutschland GmbH

Operations Research Scientist (m/f/d) DELMIA Quintiq

Düsseldorf Feste Anstellung Vollzeit Erschienen: vor 3 Wochen

- Relevant background in algorithmic techniques in operations research and/or artificial intelligence (linear programming, genetic algorithms, heuristic search techniques, logic programming, etc.).
- Master's degree in Operations Research, Computer Science, Mathematics, Econometrics, Artificial Intelligence, or similar.
- Your strong analytical skills complement your nature to challenge boundaries and think outside the box

Ökonom, Volkswirt, Economist, Economic Consulting

Frankfurt am Main/Berlin, Germany

OXFORD ECONOMICS

Sie wollen Ihre soliden quantitativen Fähigkeiten und Ihr ökonomisches Verständnis auf konkrete Fragestellungen und Herausforderungen unserer Kunden anwenden. Die erfolgreiche Bewerber*in wird an allen Aspekten eines Kundenauftrags arbeiten, einschließlich der Erstellung von Angeboten, des Projektmanagements, der analytischen Arbeit und der Übermittlung der Ergebnisse an die Kunden. Wir suchen Kandidat*innen für verschiedene Bereiche, darunter Klimawandel, digitale Märkte, Bauwesen, Wohnungsbau, Analyse der wirtschaftlichen Auswirkungen von Politikmaßnahmen, Wirtschaftsmodellierung und Szenarioanalyse

- Erfahrung in der Durchführung ökonometrischer Analysen (wünschenswert)
- Gute Präsentations- und Schreibfähigkeiten
- Ausgezeichnete Kenntnisse in Microsoft Excel, Word und PowerPoint
- Programmierkenntnisse in Stata, Python oder R oder Bereitschaft, sich diese anzueignen

EXAMPLES OF EMPLOYMENT POSSIBILITIES

BOSCH

Bosch Gruppe

Data Scientist - Time Series Analysis & Forecasting (f/m/div.)

Renningen | Feste Anstellung | Vollzeit | Erschienen: vor 2 Tagen

Schnelle Bewerbung

excellent communication and documentation skills, experience in mentoring junior colleagues, proven expertise in time series forecasting as well as in at least one of the following fields: neural networks, generalized linear models, recommendation systems, statistics, latent variable models, clustering and anomaly detection, demonstrated experience in working with ML/DL frameworks (e.g. scikit-learn, Keras, TensorFlow, PyTorch, R's forecast package), publications at major conferences or journals are highly appreciated, proficiency in Python (especially in such libraries as Pandas, Numpy, Scipy, statsmodels)

DAIMLER

Internship as a Data Scientist in the field of digital transformation

- Design and structuring of databases
- Data visualization with the help of dashboards using PowerBI
- Collaboration and development of predictive analytics (regression analysis, forecasting & machine learning) projects
- Degree in Computer Science, Business Informatics, Statistics, Mathematics, Economics (VWL), Business Administration (BWL), Industrial Engineering or a comparable course of study with existing quantitative affinity

KEY FACTS

- Program start: winter term 2022/23
- Application period: **01.04. – 15.05**.
- 20 - 30 places
- Selection criteria: **GPA (50%)** and **entrance test (50%)**
- Begin only in the winter term possible
- Core modules in English
- Most elective modules in English, some in German
- Small groups, interactive teaching, hands-on learning

PROGRAM STRUCTURE

- **Semester 1: Fundamentals**

  → Core modules

- **Semester 2/3: Specialization**

  → Academic skills

  → 7 elective modules out of the three domains or from the free part

  → 2 applied project seminars

- **Semester 4: Research**

  → Master's thesis and research colloquium

THE PROGRAM STRUCTURE IN DETAIL

1st Semester: Fundamentals

Mathematics/Statistics
Programming
Econometrics of Cross Section and Panel Data
Operations Research
Economic Decision Making & Strategic Interaction

2nd & 3rd Semester: Specialization

Academic Skills, 2 Applied Project Seminars (offered every semester in every domain); 7 elective modules

Econometrics

Microeconometrics A
Microeconometrics B
Time Series
Computational Statistics
Analysis of Micro Data
Data Governance
Official Stat. and Survey Methods
Mehrebenen/Panelanalyse
Informations-/Datenschutzrecht

Management Science & Business Intelligence

Intelligent Information Systems
Data Analytics
Database Systems/Info. Systems
Process Mining
Standortplanung & Netzwerkdesign
Transport Logistics I
Transportl Logistics II
Revenue Management

Economic Behavior & Strategy

Advanced Digital Economics
Behavioral & Experimental Econ.
Behavioral Measurement
Behavioral Theory
Behavioral Corporate Finance Theory
Economics of Education
N.N.

