Aalto University
School of Business

Business Analytics 2 - Introduction

- *Learning outcomes*
- *What is Business Analytics*
- *Course practicalities*

Teams instructions

For those who are following online via Teams

Please keep your microphone muted when following the lectures

If at any point you are unable to follow,

- Use chat to ask questions (either publicly or messaging privately to the lecturer), or
- Use the “Raise hand” function to ask your question out loud

Recordings of the lecture parts will be uploaded in due course after each session

Introduction

Lecturer: Ilkka Leppänen

D.Sc. from Aalto School of Science 2016

Assistant Professor in Management Science (2021 –)
Department of Information and Service Management
Aalto University School of Business

Assistant Prof in Operations Management (2016 – 2021)
School of Business and Economics
Loughborough University, UK

Research interests: computational decision science, behavioural operations, game theory

Feedback & consultation: during lectures / room T201 / email to book a Teams meeting, ilkka.j.leppanen@aalto.fi

Learning Outcomes

- The fundamental aim of Business Analytics is to utilise analytical models to help make better business decisions. This course focuses on decision analytics models that are commonly used in business applications.

- After the course, the student can
  - recognize the types of managerial decision problems models can be applied,
  - interpret results of these models to derive defensible decision recommendations, and
  - build and solve these models using spreadsheets and programming scripts to support business decision making.

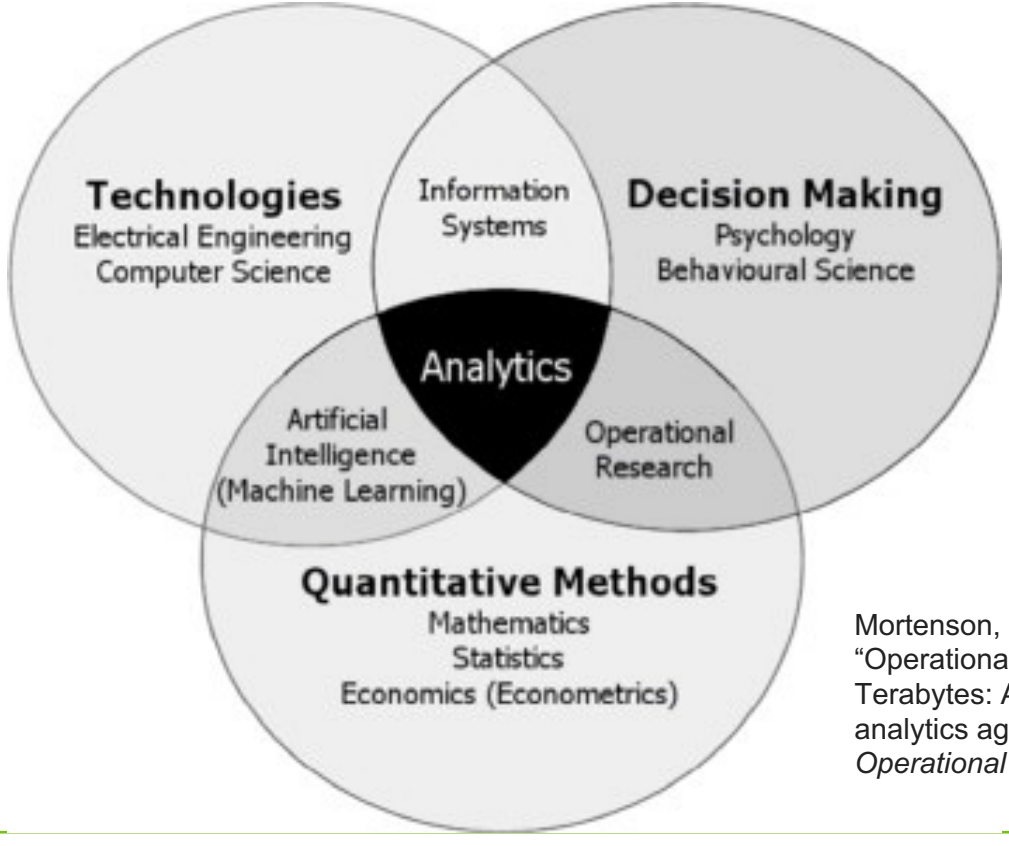
Roots of Business Analytics

Business Analytics (BA) is the scientific process of transforming data into insight for making better decisions.

