

Applied statistics; example of university master studies

Branimir Šešelja

Department of Mathematics and Informatics, Faculty of
Sciences

University of Novi Sad, Serbia

Saint Petersburg, June 18., 2013

Applied Statistics

Applied Statistics

Master academic studies

Applied Statistics

Master academic studies

Institution in which the study program is realized: University of Novi Sad

Applied Statistics

Master academic studies

Institution in which the study program is realized: University of Novi Sad

2 years, 4 semesters

Applied Statistics

Master academic studies

Institution in which the study program is realized: University of Novi Sad

2 years, 4 semesters

Credits: 120 ECTS

Applied Statistics

Master academic studies

Institution in which the study program is realized: University of Novi Sad

2 years, 4 semesters

Credits: 120 ECTS

Title: Applied statistician

From Accreditation documents:

From Accreditation documents:

Study program **APPLIED STATISTICS**, according to syllabi, forms and teaching methods, enables students to acquire basic knowledge and understanding of the application of statistics in practice, in order to analyze phenomena in finance, economics, industry, medicine and psychology.

From Accreditation documents:

Study program **APPLIED STATISTICS**, according to syllabi, forms and teaching methods, enables students to acquire basic knowledge and understanding of the application of statistics in practice, in order to analyze phenomena in finance, economics, industry, medicine and psychology.

By mastering the curriculum, students become capable of logical thinking, formulating hypotheses and drawing conclusions in a formal or formalized way.

In the course of study, using methods of general statistics, students obtain skills to apply these in the selected discipline:

In the course of study, using methods of general statistics, students obtain skills to apply these in the selected discipline:

- medicine

In the course of study, using methods of general statistics, students obtain skills to apply these in the selected discipline:

- medicine
- economics

In the course of study, using methods of general statistics, students obtain skills to apply these in the selected discipline:

- medicine
- economics
- finance

In the course of study, using methods of general statistics, students obtain skills to apply these in the selected discipline:

- medicine
- economics
- finance
- engineering

In the course of study, using methods of general statistics, students obtain skills to apply these in the selected discipline:

- medicine
- economics
- finance
- engineering
- social sciences.

In the course of study, using methods of general statistics, students obtain skills to apply these in the selected discipline:

- medicine
- economics
- finance
- engineering
- social sciences.

Students obtain the ability to communicate with other experts in the selected areas.

In the course of study, using methods of general statistics, students obtain skills to apply these in the selected discipline:

- medicine
- economics
- finance
- engineering
- social sciences.

Students obtain the ability to communicate with other experts in the selected areas.

During the study, the student masters the skills of information technology and acquire the ability of program implementation of complex problems.

Each student at the beginning of the study opts for a particular module.

Each student at the beginning of the study opts for a particular module.

Registration of candidates is based on the competition announced by the [University of Novi Sad](#).

Each student at the beginning of the study opts for a particular module.

Registration of candidates is based on the competition announced by the [University of Novi Sad](#).

In order to apply for the first year, a candidate should

Each student at the beginning of the study opts for a particular module.

Registration of candidates is based on the competition announced by the [University of Novi Sad](#).

In order to apply for the first year, a candidate should

- have completed the first stage of [ANY](#) academic studies with at least 180 ECTS points,

Each student at the beginning of the study opts for a particular module.

Registration of candidates is based on the competition announced by the [University of Novi Sad](#).

In order to apply for the first year, a candidate should

- have completed the first stage of [ANY](#) academic studies with at least 180 ECTS points,
- have basic knowledge in mathematics and computer science and

Each student at the beginning of the study opts for a particular module.

Registration of candidates is based on the competition announced by the [University of Novi Sad](#).

In order to apply for the first year, a candidate should

- have completed the first stage of [ANY](#) academic studies with at least 180 ECTS points,
- have basic knowledge in mathematics and computer science and
- use English.

Study program consists of a group of compulsory courses, elective modules, and a final (master) work, as follows:

Study program consists of a group of compulsory courses, elective modules, and a final (master) work, as follows:

- Group of 8 compulsory courses and one elective course (50 ECTS + 6 ETCS).