Free Part *(Further modules in Management, Accounting and Finance, Epidemiology, Sociology)*

4th Semester: Research

Master‘s Thesis
Research Colloquium

ADMISSION REQUIREMENTS

- **English language skills**
  - → B2 level
  - → Comprehensive information about the possible forms of proof can be found on the QDEM website
- **Bachelor‘s degree**
  - → 18 ECTS in management/economics
  - → 19 ECTS in mathematics/statistics/econometrics/quantitative empirical methods
- **Entrance test**

ENTRANCE TEST

- **Test specifics:**
  - → Electronic test
  - → 90 minutes
  - → Taking place on the campus of the University of Mainz
  - → Next DATE: June 23, 2023
- **Focus of the test:**
  - → Conceptual understanding
  - → Abstraction from specific notation
- **“Sample Material”** and references to textbooks available on the homepage

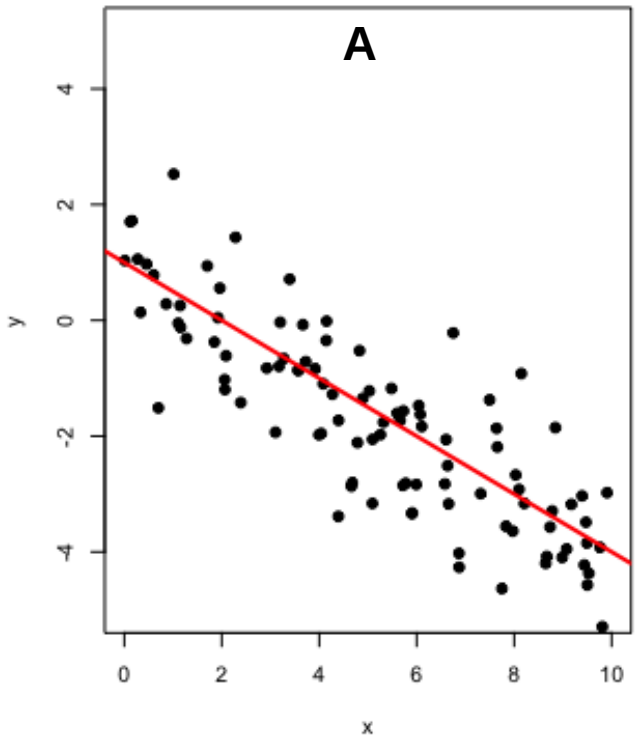
ENTRANCE TEST

Content:

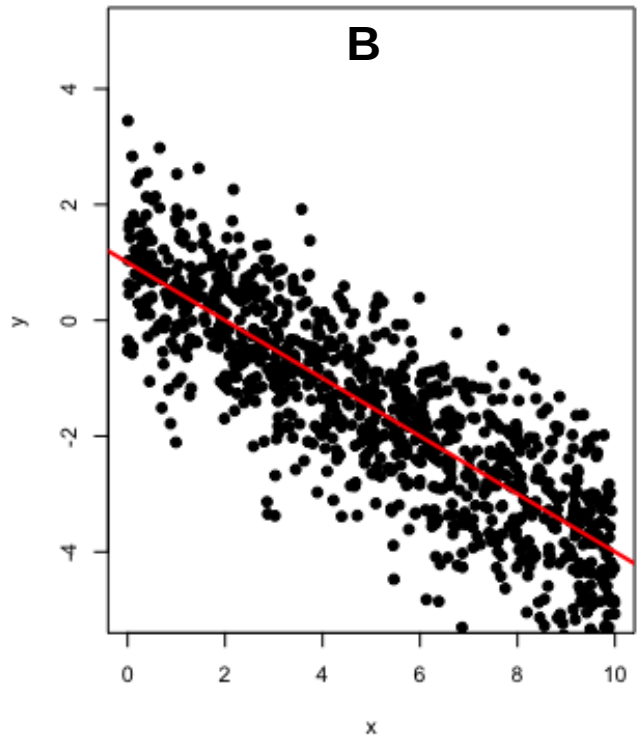
- Analysis (differentiation, integration, optimization)
- Linear algebra (matrix notation, operations, system of linear equations)
- Stochastic/probability theory (random variables, convergence)
- Descriptive statistics
- Estimation/testing
- Multiple regression analysis
- Algorithms (control structures, “reading”)
- Microeconomic foundations (supply/demand, costs/profits, utility/preferences, market models)
- Game theory