Management science (MS) is the study of problem solving & decision making in organizations. It uses analytical methods including mathematical modelling to improve an organization's ability to enact rational and accurate management decisions by arriving at optimal solutions to complex decision problems.

Operations research (OR) is the application of scientific & mathematical methods to the study & analysis of problems involving complex systems.

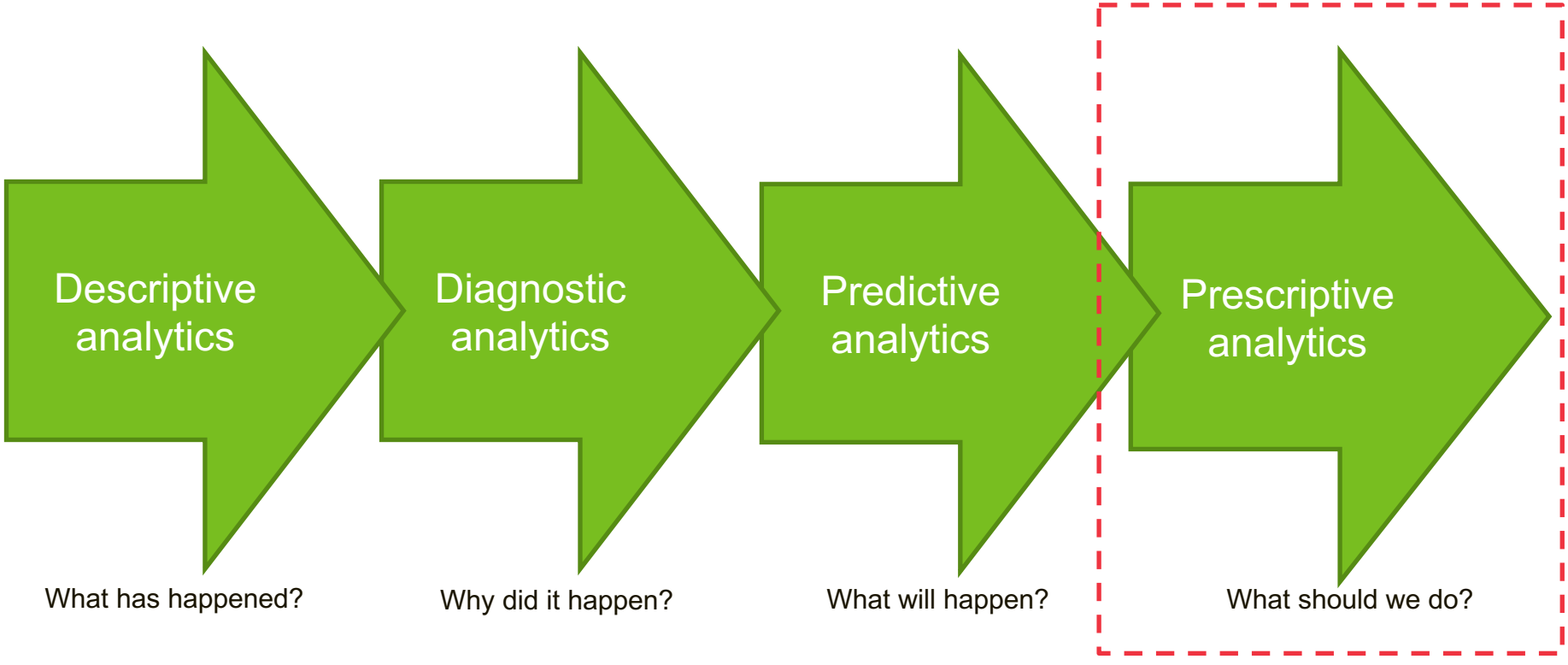
Scientific roots of Business Analytics



Mortenson, Doherty & Robinson (2015). "Operational research from Taylorism to Terabytes: A research agenda for the analytics age", *European Journal of Operational Research.*

Types of Business Analytics

Decision making part of analytics



Descriptive analytics

"What has happened?"

