

Statistics for Non- statisticians

What Matters is an
Understanding

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// Computer-aided seminar sessions

and why we need it

- Data are declared a new class of economic asset like currency or gold
- Two extreme teaching approaches: "black board" vs. "black box"
- We combine both: computer labs with a „blackboard" approach
- Tasks are demonstrated on real data:

mathematical solution on a blackboard.

What is on a blackboard:

(Tasks: hypothesis testing; estimation and confidence intervals; ...)

- Translation of the problem from „common language“ to formal language
- Formal list of assumptions and its evaluation
- Determining appropriate test statistic/pivotal statistic with its distribution
- Determining critical region (and p-values)/confidence intervals
- Formal decision and its re-formulation into common language

What is done by sw in the „meantime“:

- All needed calculations
- Some related visualisations
- Checking assumptions
- Sometimes manipulations to show possible different outcomes to show contrasts

// The infrastructure:
people, systems, software

- Multiple licence STATISTICA - „clicking sw.“ for elementary courses
- Free R environment - „command line sw.“ for advanced courses
- Setting a same standards for 15-18 parallel seminar groups ->
online folder for each session with manuals for teachers and students
- Special editor for math expressions for on-line

- Folder for each session:

- the list of problems demonstrating particular topic and the link to related lecture materials
- the appropriate data sets for the seminar itself and further for homework tasks
- the software instructions providing step by step clues
- the handbook for teachers covering not only the solutions of problems but also remarks on what to point out, which question may prompt discussion etc.



// Challenges

- Schedule problem - 380 students in 3 computer labs with 24 seats during semester
- Schedule problem - 380 students in 3 computer labs with 24 seats during exam period
- Security during the exam itself - how to protect against cheating

// How the initiative was received by students

👍 Majority of students appreciate practical approach with understanding:

- not just to substitute numbers into formulas

- or to click on recommended buttons

- but to link the sw output to formal problem description

- and to interpret the results

👎 Part of students take the chance to browse their FB profiles etc.

👎 Some students criticise the final exam with

// How the initiative was received by teachers

- Majority find it more attractive and beneficial for students so they adjusted fast
- It takes more time – precise planning needed
- Exam period is for teachers more time consuming; more challenging than correction of „without-data“ tasks
- We observe better bachelor and diploma thesis with respect to data analysis

// Future plans

- To diversify datasets: up-to-date and more relevant to students' background
- To create new subject on data visualisation

What we say to our students?
Do all your best to ...

