

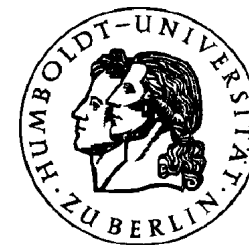
# e-learning/e-teaching of statistics: students' and teachers' views

W. Härdle

B. Rönz

[www.md-stat.com](http://www.md-stat.com)

[www.e-stat.de](http://www.e-stat.de)



Internet services follow already certain standards:

shopping cart programs allow to book, shop and trade...

e-learning/e-teaching is just emerging and is far from such standards.

Statistics is the field that can profit a lot from e-learning/e-teaching standards.

Students' and teachers' views are essential for such a standardisation.

## Statistics [stə'tistiks]

information extraction from complex structured data

skills: data handling, graphical insight, mathematics

Therefore students do not like statistics.

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information extraction from complex structured data

skills: data handling, graphical insight, mathematics

Therefore students do not like statistics.

Effective education is a necessity.

**student:** e-learning is attractive!

**teacher:** e-learning is modern!

Both "e-s" have to be realized on one platform.  
Therefore standardization is necessary.

Proposals:

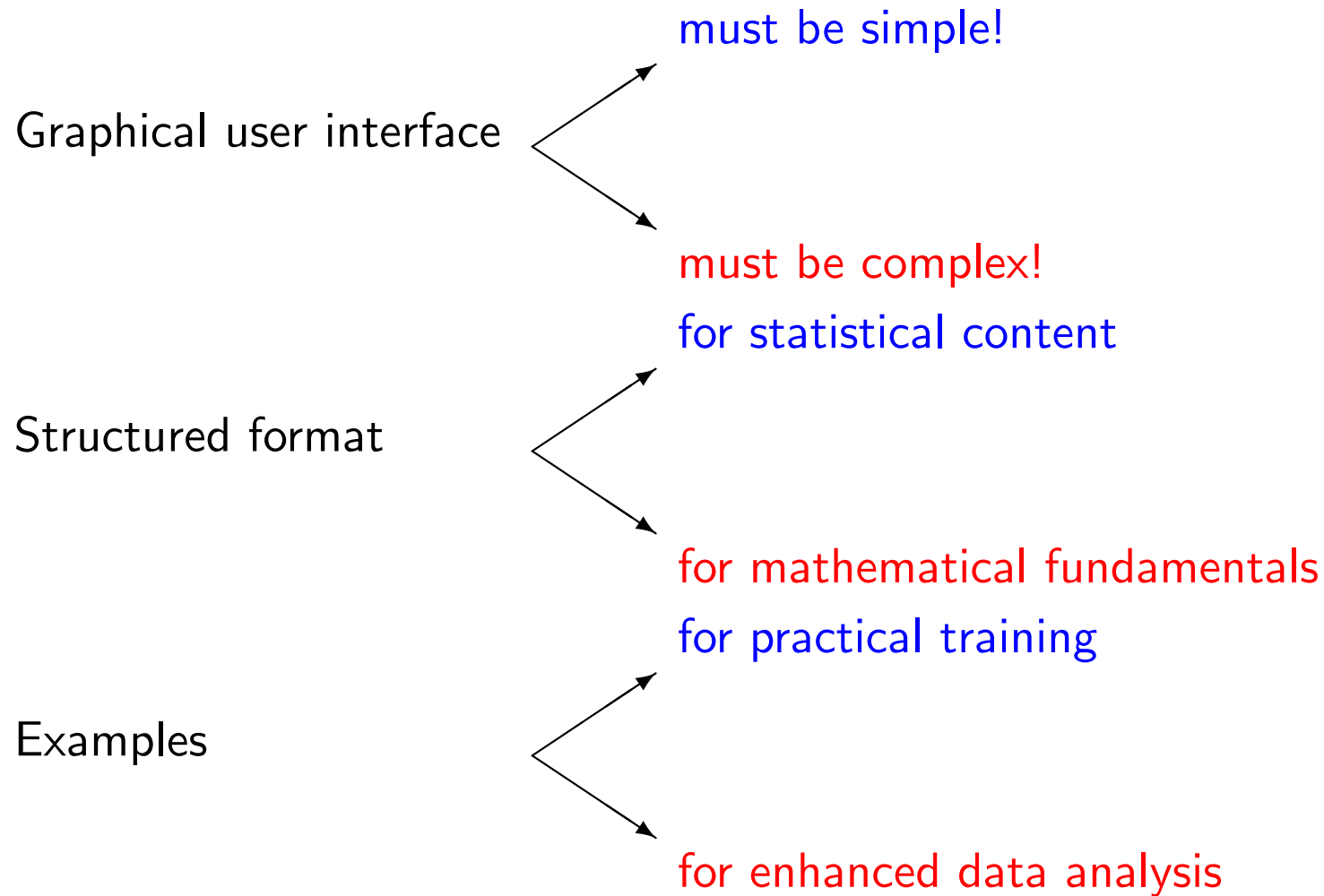


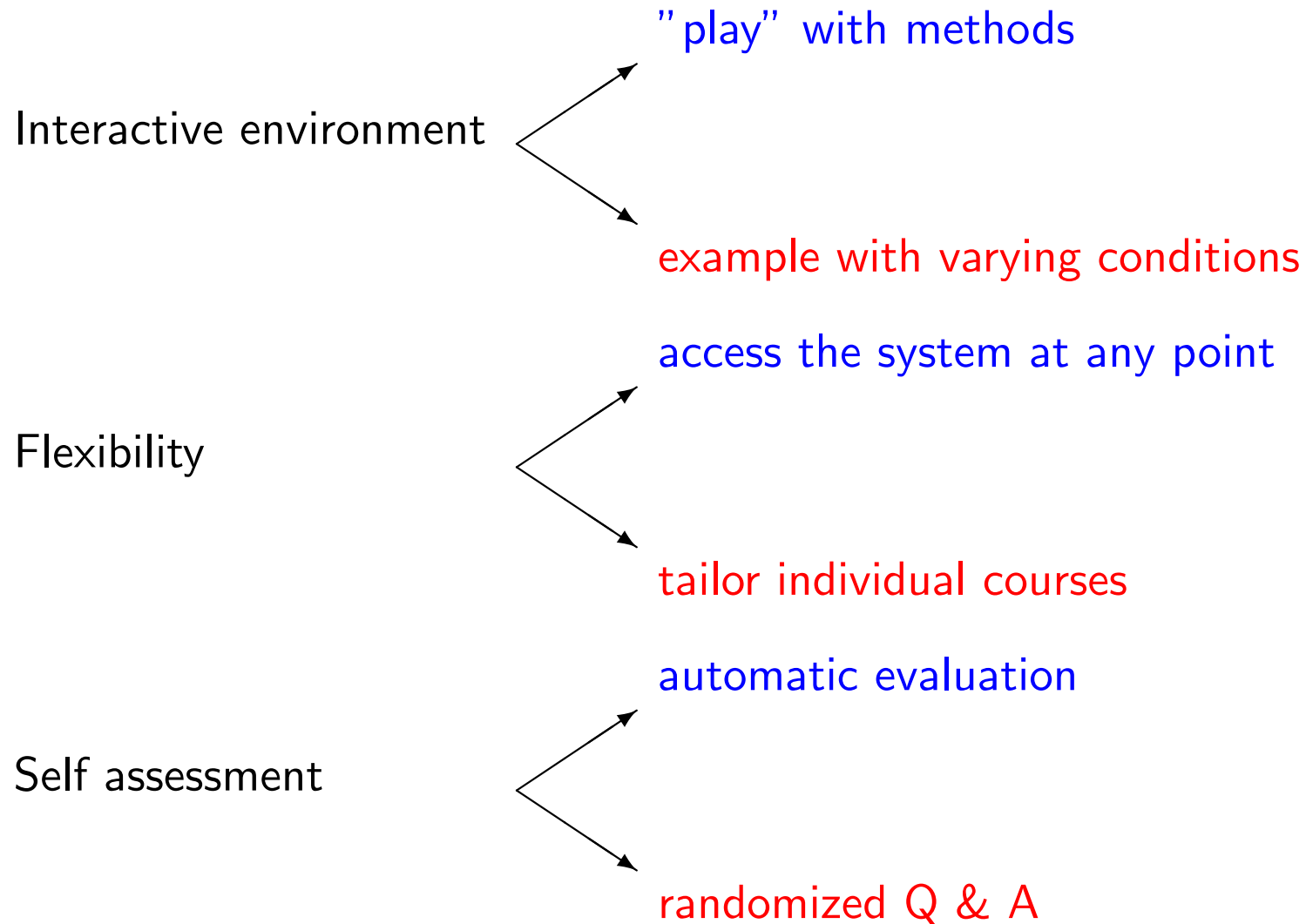
e.stat

# e-learning/e-teaching of statistics: students' and teachers' views

1. Introduction ✓
2. Teachers' and students' views
3. e-learning/e-teaching: MM\*Stat
4. e-learning/e-teaching: e-stat
5. e-learning/e-teaching documents: MD\*book
6. References