Methods:

- Descriptive statistics
- Data visualization
- Dashboards

Introduction to Business Analytics
Introduction to Statistics
Econometrics
Data Science for Business 1

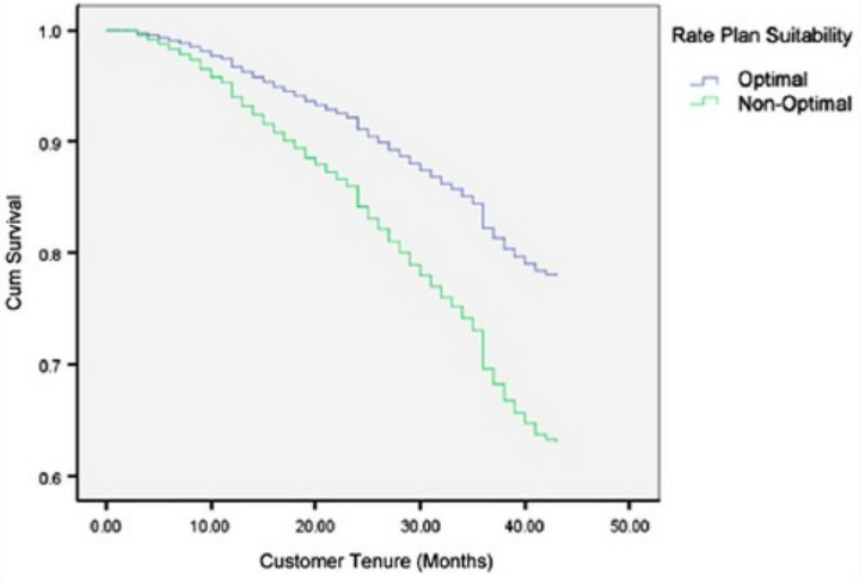
Diagnostic analytics

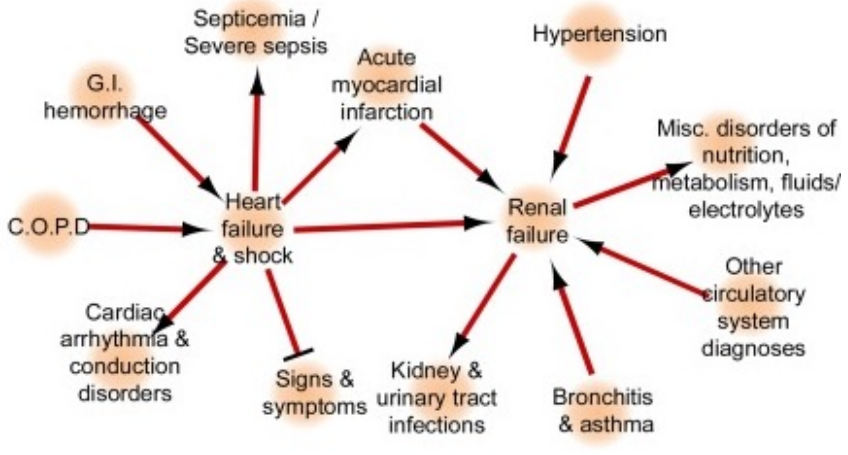
"Why did it happen?"