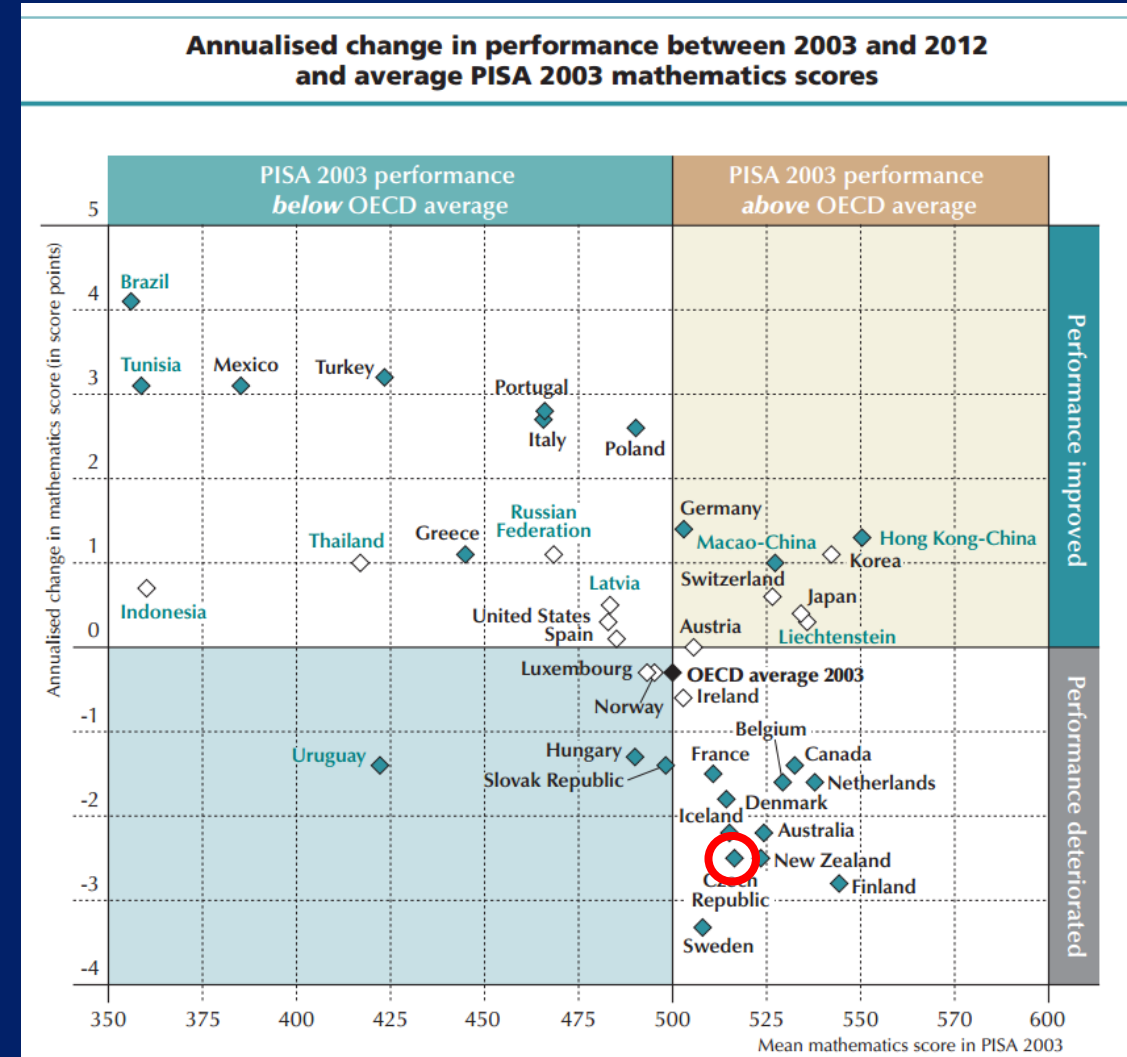
$$B > \frac{1}{n} \sum_{i=1}^n x_i$$

MATHS AND STATS

SUPPORT CENTRE

// Introduction

- The gap between highschool and university level of knowledge in math keeps getting bigger (1)
- The job market sorely needs graduates with math skills (2)

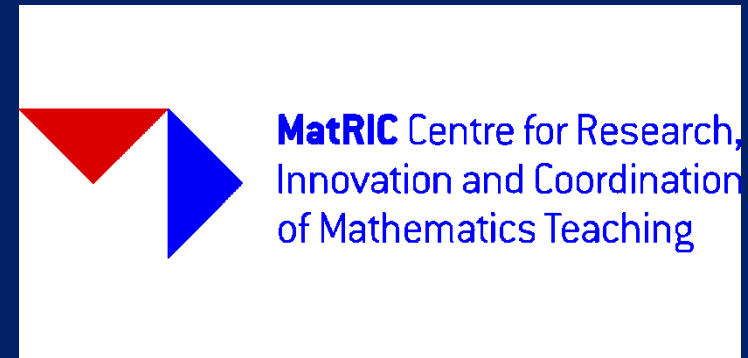
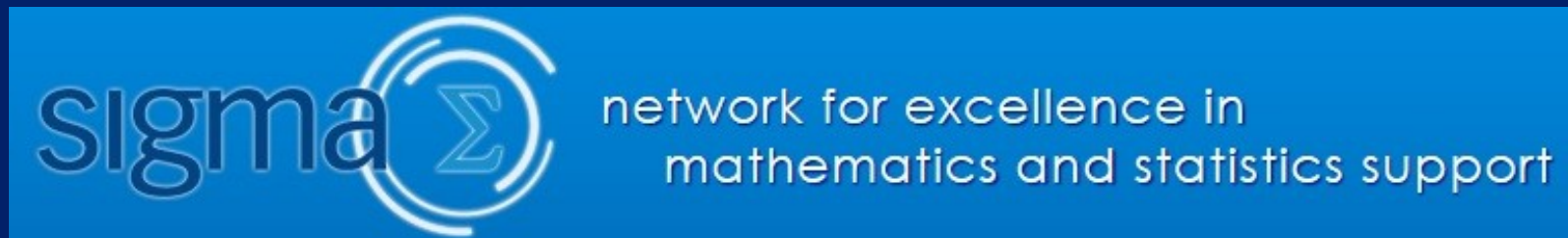


