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UNIVERSITY LEVEL STATISTICAL EDUCATION IN HUNGARY

Jenö Reiczigel
Department of Biomathematics and Informatics
University of Veterinary Science
H-1078 Budapest, István út 2, Hungary

1. Introdution

During the past ten years, I have taught probability theory and statistics at several universities in Budapest. All these courses were for students in applied fields; sociology, business and economics, agriculture, etc. In all the courses, basic level probability theory and statistics were taught, but from different points of view and with different emphases.

This paper summarises my experiences, presenting the courses in a common framework, so that some comparisons may be drawn concerning their aims, their content, the teaching methods employed and the main difficulties encountered. This short review of university level statistical education in Hungary may give an opportunity for comparisons with educational programmes in other countries. My experiences have shown that the main problems and the general solutions in other countries are often very similar to ours. This fact may strengthen the cooperation and exchange of ideas between people working in the field of statistical education.

I have not included the education of statisticians in this report. In Hungary, there are two different ways to learn to be a statistician. One is in the faculty of mathematics, and the other is in the faculty of economics. Of course, the main emphases are different: a theoretical (mathematical) approach in the first context, and an empirical (data oriented) approach in the other one. A third possibility is just being organised in the faculty of sociology, where the education of survey statisticians is going to start this year.

The system of higher level education in Hungary is much less flexible than is usually the case in Western countries. This means that, although the system has started to become more flexible than it was in the past, students generally have far fewer choices concerning the lectures and seminars that they will attend.

The following aspects of each course are considered: the length, a summary of the material covered and its particular emphases, the use made of computers, the preceding preparatory courses in general mathematics and the examinations requirements.

2. Some explanatory notes about the institutions included

Table 1 lists the institutions covered by this report, with the abbreviations which will be used throughout the paper. An asterisk by an entry indicates that the author has had personal teaching experience at that institution.

- At the Technical University, there are several faculties with their own mathematical departments and students with various specialisations. Thus several different teaching programs exist. It is typical, however, that only a minimum of statistics is taught.
- The teaching programmes at universities in the field of agriculture are quite similar to that of the University of Horticulture and Food Industry which is included in this report.
- At the medical universities, only students of pharmacy are taught by the mathematics departments. Students of medical faculties learn both mathematics and statistics within the context of a biophysics course. In spite of the lack of precise data, it is certain that both the time and also the material covered are less than where specific courses in statistics were given.
- The two faculties of pharmacy are not considered separately, although at Semmelweiss University somewhat less time is devoted to statistics, compared to courses at Szent-Györgyi, and no computer knowledge related to the statistics course is required.

Table 1. *The institutions covered by this report*

University of Veterinary Science	VETER	*
Eötvös University, Faculty of Sociology	SOCIOL	*
University of Horticulture and Food Industry		
Faculties of Horticulture	AGR	*
Faculties of Food Industry	AGR.ENG	*
International Business School, Budapest (Oxford Brookes University)	BUSINESS	*
Budapest University of Economics	ECON	*
Semmelweiss Medical University, Budapest and Szent-Györgyi A. Medical University, Szeged		
Faculties of Medicine	MED	
Faculty of Pharmacy	PHARM	
Budapest Technical University, Faculty of Electronics	TECH	

3. Some quantitative data about the courses

These courses are part of the students' basic education, so they take place in their first or second year programmes. Typically, students end their studies of statistics with these courses, although in case of certain specializations at faculties of economics and sociology, students may (or must) attend additional advanced courses in statistics (e.g. on multivariate methods), but these are not taken into account here.

Table 2 gives a summary of the total number of lectures and seminars devoted to probability theory and statistics at the various faculties. At seminars, students typically deal with numerical examples, doing exercises that may involve either manual computations or the use of the computer. The numbers shown in Table 2 represent hours, the length of a semester being taken as typically 15 weeks. Partly or wholly faculty-based lectures or seminars are noted by an (F) appearing after the number.

At Budapest University of Economics, the data in Table 2 concern the basic courses, that is those courses which are obligatory for all students. In fact, for some specialisations, much more statistics is taught, and it is here, in these specialist contexts, that most of the more advanced statistical methods which are taught would occur.

At technical faculties, where a lot of mathematics is taught, it is difficult to decide how much of it is directly relevant to statistical education, and therefore how much of it should be considered here. This is the reason for the NA (Not Applicable) entries in Table 2.

Table 2. *Total amount of lectures and seminars on probability theory and statistics, and preparatory general mathematics at the various faculties (in hours)*

faculty	lectures in probab./stat.	seminars in probab./stat.	lectures in general maths	seminars in general maths
ECON	75	105(F)	60	60(F)
BUSINESS	30	90	0	0
SOCIOL	60	30(F)	30	30(F)
AGR	30	60	30	30
AGR.ENG	45	30	60	60
TECH	30	30	NA	NA
PHARM	15	30	30	30
VETER	24	16	21	14

The information in Table 2 may be illustrated in the form of a scattergram as shown in Fig. 1. Lectures and seminars have been equally weighted and the scales on the two axes - statistics versus general mathematics - are not intended to be equivalent. It can be seen that the students receiving the most statistical education are those of the business and economics faculties. It may be surprising, however, to see that medical students seem to be the least receiving statistics education.