SAMPLE QUESTIONS

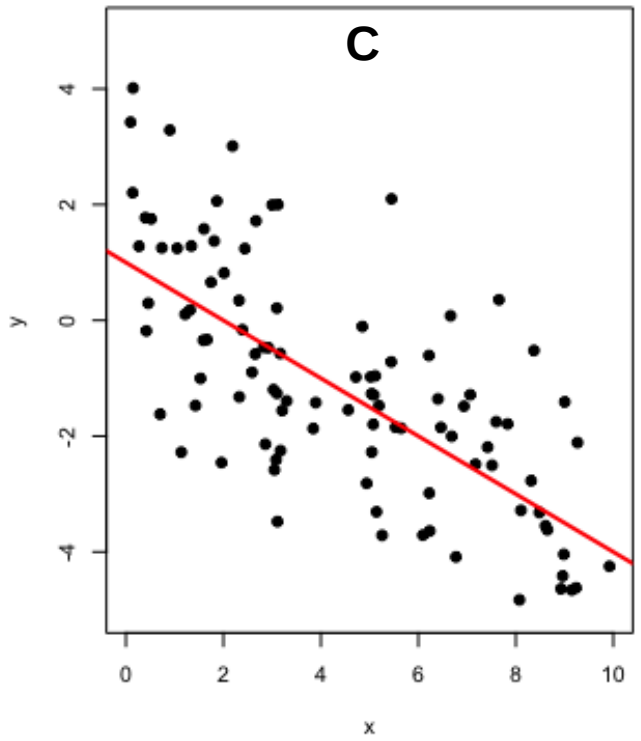
For the three samples below, a regression analysis is carried out to estimate the model $y_i = \beta_0 + \beta_1 x_i + \varepsilon_i$.
Which sample leads to the smallest standard error for the estimate of β_1 (A, B or C) ?



σ_ε =0.95 N=100



$\sigma_\varepsilon = 1$ N=1000



$\sigma_\varepsilon = 1.5$ N=100

SAMPLE QUESTIONS

Run the following program with paper and pencil. Which value for b will be returned?

```
1 S ← 9
2 b ← S
3 n ← 0
4 while n < 2 do
5 |   b ← ½(b + S/b)
6 |   n ← n + 1
7 return b
```

SAMPLE QUESTIONS

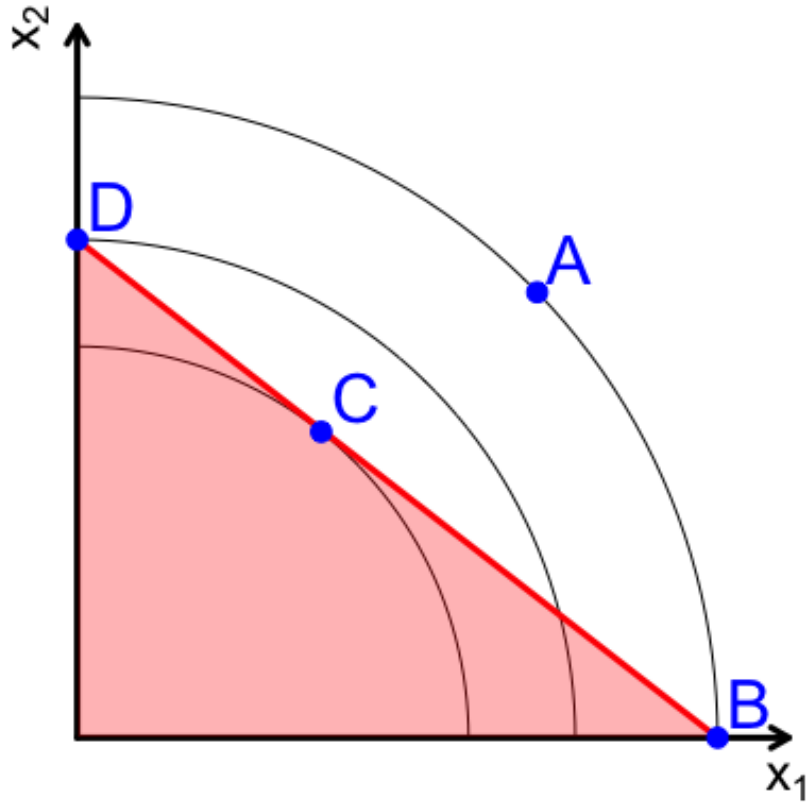
Carry out the following matrix operations.