// Our inspiration

- MatRIC Drop-in, University of Agder since 2015

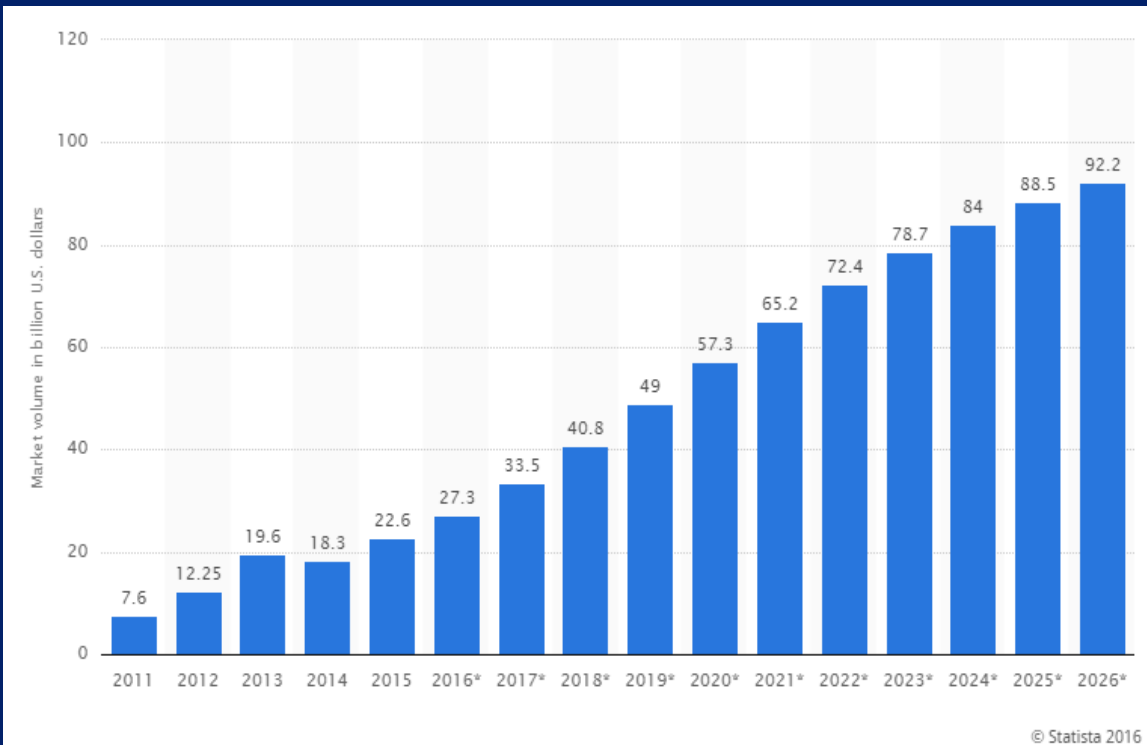


- **sigma** Network, England since 2005



- other networks – Ireland, Scotland, Wales, ...