# Teachers' and students' views

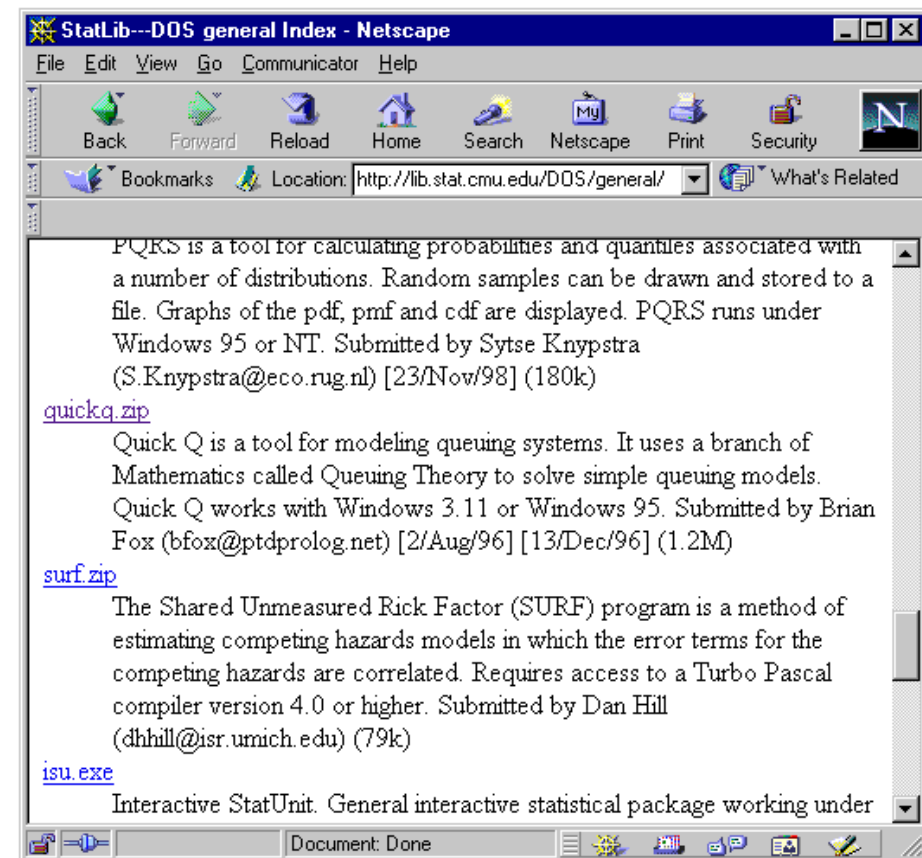






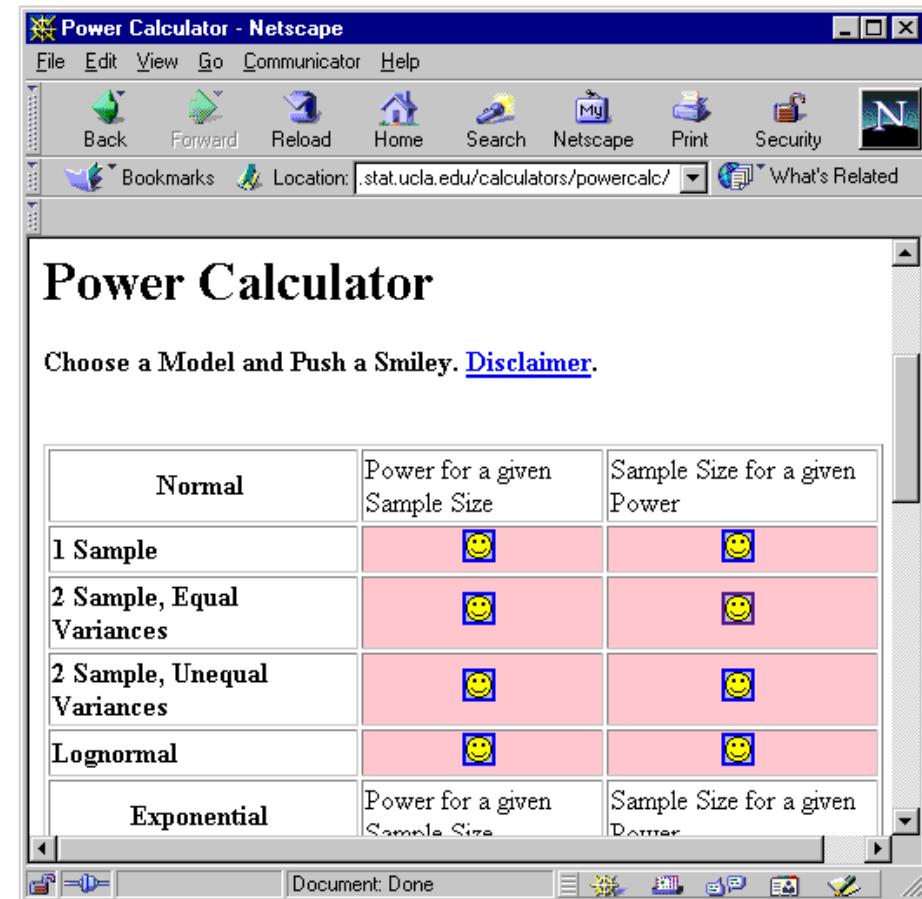
## Standardization issues

- Obtain code
  - Copy and paste into the editor
  - Run
- + Rich methodology
- + Easy drop of methods
- No homogenous platform
  - No guarantee
  - Need proper software