Methods:

- Regression models
- Time series analysis
- Dimension reduction techniques
- Machine learning / AI

Introduction to Business Analytics
Introduction to Statistics
Statistics & R
Econometrics
Data Science for Business 1





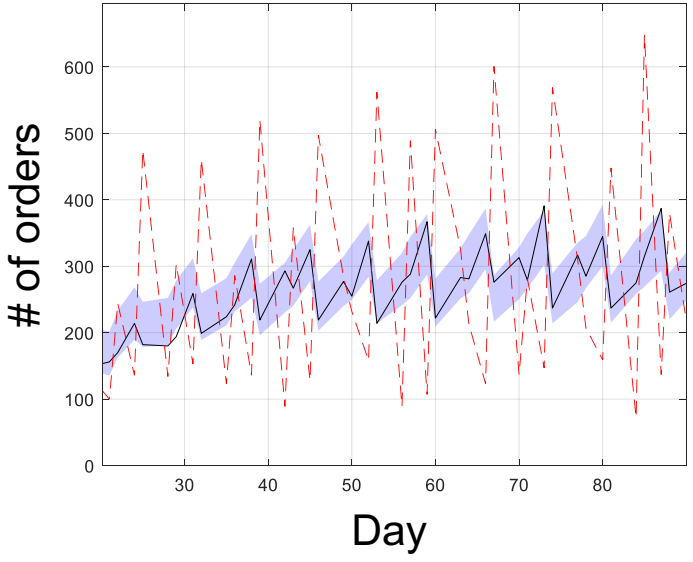
Predictive analytics

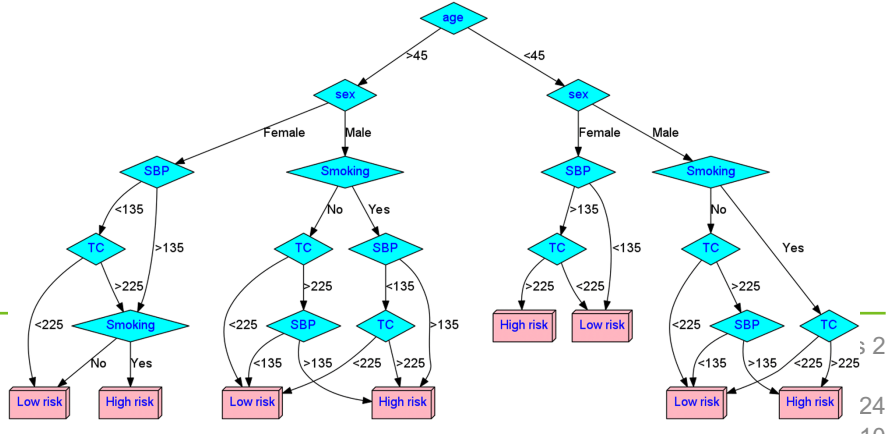
"What will happen?"

Methods:

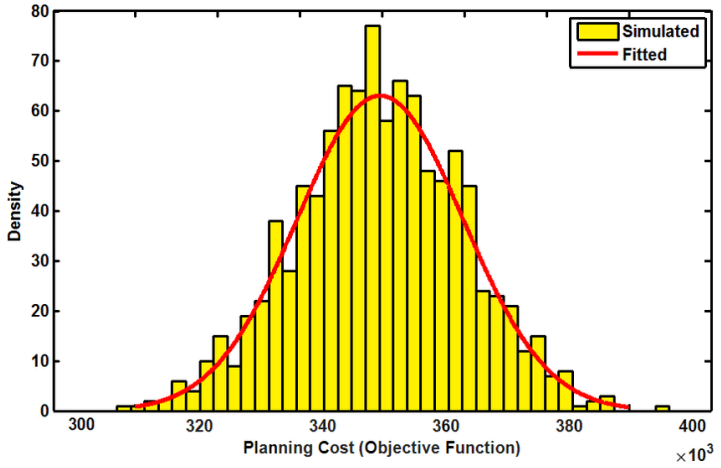
- Regression models
- Time series analysis
- Monte Carlo Simulation
- Machine learning / AI

Introduction to Business Analytics
Introduction to Statistics
Statistics & R
Econometrics
Data Science for Business 1