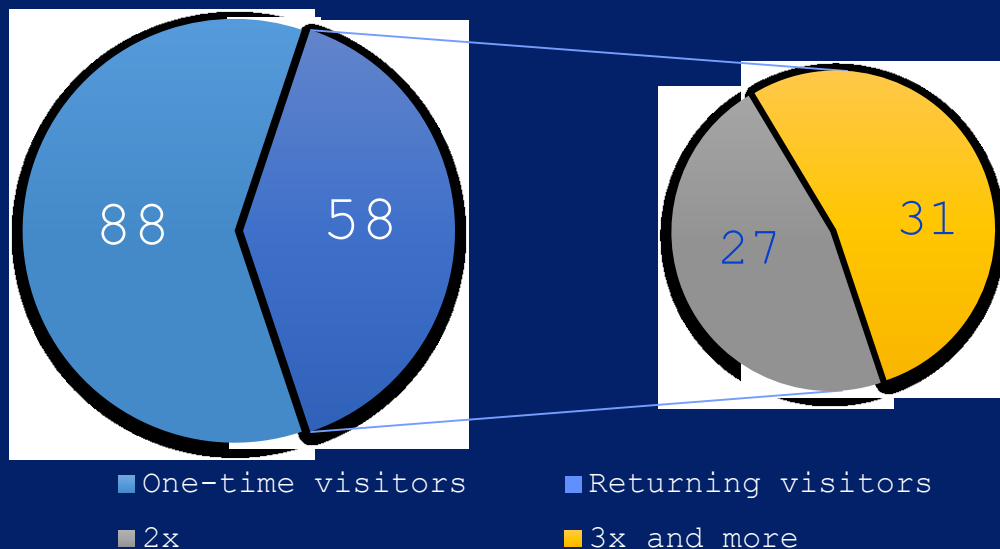
// Why we need it



- The market volume for big data is expected to triple by 2026
- Significant growth in job demand of big data related vacancies (4)

// The service so far - Spring 2016

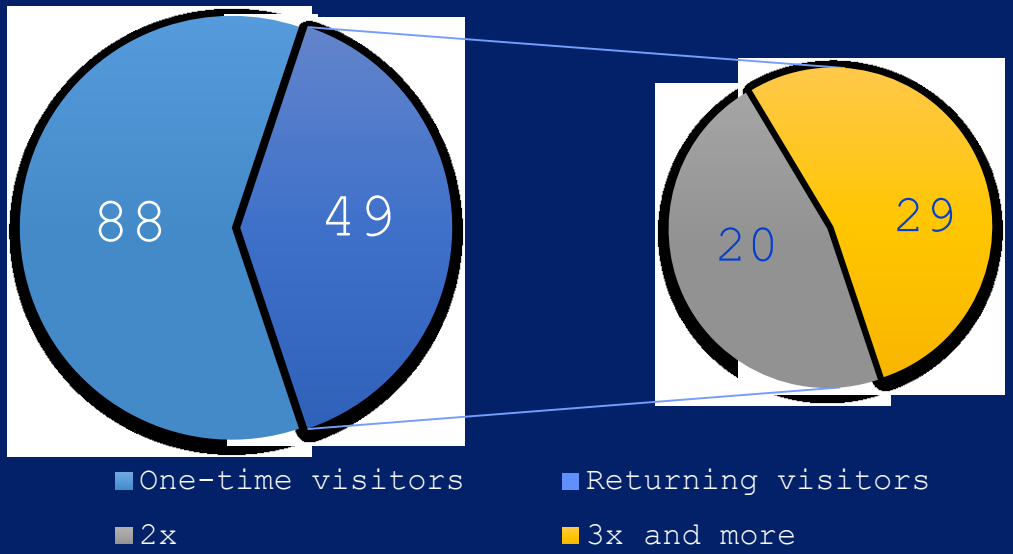
Unique visitors



- Timeframe: **from 22. 2. 2016**
to 4. 7. 2016
(1 semester)
- Total visits: **300**
- Unique visitors: **146**

// The service so far - Autumn 2016

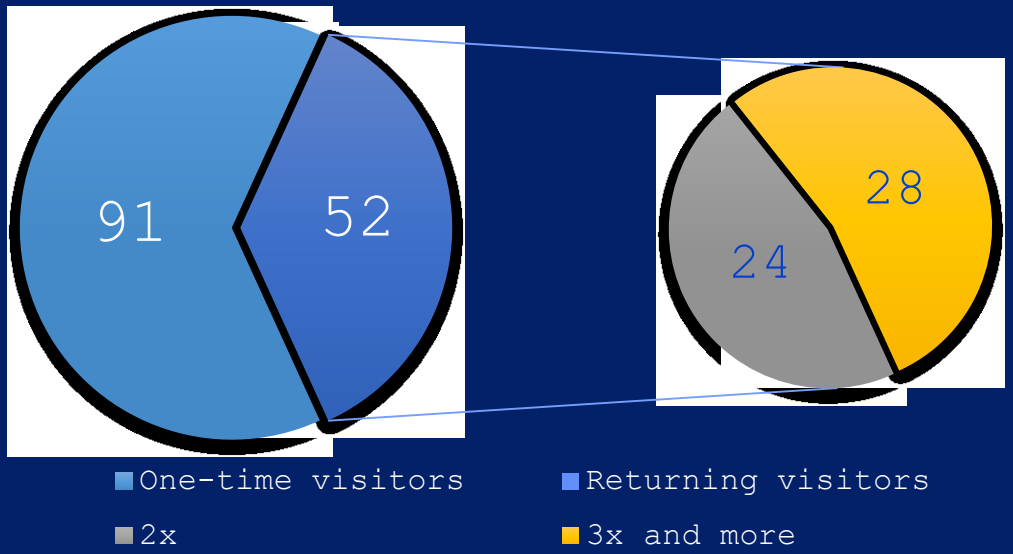
Unique visitors



- Timeframe: **od 26. 9. 2016**
(2 semesteru) 24. 1. 2017
- Total visits: **273**
- Unique visitors: **137**