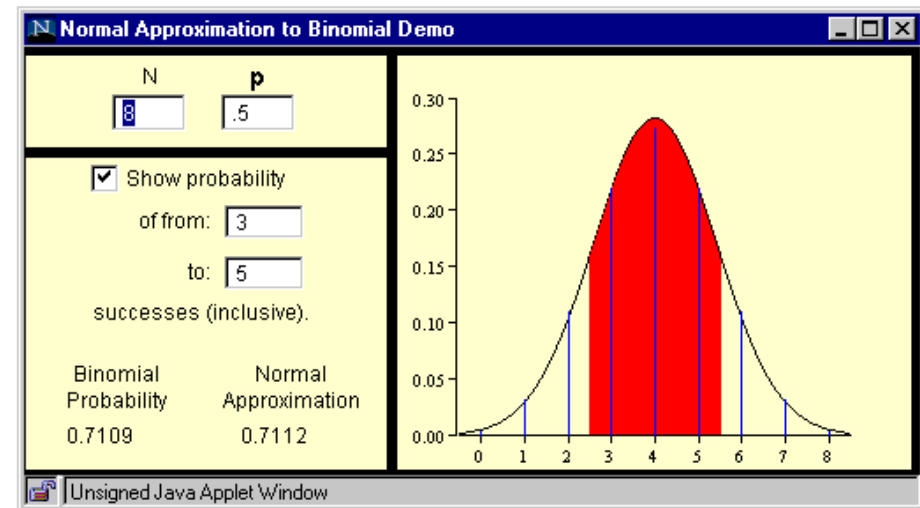
## Standardization issues

- "Common Gateway Interface"
- Doesn't need Java
- Start through web server
- + Easy browsing
- + Fast access
- Only small data sets possible
- Limited methods selection
- Difficult to handle for authors



## Standardization issues

- Applets
- Start through web browser
- + Easy availability via browser
- + Attractive for beginners
- + Multiple platforms
  - Code is prefixed
  - Own data?
  - Closed package



# e-learning/e-teaching: MM\*Stat



MM\*Stat is an HTML based multimedia environment ([www.md-stat.com](http://www.md-stat.com)).

MM\*Stat is an MD\*booklet, created by MD\*book.

MM\*Stat is course-oriented:

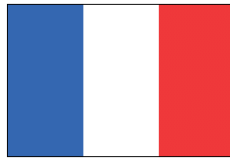
It contains an introductory statistics course, usually taught at universities.



German



English



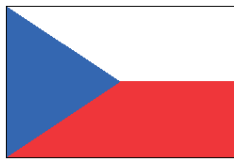
French



Spanish



Italian



Czech

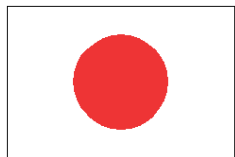


Polish

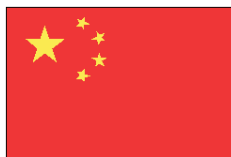


Indonesian

and soon in



Japanese



Chinese



Portuguese



Dutch

## Graphical user interface of MM\*Stat

lecture contents lecture 6.3

### 6.3 Binomial Distribution

A Binomial distribution is derived from a **random experiment** in which we either obtain **event A** with constant **probability p**, or the **complementary event  $\bar{A}$**  with probability  $1-p$ .

Suppose this experiment is repeated  $n$  times.

A **discrete random variable** that contains the number of successes  $A$  after  $n$  repetitions of this experiment, has a Binomial distribution with parameters  $n$  and  $p$ . Its probability density function is:

$$f(x; n, p) = \begin{cases} \binom{n}{x} \cdot p^x \cdot (1-p)^{n-x} & \text{for } x = 0, 1, \dots, n \\ 0 & \text{otherwise} \end{cases}$$

Denoted:  $X \sim B(n; p)$

The **distribution function** is given as:

$$F(x; n, p) = \begin{cases} \sum_{k=0}^x \binom{n}{k} \cdot p^k \cdot (1-p)^{n-k} & \text{for } x \geq 0 \\ 0 & \text{for } x < 0 \end{cases}$$

The **expected value** and the **variance** of a Binomial distribution  $B(n; p)$  are:

information explained enhanced enhanced interactive

Standardization is via an HTML filing card system.

The screenshot shows a web browser window titled "MM\*Stat - Microsoft Internet Explorer von Lycos Bertelsmann". The page has a navigation bar at the top with tabs: "lecture contents", "lecture 6.3", "information 6.3", "explained 6.3", "enhanced 6.3", "enhanced 6.3", and "interactive 6.3". The "information 6.3" tab is selected.

## 6.3 Binomial Distribution

A Binomial distribution is derived from a **random experiment** in which we either obtain **event** A with constant **probability** p, or the **complementary event**  $\bar{A}$  with probability 1-p.

Suppose this experiment is repeated n times.