$$\begin{bmatrix} 1 & 2 & 3 \end{bmatrix} \times \begin{bmatrix} 4 \\ 5 \\ 6 \end{bmatrix} =$$

$$\begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix} \times \begin{bmatrix} 4 & 5 & 6 \end{bmatrix} =$$

SAMPLE QUESTIONS

The diagram shows the indifference curves of an ordinary consumer in a two-product setup (x_1, x_2) and the budget constraint. Which product-bundle will the consumer choose (A,B,C or D)?



SAMPLE QUESTIONS

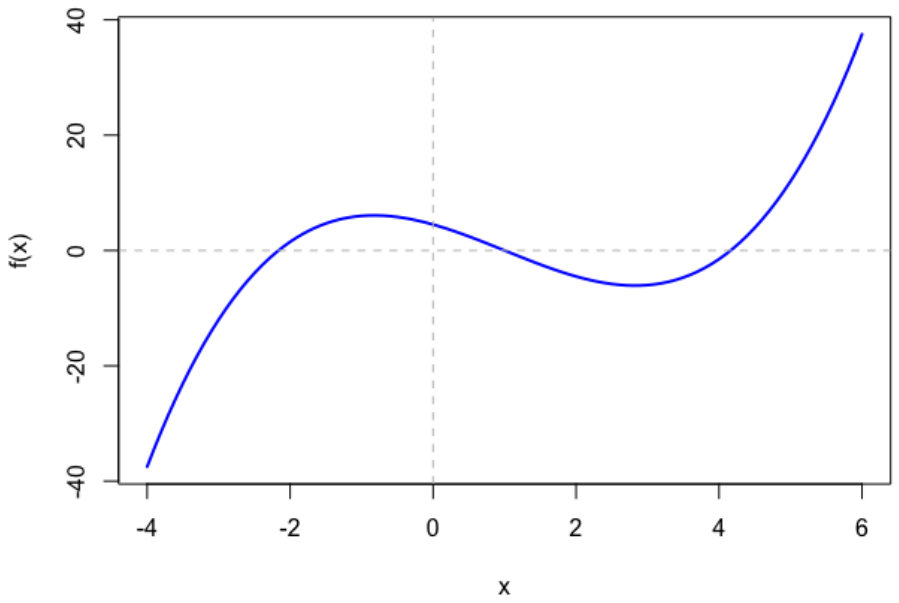
Simon and Laura want to go out for dinner. Simon prefers pasta, Laura prefers potatoes. Both would love to go out to eat together. There is no restaurant in your city that offers both pasta and potatoes. There is only a pasta house and a potato house. The table shows the payoffs (Simon / Laura).