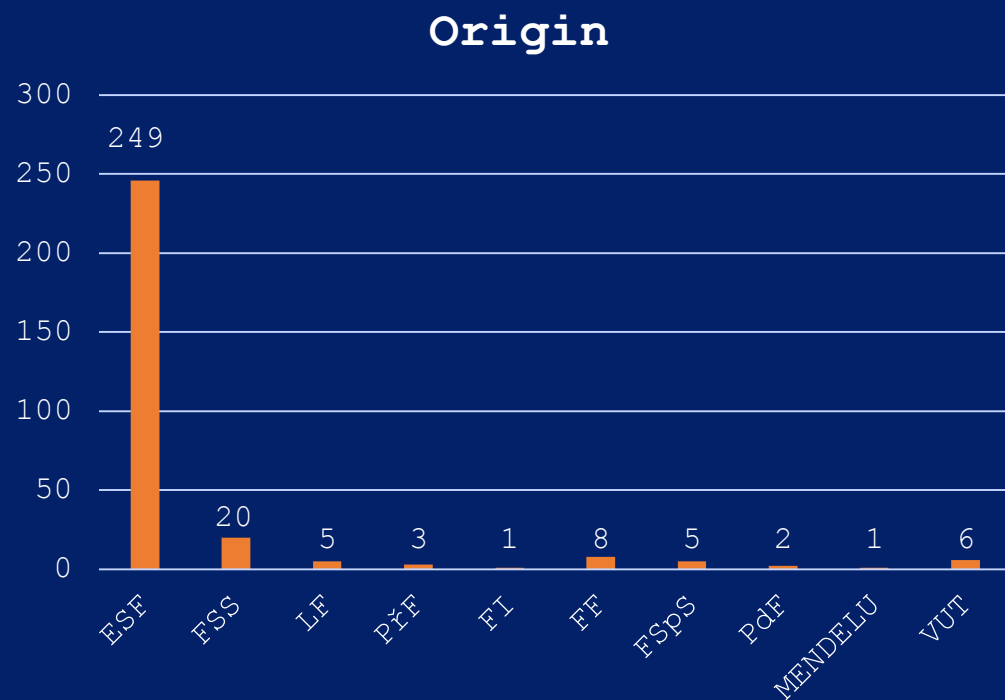
// The service so far - Spring 2017

Unique visitors



- Timeframe: od 6. 3. 2017 (3 semester) do 27.6. 2017
- Total visits: 283 (ID - 254)
- Unique visitors: 143