Study program consists of a group of compulsory courses, elective modules, and a final (master) work, as follows:

- Group of 8 compulsory courses and one elective course (50 ECTS + 6 ETCS).
- Group of 4 modules with elective courses, each with 3 courses (18 ECTS). Each module contains topics that are related to specific scientific fields

Study program consists of a group of compulsory courses, elective modules, and a final (master) work, as follows:

- Group of 8 compulsory courses and one elective course (50 ECTS + 6 ETCS).
- Group of 4 modules with elective courses, each with 3 courses (18 ECTS). Each module contains topics that are related to specific scientific fields
- 12 ECTS credits through electives courses

Study program consists of a group of compulsory courses, elective modules, and a final (master) work, as follows:

- Group of 8 compulsory courses and one elective course (50 ECTS + 6 ETCS).
- Group of 4 modules with elective courses, each with 3 courses (18 ECTS). Each module contains topics that are related to specific scientific fields
- 12 ECTS credits through electives courses
- 10 ECTS credits in professional practice

Study program consists of a group of compulsory courses, elective modules, and a final (master) work, as follows:

- Group of 8 compulsory courses and one elective course (50 ECTS + 6 ETCS).
- Group of 4 modules with elective courses, each with 3 courses (18 ECTS). Each module contains topics that are related to specific scientific fields
- 12 ECTS credits through electives courses
- 10 ECTS credits in professional practice
- final work (24 ECTS).

Law on Higher Education

Law on Higher Education

Article 32

Law on Higher Education

Article 32

Higher education is performed by the following higher education institutions:

Law on Higher Education

Article 32

Higher education is performed by the following higher education institutions:

- 1) University

Law on Higher Education

Article 32

Higher education is performed by the following higher education institutions:

- 1) University
- 2) Faculty..

Law on Higher Education

Article 32

Higher education is performed by the following higher education institutions:

- 1) University
- 2) Faculty..

...

Law on Higher Education

Article 32

Higher education is performed by the following higher education institutions:

- 1) University
- 2) Faculty..

...

Article 33

Law on Higher Education

Article 32

Higher education is performed by the following higher education institutions:

- 1) University
- 2) Faculty..

...

Article 33

University is an independent institution of higher education which integrates educational and scientific activities, or artistic work, as components of a unique high education process.

Law on Higher Education

Article 32

Higher education is performed by the following higher education institutions:

- 1) University
- 2) Faculty..

...

Article 33

University is an independent institution of higher education which integrates educational and scientific activities, or artistic work, as components of a unique high education process.

University can perform all types and levels of study.

The higher education institution has the status of a university if it performs academic degree programs at all levels of study, within at least three fields mentioned in Article 27 this law.

The higher education institution has the status of a university if it performs academic degree programs at all levels of study, within at least three fields mentioned in Article 27 this law.

Article 34

The higher education institution has the status of a university if it performs academic degree programs at all levels of study, within at least three fields mentioned in Article 27 this law.

Article 34

Faculty or an academy is an institution of higher education or a higher education unit within the university, performing academic study programs and developing scientific research, professional or artistic work in one or more areas.

The higher education institution has the status of a university if it performs academic degree programs at all levels of study, within at least three fields mentioned in Article 27 this law.

Article 34

Faculty or an academy is an institution of higher education or a higher education unit within the university, performing academic study programs and developing scientific research, professional or artistic work in one or more areas.

...

The higher education institution has the status of a university if it performs academic degree programs at all levels of study, within at least three fields mentioned in Article 27 this law.

Article 34

Faculty or an academy is an institution of higher education or a higher education unit within the university, performing academic study programs and developing scientific research, professional or artistic work in one or more areas.

...

Faculty or an academy, in the legal system acts under the name of the university and under its own name, in accordance with the statute of the university.

Article 48

Article 48

University integrates functions of its institutions and units, in particular faculties, so that it implements a unified policy aimed at continuously improving the quality of teaching, scientific research and artistic activity.

Integrating role of the university?

Integrating role of the university?

University of Novi Sad:

Integrating role of the university?

University of Novi Sad:

Association of Centres for Interdisciplinary and Multidisciplinary
Studies and Research (ACIMSI)

Integrating role of the university?

University of Novi Sad:

Association of Centres for Interdisciplinary and Multidisciplinary
Studies and Research (ACIMSI)

Center for Applied Statistics

Obstacles:

Obstacles:

- Financing

Obstacles:

- Financing
- Working space

Obstacles:

- Financing
- Working space
- Interest of enterprizes and society.

Obstacles:

- Financing
- Working space
- Interest of enterprizes and society.
- Different knowledge background of students.