Prescriptive analytics

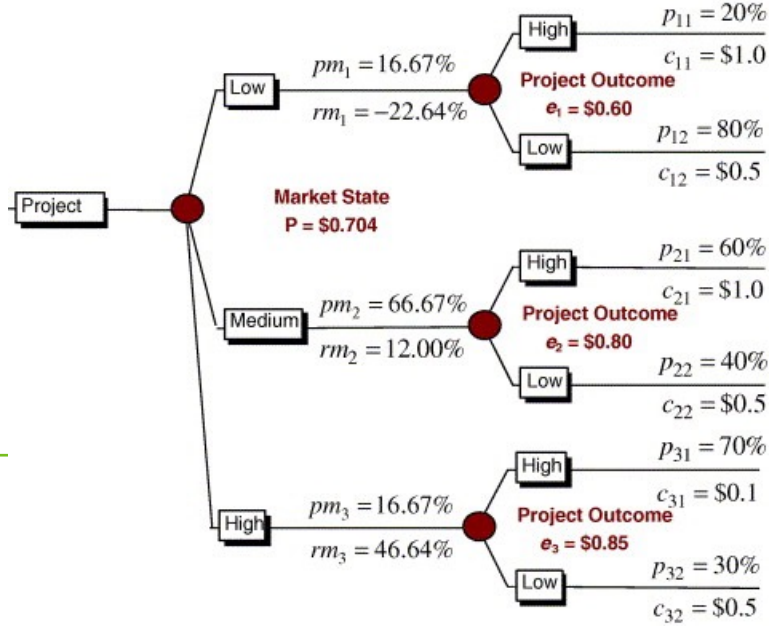


"What should we do?"

Methods:

- Monte Carlo Simulation
- Decision analysis
- Mathematical optimization / programming

Business Analytics 1
Business Analytics 2
Decision Making and Choice Behavior
Data Science for Business 2



BA / MS applications: https://pubsonline.informs.org/loi/ijaa

Example: Lockheed Martin Space Systems Company Optimizes Infrastructure Project-Portfolio Selection

Cigdem Z. Gurgur, Charles T. Morley, *INFORMS Journal on Applied Analytics*, Vol. 38, No. 4

Lockheed Martin Space Systems Company spends **millions of dollars on the maintenance and modernization of its infrastructure** each year. Projects often involve investments that cannot be justified purely in terms of net present value or other classical investment-evaluation methods. The options are also restricted because funds that are not spent within a given time frame must be relinquished. Furthermore, some projects may be delayed and the unplanned carryover of their costs moved into the next fiscal year; this causes the postponement or cancellation of other unrelated projects because of in-budget transfers. In this paper, we used **multiattribute utility theory and chance-constrained programming to optimize the selection of infrastructure projects**. Our solution ensured the selection of high-value projects to maximize the company's performance. These selections were subject to the constraints that a portfolio did not exceed the available budget and that the carryover of the unspent funds to the next fiscal year did not exceed predetermined limits. We used **Microsoft Excel** to ensure broad accessibility, transparency, user interaction, improved data collection and asset management, and ease-of-use by managers.

Course practicalities

Course implementation

- Two ~3h sessions per week on Mondays & Wednesdays
  - Of which 1–1.5 h dedicated to working on the assignments
- Three assignments, each containing 4–7 problems – details in MyCourses
  - Assignment 1 DL: Tuesday 23 January at 14:00.
  - Assignment 2 DL: Tuesday 6 February at 14:00.
  - Assignment 3 DL: Tuesday 13 February at 14:00.
- Model solutions for the assignments will be presented after each deadline

Using the computer

- You will mostly need Excel to solve the problems in the assignments
  - Make sure that you also have Solver and Analysis ToolPak add-ins

- You will also need R or Python using Jupyter Notebook
  - https://jupyter.cs.aalto.fi/
    => choose either Python or R server depending on the need
  - No installations needed

- **Being fluent in building spreadsheet models and programming scripts is an essential skill for a BA professional!**

Submitting the assignments

See MyCourses for info

Classroom experiment

- On calendar week 3 there is an opportunity to participate on an experiment in probability assessments, organised by Teemu Seeve, a Doctoral Researcher at the ISM department
- You can register for the experiment by filling out a form at MyCourses and choosing a suitable date for you
- There are a **limited number of seats available** (about 60), so please register only if you intend to participate; the experiment takes about 1.5 h
- Participation will substitute Problem 1 in Assignment 1