// The service so far - Spring 2016



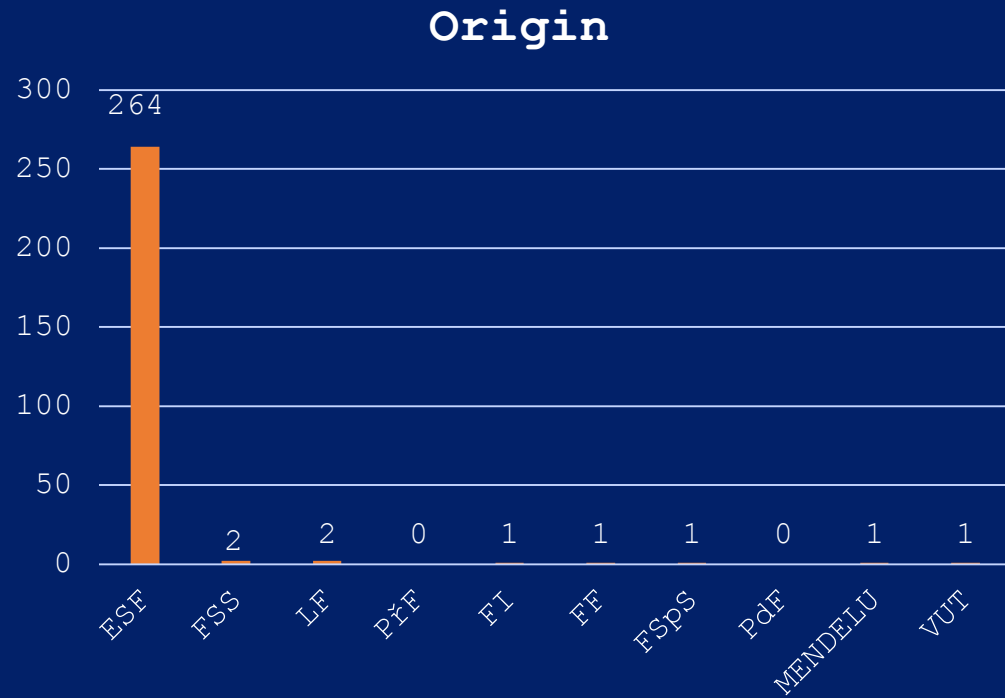
ESF dominates: **249**

FSS follows: **20**

Other faculties: **24**

Outside MUNI: **7**

// The service so far - Autumn 2016



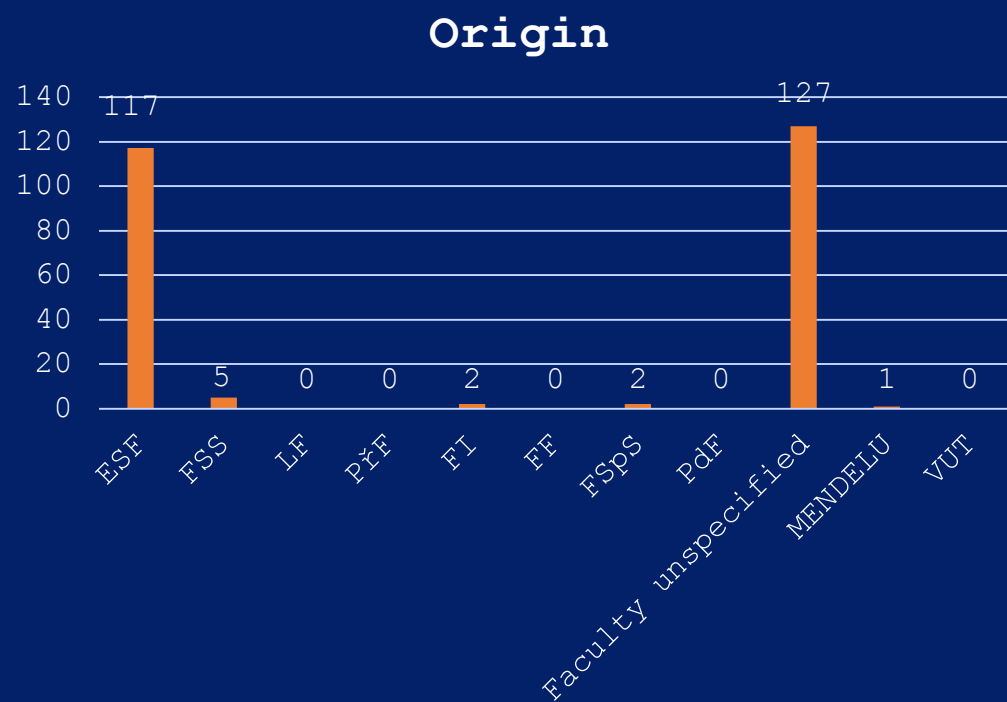
ESF dominates: **264**

FSS follows: **2**

Other faculties: **5**

Outside MUNI: **2**

// The service so far - Spring 2017



ESF dominates: **117**

FSS follows: **5**

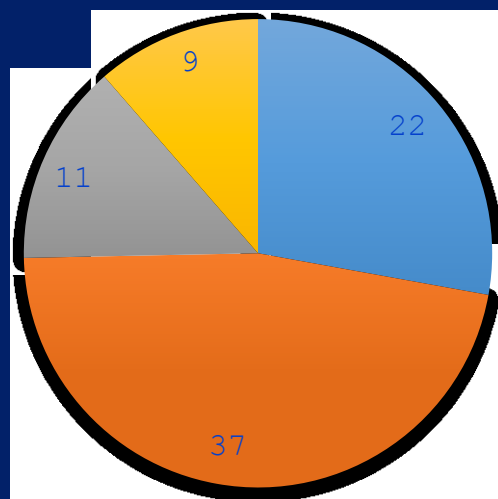
Other faculties: **4**

Faculty unspecified: **127**

Outside MUNI: **1**

// The service so far - Spring 2016

Final thesis



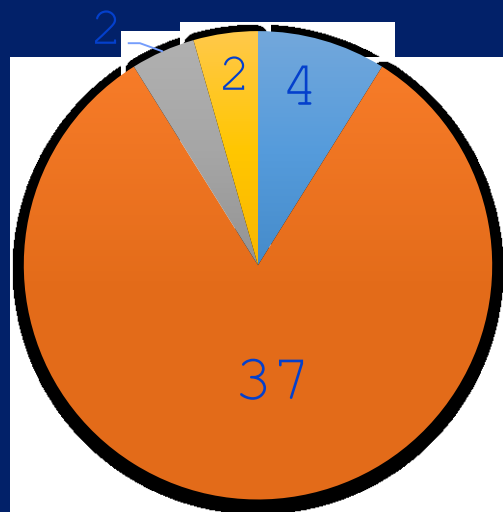
■ Bachelor's thesis
■ Master's thesis
■ Dissertations

- Percentage of visits regarding final thesis:

27%

// The service so far - Spring 2017

Final thesis



■ Bachelor's thesis
■ Master's thesis
■ Dissertations

- Percentage of visits regarding final thesis:

17.7%