Teaching Calculus and Linear Algebra

Teaching Calculus and Linear Algebra

Some experiences

Teaching Calculus and Linear Algebra

Some experiences

- First generation: all students were at least bachelors, hence:
They had necessary skills in order to follow the lectures.

Teaching Calculus and Linear Algebra

Some experiences

- First generation: all students were at least bachelors, hence:
They had necessary skills in order to follow the lectures.
They knew why they study this program.

Teaching Calculus and Linear Algebra

Some experiences

- First generation: all students were at least bachelors, hence:
They had necessary skills in order to follow the lectures.
They knew why they study this program.
Therefore they were motivated to learn.

Teaching Calculus and Linear Algebra

Some experiences

- First generation: all students were at least bachelors, hence:
They had necessary skills in order to follow the lectures.
They knew why they study this program.
Therefore they were motivated to learn.

On the other hand:

Teaching Calculus and Linear Algebra

Some experiences

- First generation: all students were at least bachelors, hence:
They had necessary skills in order to follow the lectures.
They knew why they study this program.
Therefore they were motivated to learn.

On the other hand:

- Some of them never had any mathematics at the bachelor level, and some had.

Teaching Calculus and Linear Algebra

Some experiences

- First generation: all students were at least bachelors, hence:
They had necessary skills in order to follow the lectures.
They knew why they study this program.
Therefore they were motivated to learn.

On the other hand:

- Some of them never had any mathematics at the bachelor level, and some had.
Therefore it was not easy for the teacher to have an appropriate tempo at lectures, neither it is easy to determine how many details to present.

Teaching Calculus and Linear Algebra

Some experiences

- First generation: all students were at least bachelors, hence:
They had necessary skills in order to follow the lectures.
They knew why they study this program.
Therefore they were motivated to learn.

On the other hand:

- Some of them never had any mathematics at the bachelor level, and some had.
Therefore it was not easy for the teacher to have an appropriate tempo at lectures, neither it is easy to determine how many details to present.
- Block teaching was difficult for them: too many new notions in a short period.

Some questions by students

Some questions by students

- *What is (essentially, philosophically) a complex number (in particular the number i)?*

Some questions by students

- *What is (essentially, philosophically) a complex number (in particular the number i)?*
- *If a matrix is a table, why is mathematics (and how can it be) dealing with such an object?*

Some questions by students

- *What is (essentially, philosophically) a complex number (in particular the number i)?*
- *If a matrix is a table, why is mathematics (and how can it be) dealing with such an object?*
- *If practically never we get an irrational number among some data, then why do we need these numbers?*

Some questions by students

- *What is (essentially, philosophically) a complex number (in particular the number i)?*
- *If a matrix is a table, why is mathematics (and how can it be) dealing with such an object?*
- *If practically never we get an irrational number among some data, then why do we need these numbers?*
- *So you have proved that this is true, but is there also a proof that it is not?*

Some questions by students

- *What is (essentially, philosophically) a complex number (in particular the number i)?*
- *If a matrix is a table, why is mathematics (and how can it be) dealing with such an object?*
- *If practically never we get an irrational number among some data, then why do we need these numbers?*
- *So you have proved that this is true, but is there also a proof that it is not?*
- *How could $0.\overline{99}$ be equal 1, since it is obviously less than 1.*

According to experience: How to teach
Mathematics for statisticians (which previously did
not have mathematical courses)?

According to experience: How to teach Mathematics for statisticians (which previously did not have mathematical courses)?

- At the beginning: try to convince them that basic mathematics is necessary:

According to experience: How to teach Mathematics for statisticians (which previously did not have mathematical courses)?

- At the beginning: try to convince them that basic mathematics is necessary:
By presenting simple examples with statistical origin and mathematical explanation.

According to experience: How to teach Mathematics for statisticians (which previously did not have mathematical courses)?

- At the beginning: try to convince them that basic mathematics is necessary:
By presenting simple examples with statistical origin and mathematical explanation.
By recalling knowledge from secondary school (through examples).

According to experience: How to teach Mathematics for statisticians (which previously did not have mathematical courses)?

- At the beginning: try to convince them that basic mathematics is necessary:

By presenting simple examples with statistical origin and mathematical explanation.

By recalling knowledge from secondary school (through examples).

By claiming that this will not be difficult.

According to experience: How to teach Mathematics for statisticians (which previously did not have mathematical courses)?