A **discrete random variable** that contains the number of successes A after n repetitions of this experiment, has a Binomial distribution with parameters n and p. Its probability density function is:

$$f(x; n, p) = \begin{cases} \binom{n}{x} \cdot p^x \cdot (1-p)^{n-x} & \text{for } x = 0, 1, \dots, n \\ 0 & \text{otherwise} \end{cases}$$

Denoted:  $X \sim B(n; p)$

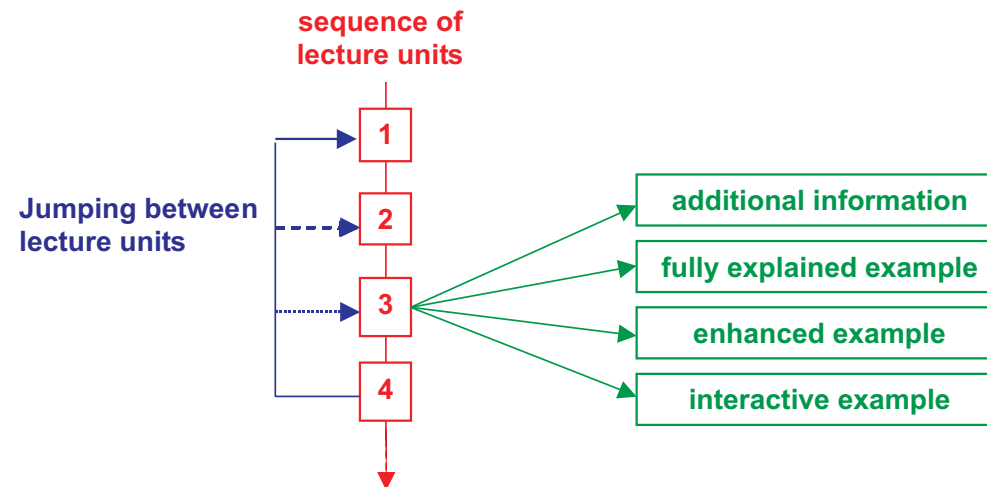
The **distribution function** is given as:

$$f(x; n, p) = \begin{cases} \sum_{k=0}^x \binom{n}{k} \cdot p^k \cdot (1-p)^{n-k} & \text{for } x \geq 0 \\ 0 & \text{for } x < 0 \end{cases}$$

The **expected value** and the **variance** of a Binomial distribution B(n;p) are:

At the bottom of the page, there are icons for "contents", "search", and "print", and a row of buttons for "information", "explained", "enhanced", "enhanced", and "interactive".