// The service so far - Spring 2016

Stats and metrics

- Average hits per month (website) 1,800
- Average time of a visit (website)
00:03:02
- Peak reach (Facebook) 1,105
- Likes in the first month (Facebook) 228

// The service so far - Autumn 2016

Stats and metrics

- Average time of visit (website)
00:02:32
- Likes (Facebook)

459

// The service so far - Spring 2017

Stats and metrics

- Average hits per month (website) 1 417
- Average time of a visit (website)
00:04:50
- Likes (Facebook) 467

// Events

- The Support Centre regularly organizes events for students

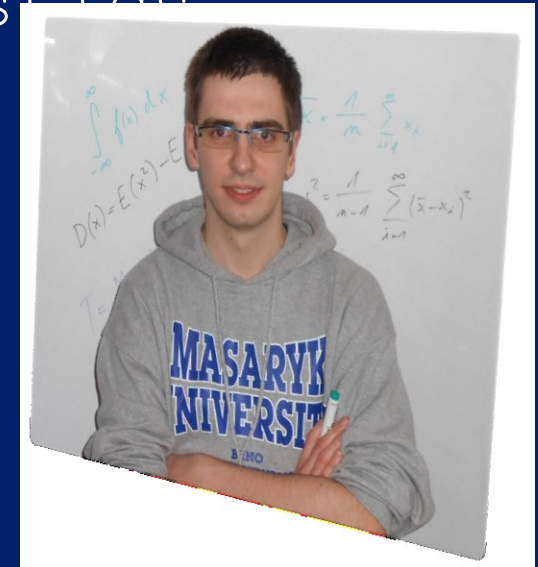
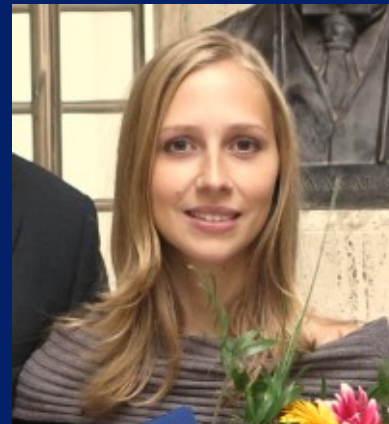
„Quantified Nature“ or
*„The answer of Kurt Gödel
to Pontius Pilate's
question“*

are just a few of
them



// Our team

- So far the Support Centre operated through volunteers.
- Students and teachers alike offered their time to help others with math and statistics.