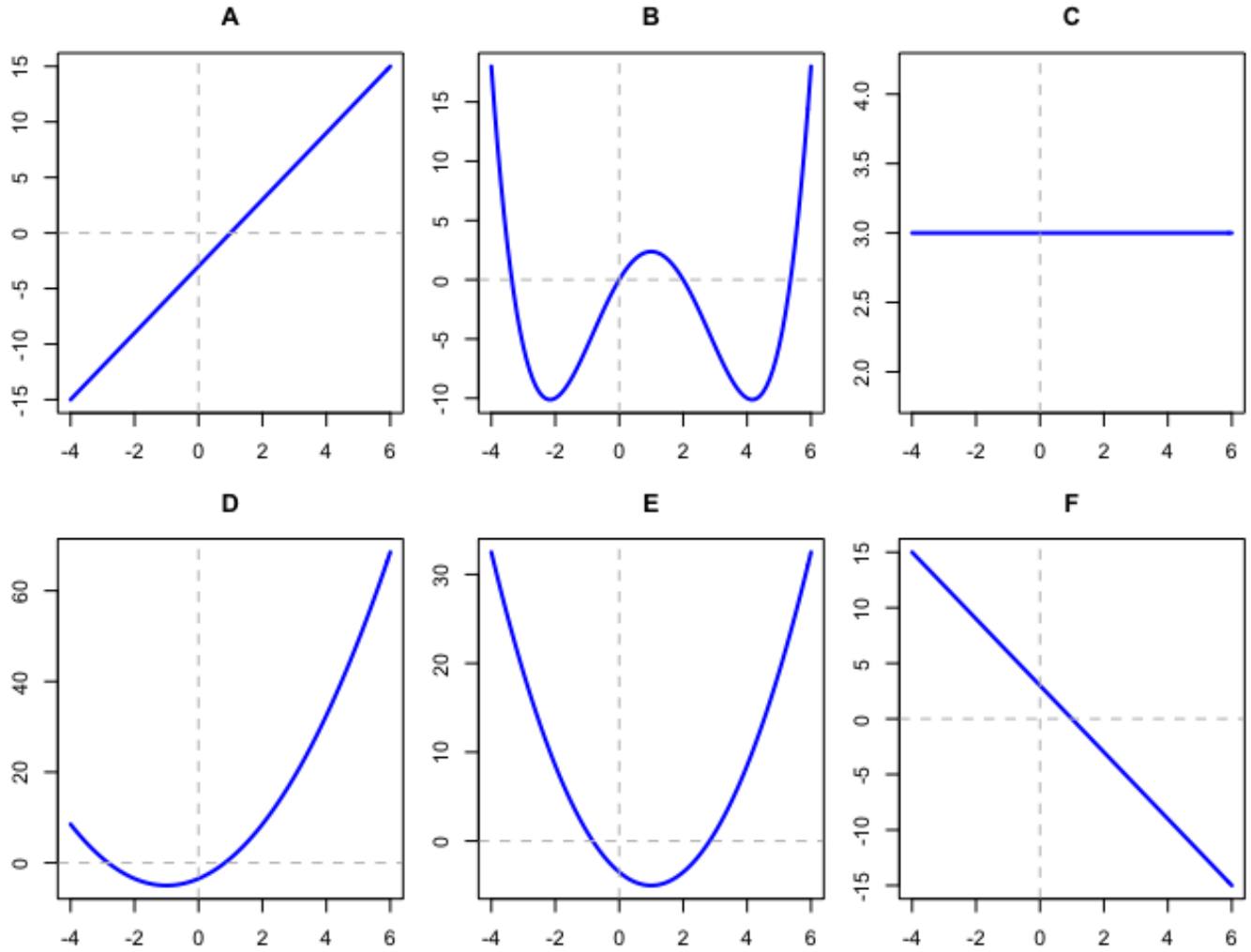
		Laura	
		potatoes	pasta
Simon	potatoes	2 / 4	0 / 0
	pasta	1 / 1	4 / 2

1. If possible, determine the Nash equilibrium(s) in pure strategies.
2. Assume that Simon can credibly commit to a decision in front of Laura. Now determine the Nash equilibrium by backward induction (Hint: map the new situation in a sequential game)

SAMPLE QUESTIONS

Consider the following function plot. Which plots (A-F) show the first and second derivative of the function?





DO YOU HAVE QUESTIONS?
FEEL FREE TO CONTACT US

LINK TO OUR HOMEPAGE

EMAIL

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WE ARE LOOKING FORWARD TO YOUR APPLICATION!

LINKS USED IN THE PRESENTATION

- **Employment possibilities:**

Data Scientist – Google

Data Scientist, Time Series Analysis & Forecasting (f/m/div.) – Bosch

Operations Research Scientist (m/f/d) - DELMIA Quintiq

Oxford Economics Jobbörse

Daimler: Daimler Jobbörse