## Structured format:



Sequence of lecture units:  
straight ahead in statistical  
theory

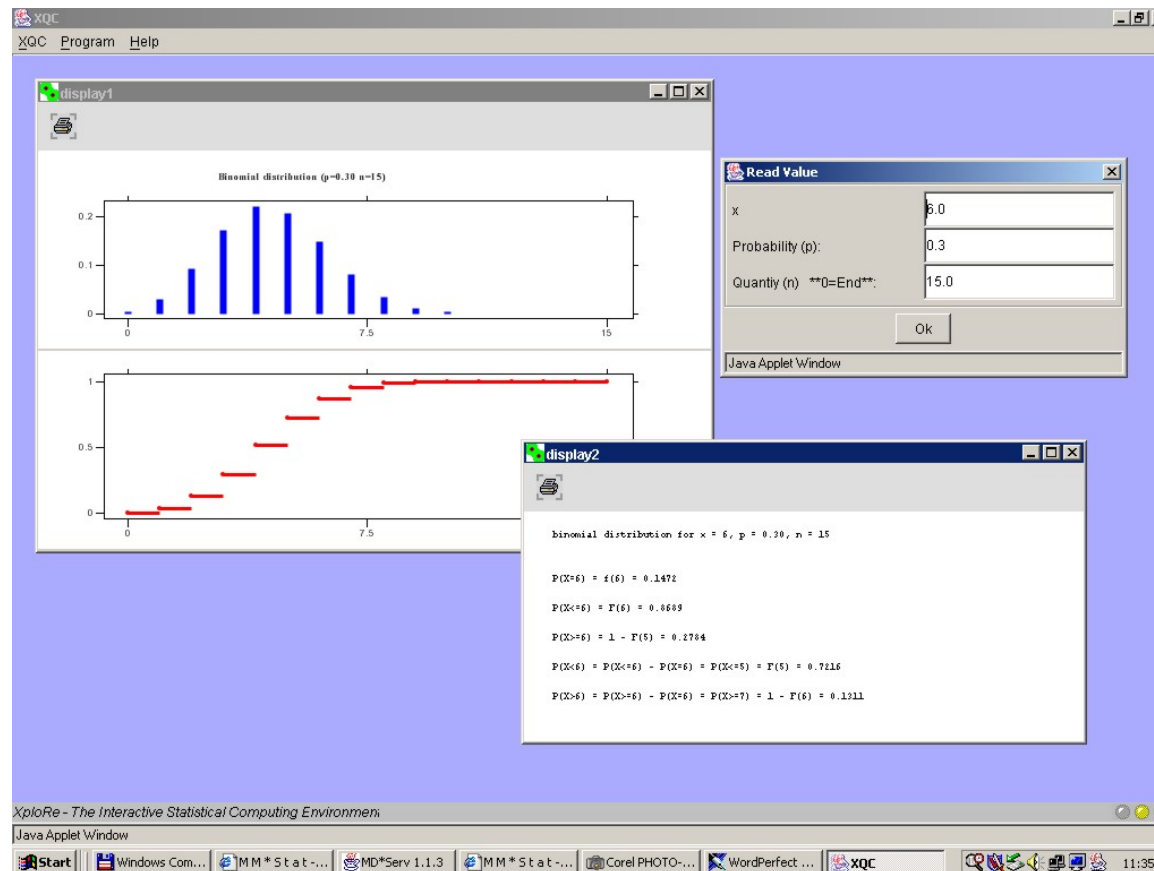
Ramification by

- additional information
- examples
- self assessment
- hypertext functionality



## Interactive environment

The implementation of interactive examples into MM\*Stat is based on the XploRe Quantlet technology.



The graphical user interface of MM\*Stat supports a structure which allows for

- standardization
- structured format
- flexibility
- interactive environment
- examples
- self assessment

## Limitations of MM\*Stat

- There is a specific course orientation.
- The example have an economics flavor.
- A specific statistical engine is addressed

## Advantages of MM\*Stat

- + usage in various courses of studies
- + automatic production from LaTeX via MD\*book
- + MD\*booklet format is very flexible with configuration of 300 parameters

# e-learning/e-teaching: e-stat e.stat

e-stat([www.e-stat.de](http://www.e-stat.de)) is currently under development by teams of 7 German universities.

e-stat is an **open source system** which is XML based. The statistical content is broken down into small modules.

**Example:** regression analysis

- module1: actual motivation

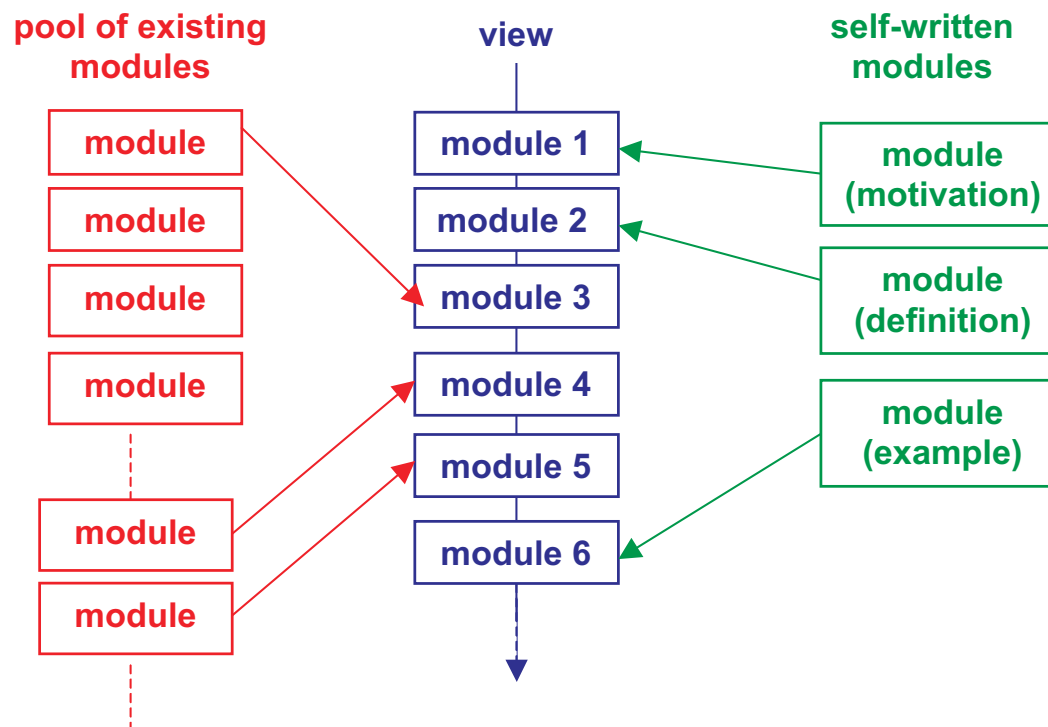
- module2: explanation of general purpose

- module3: specification of regression model

- module4: listing of properties

- module5: estimation techniques

**aim of the module concept:** to compile statistics courses across topics and applications



**e-stat view:** application oriented arrangement of modules e.g. economics, biology, mathematics ...

**e-stat scenarios:** empirical applications with real-world data sets e.g.  
insurance, virtual enterprise ...

**e-stat levels:** A(low) B(medium) C(experienced)

emilea-Stat - Microsoft Internet Explorer von Lycos Bertelsmann

Adresse: <http://emilea-stat-db.uni-oldenburg.de/index.jsp>

View: Allgemein

Testmodule > Markov-Kette

Level A Level B Level C

Definition Satz 1 Beweis

Eine Folge  $X_0, X_1, \dots$  von Zufallsvariablen mit Werten in einer endlichen oder höchstens abzählbaren Menge  $I$  heißt **Markov-Kette**, wenn