// Visitor feedback (1/3)

„ (...) chci (znovu) projekt pochválit :) zatím jsem konzultaci nepotřebovala, ale to, že centrum funguje a že s ním můžu počítat, je skvělé“ – Respondent 3

„Pan Josef Nešleha vysvětluje opravdu dobře a vždy si našel čas, i když to vypadá, že jeho den má 40 hodin.“ – Respondent 14

*Myslím si, že Maths and Stats Support Centre je skvělý nápad a budu moc rád, pokud jeho fungování bude pokračovat.“
– Respondent 76*

// Visitor feedback (2/3)

„ (...) veľmi ma potešilo, že sa niečo také vytvorilo, je to super pre študentov. Našťastie som zatiaľ Vašu pomoc nepotreboval ale rád ju využijem v budúcnosti ak bude príležitosť.“ - Respondent 65

„Ačkoliž jsem nevyužil jeho služeb, tak jsem ho doporučil několika kamarádům (...) Ti, kteří služeb centra využili, si ho moc pochvalovali.“ - Respondent 76

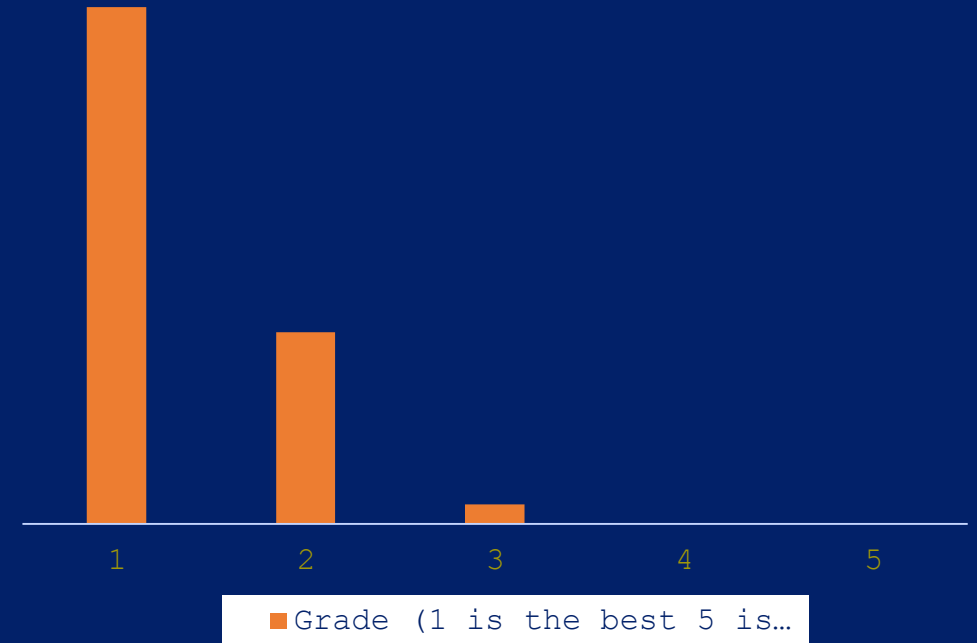
Support Centre je super projekt, jsem hrozně rád, že se ho podařilo otevřít! Díky paní doktorce Králové i všem tutorům. :) - Respondent 23

// Visitor feedback (3/3)

Visitors liked the most:

- 1) Tutors` friendly and non-critical approach
 - 2) Tutor explained all questions
 - 3) Tutor was able to explain complicated issues in simple terms
- (6)

Grades awarded by visitors



// Spreading the idea

- 3 other support centers were inspired and are taking off



VŠB

Technical University of Ostrava

- launch in September 2016



UTB

Tomáš Baťa University in Zlín

- launch in September 2016



VUT

Brno Technical University (FME)

- launch in September 2017 with

support from OP VVV

project

// Outlook (1/2)



- Engage more people
 - spark interest in mathematics and statistics
 - break the „I`m bad at math“ mindset
- Improve the website
 - reduce bounce rate
 - incentivise visitors to browse syllabi
- Reduce math and stats failing grades at MU

// Outlook (2/2)

- Academic year target budget:

550,000 CZK



Labor costs

- two part-time tutors

Technical background

- projector
- interactive whiteboard
- software and web development

Marketing

- leaflets, DTP labor, print

// Sources

<http://archiv.ihned.cz/c1-65399490-ustup-maturity-z-matematiky>

<http://www.statista.com/statistics/254266/global-big-data-market-forecast/>

<https://www.oecd.org/pisa/keyfindings/pisa-2012-results-overview.pdf>

<https://acadgild.com/blog/big-data-job-opportunities-in-2016-and-the-coming-years/>

Facebook analytics internal data

<http://mathstat.econ.muni.cz/>

Google forms questionnaire survey