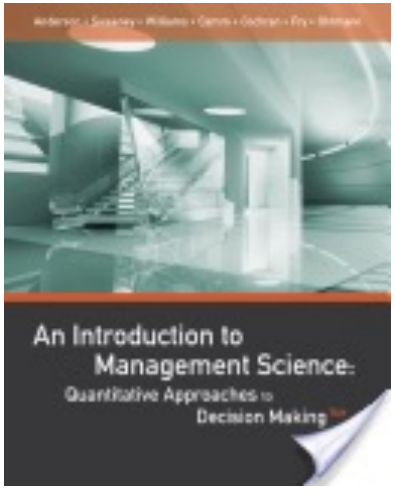
Assessments: assignments (50%) + exam (50%)

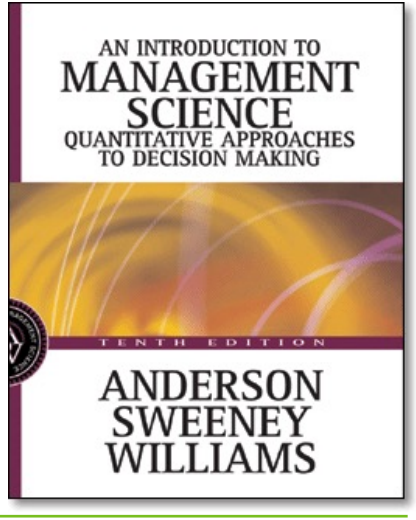
- Online exam (19 February 2024)
  - Modelling problems (similar but lighter than those in the assignments)
  - Theory and terminology questions
  - **At least half of exam points needed to pass**

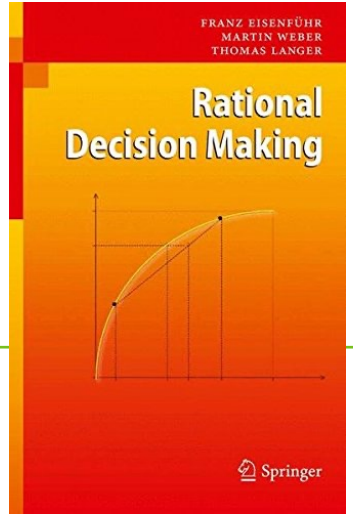
  - Lower bounds for grades (max 100 final points)
    1 = 50 final points
    2 = 60 final points
    3 = 70 final points
    4 = 80 final points
    5 = 90 final points
  - Bounds may be relaxed during final marking

Learning material

- Lecture slides & accompanying files
- Assignments & answer demos
- Supporting reading
  - Anderson et al: An Introduction to Management Science: Quantitative Approaches to Decision Making (different publishers and editions)
  - Eisenführ et al.: Rational Decision Making (Springer)







About the chosen course structure

- Learning by doing is the best (and perhaps the only) way to learn modelling
- Simple course setup:
  - Instead of “Quizzes, problems, exercises, projects, cases” one format: “Assignment”
  - Assignments contain both large and small problems
    - The largest ones are akin to small case studies in modelling
- Why exactly 3 assignment batches? We are balancing between
  - 1 large batch of assignments, 1 deadline:
    - Maximum flexibility for student to schedule his/her work over the six weeks
  - 12 small assignment batches, 12 deadlines:
    - Maximal incentive to solve assignments at the same tempo with lectures

What is expected from students?