$$P(X_{n+1} = i_{n+1} \mid X_0 = i_0, \dots, X_{n-1} = i_{n-1}, X_n = i_n) = P(X_{n+1} = i_{n+1} \mid X_n = i_n)$$

für alle  $n \in \mathbb{N}_0$  und alle  $i_0, \dots, i_{n-1}, i_n, i_{n+1} \in I$  gilt. Die (sog.) **Markov-Eigenschaft** besagt, dass die zukünftige Entwicklung des Systems nur von dem zuletzt beobachteten Zustand  $i_n$  abhängt und von der sonstigen Vorgeschichte  $i_0, \dots, i_{n-1}$  unabhängig ist. Sind die bedingten Wahrscheinlichkeiten  $P(X_{n+1} = j \mid X_n = i)$  unabhängig von  $n$ , so ist die Markov-Kette **homogen**; andernfalls **inhomogen**. Wir betrachten im folgenden nur homogene Markov-Ketten. Die Menge  $I$  der Zustände heißt **Zustandsraum**.

XploRe® SPSS R

## self assessment

- online examples
- exercises
  - discrete or multiple choice
  - fill-in-the-blank text
  - free text answers

## interactive environment


- applets
- R
- XploRe

# e-learning/e-teaching: MD\*book

MD\*book

([www.md-book.com](http://www.md-book.com)) web based document generation.

MD\*book creates

- e-books 
- MD\*booklets  
(MM\*Stat, FIC, XIC, NIC, MIC)
- XML documents for e-stat
- PS format
- pdf format
- HTML format



## Cooperation with Springer Verlag, Heidelberg



### **Applied Multivariate Statistical Analysis**

W. Härdle, L. Simar



### **Applied Nonparametric Regression**

W. Härdle



DOWNLOAD

### **Applied Quantitative Finance**

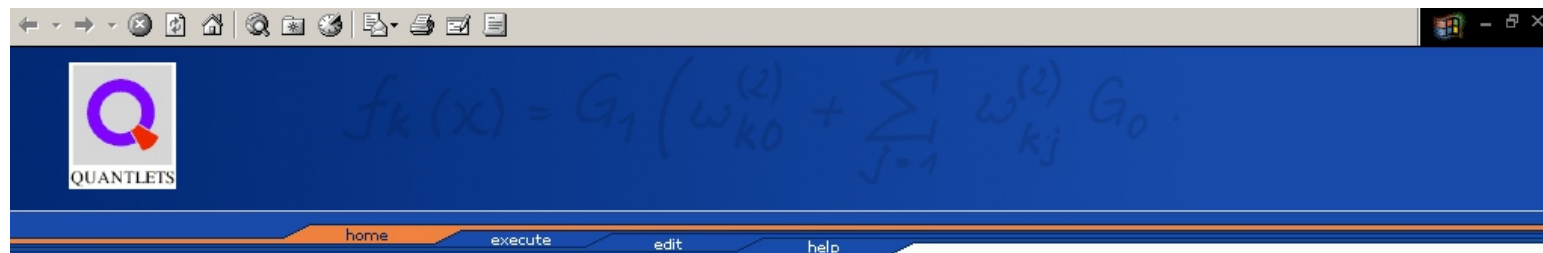
W. Härdle, T. Kleinow, G. Stahl



### **COMPSTAT 2002—Proceedings in Computational Statistics**

W. Härdle, B. Rönz





## XFGiv03

**Description:** XFGiv03 shows the term structure of implied volas.

**Download:** [XFGiv03.xpl](#)

**Code:**

```
proc()=XFGiv03()

  x = read("XFGIVTermStructure.dat")

  d = createdisplay(1,1)
  x1 = 1:8~x[,1]
  x2 = 1:8~x[,2]
  x3 = 1:8~x[,3]
  x4 = 1:8~x[,4]

  setmaskl(x1,(1:8)' ,1,1,4)
  setmaskl(x2,(1:8)' ,2,1,4)
  setmaskl(x3,(1:8)' ,3,1,4)
  setmaskl(x4,(1:8)' ,4,1,4)

  show(d,1,1,x1,x2,x3,x4)
  setgopt(d,1,1,"title","Term structure","xlabel", "Subindex","ylabel", "Percentage [%]", "yvalue",0|1,"xmajor",
endp

XFGiv03()
```

The screenshot displays the XploRe Quantlet Client interface. The main window is titled "XQC" and contains a plot titled "Term structure". The plot shows four data series (red, green, blue, and black) representing different term structures over a range of 1 to 8 on the x-axis. The y-axis ranges from 0.21 to 0.32. The plot is titled "Term structure" and has "x-Axis" labeled on the x-axis.