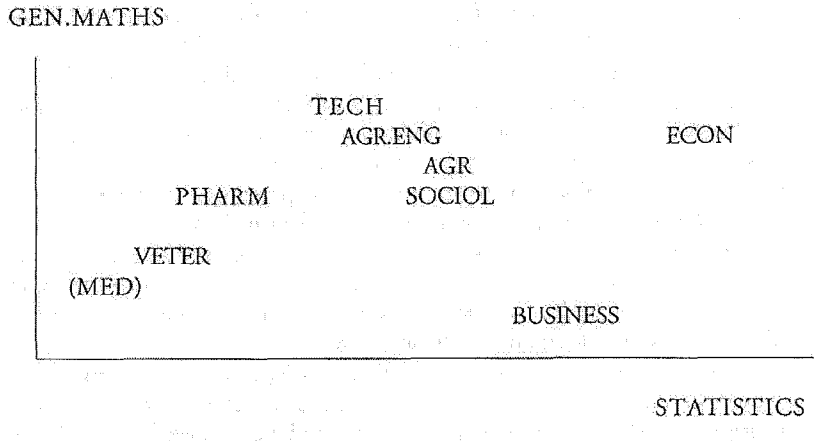

Figure 1. *Scattergram of the total amount of time devoted to statistics and general mathematics.*

4. The material covered

In listing the material of these courses, I will follow the usual grouping; probability theory, descriptive statistics and inferential statistics. In fact, except in the business and economics faculties, descripive statistics are of only marginal importance. In the business and economics faculties, however, descriptive methods and presentation techniques, graphics, etc., have particular importance, but strict probability-based theoretical foundations of inferential methods are often replaced by intuitive approaches. The teaching may be shared between the departments of statistics and mathematics, thereby providing both approaches.

In all faculties, statistics courses include some computer awareness, and the use of some statistical software as well. Different program packages are used, determined partly by traditional, and partly by financial factors. Besides computer usage, students are required to be able to carry out some

basic statistical computations like a t-test or a chi-square test for independence, manually as well (although calculators can be used), and to be able to use probability tables.

From general mathematics, the following units can by regarded as preparatory with respect to statistics: set theory, matrix algebra, infinite series and sums, differentiation and integration of uni- and multivariate functions (of course, these are not explained in detail at all faculties).

Concerning probability distributions, it should be noted that those distributions used in statistics, like chi-square, Student-t, F, etc. are generally not discussed in the probability theory course, but rather they are left to the statistics course.

Table 3. *The material covered in the various faculties*
(L = learnt in detail; M = mentioned but not learnt in detail; - = not learnt)

	ECON	BUSINESS	SOCIOL	AGR	AGR ENG	TECH	PHARM	VET
Probability theory								
axiomatic foundation of probability theory	M	-	M	-	M	M	-	-
random variables	L	L	L	L	L	-	M	L
univariate discrete probab. distributions								
uniform, binomial, Poisson	L	L	L	L	L	L	M	M
others	L	-	-	M	M	L	-	-
univariate continuous probab. distributions								
uniform, normal	L	L	L	L	L	L	L	L
exponential and others	L	L	-	-	-	L	-	-
sampling								
sampling with or without replacement	L	L	M	L	L	L	-	M
sampling distributions of random variables	L	L	-	-	-	M	M	-
limit theorems	M	-	-	-	M	M	-	-
relations between random variables								
joint distribution, condit. distribution	L	-	M	M	M	M	-	-
association	L	-	L	-	-	-	-	-
correlation	L	L	L	L	L	L	L	L
multivariate distributions								
(mulrinomial, normal, etc.)	L	-	-	-	M	L	-	-

Table 3. *The material covered in the various faculties* (continued)

	ECON	BUSINESS	SOCIOL	AGR	AGR ENG	TECH	PHARM	VETER
Descriptive statistics								
tabular and graphical presentations of data	L	L	L	M	M	M	M	M
quantitative measurements	L	L	M	M	M	M	M	M
sampling methods	L	M	M	-	-	-	-	-
index numbers	L	L	-	-	-	-	-	-
Inferential statistics								
theoretical considerations of								
estimation	L	M	-	-	M	M	-	-
hypothesis testing	L	-	M	-	M	M	-	-
interval estimation for the								
probability (proportion) or mean	L	L	M	L	L	L	L	L
variance	L	L	-	L	L	L	-	-
one- and two sample tests for the								
probability (proportion) or mean	L	L	L	L	L	L	L	L
variance	L	-	L	L	L	L	L	M
chi-square tests of goodness of fit and								
independence	L	L	L	L	L	L	L	L
other nonparametric tests	L	-	M	-	-	-	L	-
regression analysis								
linear with one independent var.	L	L	-	L	L	L	L	L
nonlinear with one independent var.	L	-	-	L	L	-	-	M
multiple linear regression	L	-	-	L	L	-	-	-
ANOVA								
one-way	L	-	-	L	L	-	-	L
multiway	L	-	-	L	M	-	-	-
experimental designs	L	-	-	L	-	-	-	-

In more advanced courses, in later studies at the faculties of economics and sociology, essentially all advanced statistical methods occur but mostly with little respect to their mathematical basis, especially if they are discussed in the so called empirical data analysis courses.

5. Examination requirements

The assessment requirements differ in the various faculties. A summary is given in Table 4. In the written/oral column, a W+O may have the meaning that the course is ending with an oral examination but students are required to work out exercises during the course. Where computer knowledge is not indicated, it may be included in another, not strictly statistical course (e.g. business information systems, empirical data analysis, etc.). Parentheses in Table 4 mean that those requirements are of secondary importance for some reason (e.g. an oral examination at the faculty of sociology is only for those who failed to pass the written examination). Written examinations take from 1.5 to 3 hours working time. Theoretical questions in written examinations may be of either multiple-choice or essay type.

Table 4. *Examination requirements*

faculty	written/oral	theor./exerc.	manual/computer
ECON	W+O	T+E	M
BUSINESS	W	(T+)E	M
SOCIOL	W(+O)	(T+)E	M
AGR	W+O	T+E	M+C
AGR.ENG	W+O	T+E	M+C
TECH	W	E	M
PHARM	W+O	T+E	M+C
VETER	O	T+E	M