- Allocate time to work on the assignments
  - Huge synergy with the exam
  - If stuck, consult course material and the teacher
  - Make sure that you understand the errors you made in the assignments and learn from them
    - Model solutions will be presented after each assignment deadline

- Lectures:
  - Glance through the slides before the lecture
  - Participate during the lectures
  - Ask if something is too complicated

Coping with the Covid & remote learning stress

- Stay organised, monotasking instead of multitasking
  - Research shows that only about 2% of people benefit from multitasking
- Don’t rely only on lecture recordings, use these for revision
  - Live participation gives you a schedule to follow
- Work in pairs & teams
  - Timetable regular meetings
  - But make sure you can also work alone as this is required in the exam
- Stay connected with family and friends, take care of yourself and others

Learning feedback & support

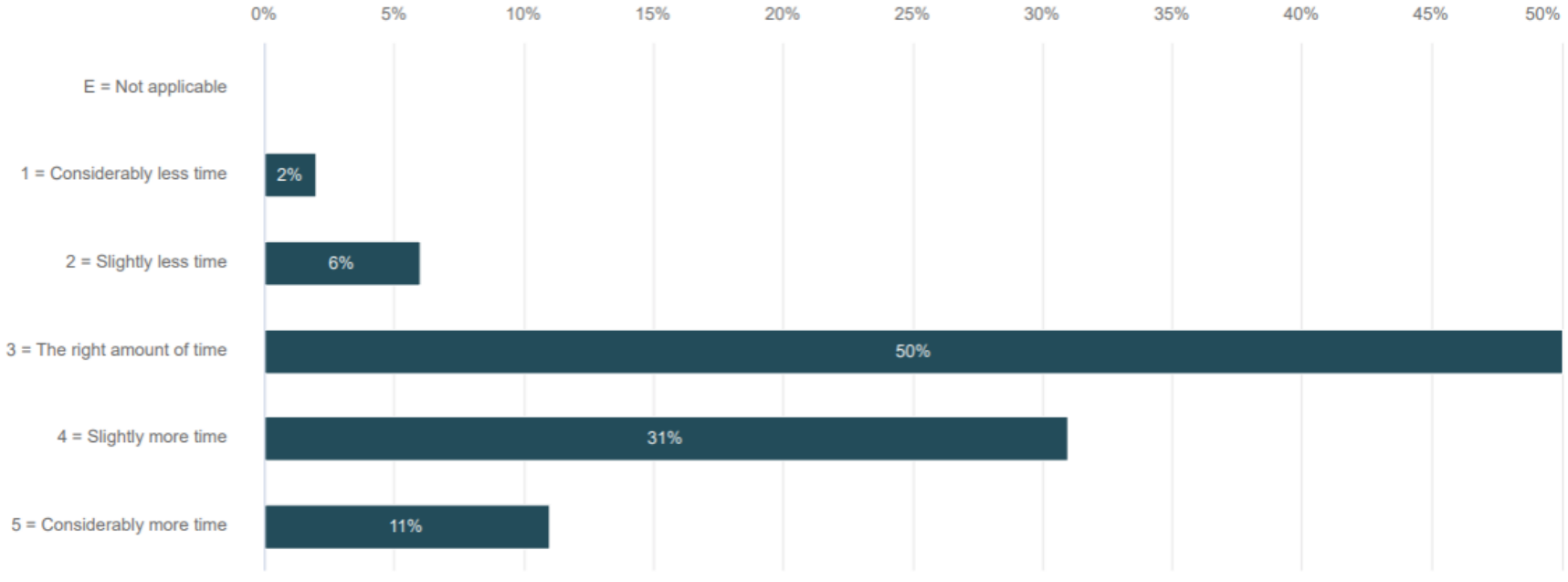
- There will be many opportunities to receive feedback and learning support during the course
  1. Assignment marks and model solutions (3 times)
  2. Interaction within lectures (11 sessions)
  3. Support for the assignments (11 sessions)

- I will also organise Teams support sessions on the days when the assignments are due, where you can ask last minute questions

Feedback from 2023

4. According to the guidelines, one credit (ECTS) requires 27 hours of student work. Compared with this, the completion of the course required

Number of respondents: 64



Feedback from 2023

Most common positives

“Hands-on exercises”

“Both live and recorded lectures”

“Exercise sessions after the classes”

Most common improvement suggestions

“More practical examples”

“More instructions in using R and Python”

“Would have liked to receive assignment grades earlier”