Below the plot, the code editor shows the following code:

```

proc()=XFGiv03()

  x = read("XFGIVTermStructure.d")

  d = createdisplay(1,1)
  x1 = 1:8~x[,1]
  x2 = 1:8~x[,2]
  x3 = 1:8~x[,3]
  x4 = 1:8~x[,4]

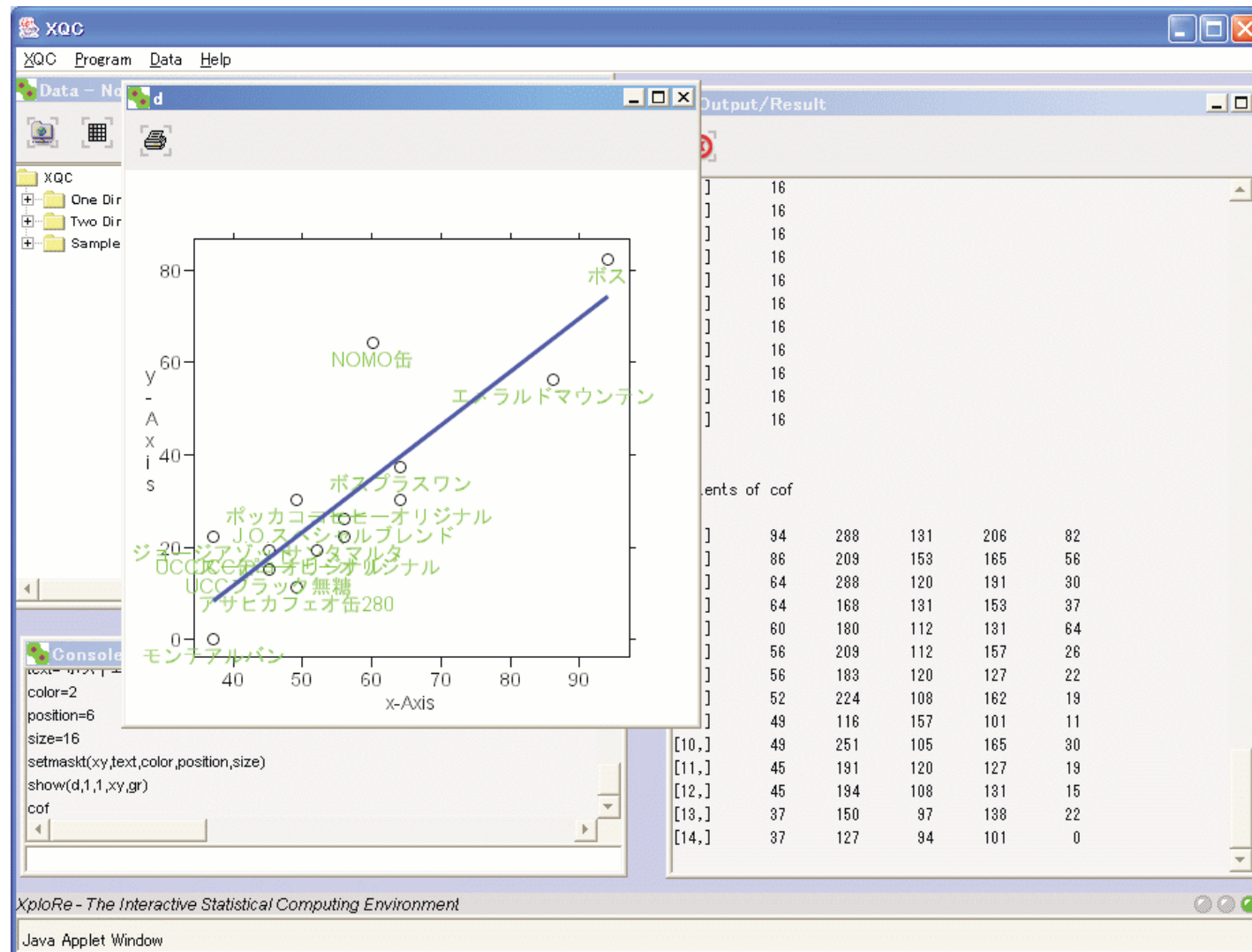
  setmask1(x1,(1:8)',1,1,4)
  setmask1(x2,(1:8)',2,1,4)
  setmask1(x3,(1:8)',3,1,4)
  setmask1(x4,(1:8)',4,1,4)

  show(d,1,1,x1,x2,x3,x4)
  setgopt(d,1,1,"title","Term structure","xLabel","Subindex","yLabel","Percentage [%","yvalue",0|1,"xmajor",
endp

XFGiv03()
  
```

The "Output/Result" window on the right displays the message: "Welcome to XploRe Quantlet Client Version 1.2".

The taskbar at the bottom shows various open applications, including "Start", "Yahoo...", "SMS...", "www...", "Win...", "Appl...", "obra...", "XploRe", "Zube...", "xfg0...", and "XQC". The system clock shows 15:10.



e-learning/e-teaching

are the basis for

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e-science

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e-science

and

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Cramer, E., Cramer, K. & Kamps, U. (2002). e-stat: A Web-based Learning Environment in Applied Statistics. *Härdle, W., Rönz, B., Compstat 2002, Proceedings in Computational Statistics*, Physica-Verlag, Heidelberg, New York, 309–314.



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