- At the beginning: try to convince them that basic mathematics is necessary:

By presenting simple examples with statistical origin and mathematical explanation.

By recalling knowledge from secondary school (through examples).

By claiming that this will not be difficult.

By the final argument (brut force): this subject does exist in their study program.

When presenting a new topic

When presenting a new topic

- Start with an example in which the new topic appears (implicitly).

When presenting a new topic

- Start with an example in which the new topic appears (implicitly).
- Then describe the new topic colloquially, without (too many) formulas.

When presenting a new topic

- Start with an example in which the new topic appears (implicitly).
- Then describe the new topic colloquially, without (too many) formulas.
- Again an example.

When presenting a new topic

- Start with an example in which the new topic appears (implicitly).
- Then describe the new topic colloquially, without (too many) formulas.
- Again an example.
- Finally give the **precise, correct mathematical definition, formulation of the theorem...**

When presenting a new topic

- Start with an example in which the new topic appears (implicitly).
- Then describe the new topic colloquially, without (too many) formulas.
- Again an example.
- Finally give the **precise, correct mathematical definition, formulation of the theorem...**
- If the theorem has to be proved, first illustrate the proof throughout an example.

When presenting a new topic

- Start with an example in which the new topic appears (implicitly).
- Then describe the new topic colloquially, without (too many) formulas.
- Again an example.
- Finally give the **precise, correct mathematical definition, formulation of the theorem...**
- If the theorem has to be proved, first illustrate the proof throughout an example.
- Then present the **correct proof**.

When presenting a new topic

- Start with an example in which the new topic appears (implicitly).
- Then describe the new topic colloquially, without (too many) formulas.
- Again an example.
- Finally give the **precise, correct mathematical definition, formulation of the theorem...**
- If the theorem has to be proved, first illustrate the proof throughout an example.
- Then present the **correct proof**.
- Then again the above example.

- For exercises, try to find problems in which students should discover a necessity of using some mathematical tool.

- For exercises, try to find problems in which students should discover a necessity of using some mathematical tool.
- Present problems with several possible approaches and encourage students to explore and find an appropriate algorithm.

- For exercises, try to find problems in which students should discover a necessity of using some mathematical tool.
- Present problems with several possible approaches and encourage students to explore and find an appropriate algorithm.
- *A suggestion by a colleague:* try to write on a board, avoid video presentation.

- For exercises, try to find problems in which students should discover a necessity of using some mathematical tool.
- Present problems with several possible approaches and encourage students to explore and find an appropriate algorithm.
- *A suggestion by a colleague:* try to write on a board, avoid video presentation.

In this way, students will believe you.

- For exercises, try to find problems in which students should discover a necessity of using some mathematical tool.
- Present problems with several possible approaches and encourage students to explore and find an appropriate algorithm.
- *A suggestion by a colleague:* try to write on a board, avoid video presentation.

In this way, students will believe you.

To them, it would mean that they could do the same, i.e., that they can learn the topic.

- For exercises, try to find problems in which students should discover a necessity of using some mathematical tool.
- Present problems with several possible approaches and encourage students to explore and find an appropriate algorithm.
- *A suggestion by a colleague:* try to write on a board, avoid video presentation.

In this way, students will believe you.

To them, it would mean that they could do the same, i.e., that they can learn the topic.

- Encourage students to **understand** topics, formulations, theorems...

- For exercises, try to find problems in which students should discover a necessity of using some mathematical tool.
- Present problems with several possible approaches and encourage students to explore and find an appropriate algorithm.
- *A suggestion by a colleague:* try to write on a board, avoid video presentation.

In this way, students will believe you.

To them, it would mean that they could do the same, i.e., that they can learn the topic.

- Encourage students to **understand** topics, formulations, theorems...
- At the exam, do not ask proofs, require understanding.

- For exercises, try to find problems in which students should discover a necessity of using some mathematical tool.
- Present problems with several possible approaches and encourage students to explore and find an appropriate algorithm.
- *A suggestion by a colleague:* try to write on a board, avoid video presentation.

In this way, students will believe you.

To them, it would mean that they could do the same, i.e., that they can learn the topic.

- Encourage students to **understand** topics, formulations, theorems...
- At the exam, do not ask proofs, require understanding.
- Have permanent contact with colleagues teaching statistical subjects.

Thank you, that was all!