

Experiences with International Web-based Introductory Long-Distance Statistics Courses

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Part I: Overall Structure

Introduction

- Stat 2000: Introduction to Statistical Methods
- Utah State long-distance course
- 3 sessions offered 2004 in Hong Kong
 - Spring (15 weeks, 01/12-04/19): 60 students
 - Summer 1 (12 weeks, 02/23-05/10): 30 students
 - Summer 2 (15 weeks, 04/26-08/02): 89 students

US Setup: Course Structure

- Use of electronic textbook CyberStats (first use outside North America)
- ~2 CyberStats subunits assigned per week
- 1 main instructor in US
- 1 local instructor in Hong Kong
- Students have to work fully electronically:
 - No printed textbook required (but optionally available)
 - Web-based homework submission and grading
 - Web-based exams and grading
 - Communication via message board & e-mails

Course Map

Units A - Collecting and Visualizing Data

Units B - Modeling Random Behavior

Units C - Inference

Units D - Regression

Units E - Design of Experiments and ANOVA

Units F - Time Series

Units G - Statistical Process Control

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US Setup: Electronic Exams

- Web-based exams:
 - 3 in Spring
 - 2 in Summer 1 & 2
- Exams taken in Hong Kong classroom
- Multiple-choice questions and text-based questions to be answered via CyberStats password-protected html Web page
- Question order randomized for each student, but identical questions within each group

US Setup: Electronic Grading

- Grading via html Web page with forms for points and instructor comments
- ALL answers (including duplicated ones) for a questions for ALL students visible at the same time
- Future research question: in which way do students change their answers?

US Setup: Problems & Solutions (1)

- 7 students involved in cheating in final exam in Spring (awarded F), e.g., Question 39:
 - 1244x: [ServerTime Apr-21-2004 10:46:52 PM]
there has three outliers , and the data is fairly symmetric
 - 1257x: [ServerTime Apr-21-2004 10:54:14 PM]
there are no outliers. The boxplot shows that there is fairly symmetric.
 - 1257x: [ServerTime Apr-21-2004 11:18:37 PM]
there has three outliers , and the data is fairly symmetric
- Solution: Additional proctors in back of the classroom

US Setup: Problems & Solutions (2)

- Almost impossible to motivate students to participate in discussion via message board; too shy or language problems ?
- Solution: none so far

Hong Kong Setup: Weekly Meetings (1)

- Weekly meetings of 180 minutes, mostly in computer lab
 - 10 min computer setup
 - 75 min lecture period
 - 5 min break
 - 75 min lecture period
 - 15 min Q & A period
- In lecture period: discussion of course material & work with WebStat & other interactive tools
- In Q & A period: Homework questions and further work with interactive tools

Hong Kong Setup: Weekly Meetings (2)

- Attendance above 90% at start of the semester
- Attendance gradually decreased to about 70%
- Exception: Close to 100% before exams
(discussion of sample exams)

Hong Kong Setup: Electronic Homework Submission & Grading

- Almost 100% of homeworks submitted electronically
- About 60% to 70% of homeworks submitted on time
- Grading of homeworks:
 - “In my opinion, it’s really convenient to grade the homework online in CyberStats.” (Alex, Local Hong Kong Instructor)

Hong Kong Setup: Problems & Solutions

- Some technical problems with CyberStats
- Sometimes slow to access CyberStats
- Sitemap would be helpful
- Solutions: Communication with CyberStats developers; possibly CyberStats mirror site?

Student Survey (1)

- After the final exam
- No extra credit in Spring: 5 / 58 responses from students attending the final exam
- 20 points (towards 1000 points score) in Summer 1 & 2: 27 / 27 and 60 / 81 responses (59 / 69 from students eventually passing the course)
- 25 (Spring) and 23 (Summer 1 & 2) questions on:
 - General
 - Instruction
 - CyberStats
 - Exams
 - Demographics/Personal
- Non-anonymous responses, due to CyberStats; any answer (including “NA”) was acceptable

Student Survey (2)

- Results for Summer 2 session only (60 responses):
 - Demographics: about 50% male & 50% female; mostly early 20ies; English as a secondary language
 - For most students, this was their first statistics course
 - Students generally satisfied with overall quality of the course and instruction
 - 19 students found this course better than other distance learning courses they took before
 - Some students complained about computer shortage and fast pace of local instructor

Student Survey (3)

- Results for Summer 2 session only (continued):
 - 27 students found CyberStats terrible, or were not very happy about it; 17 students liked it
 - Favorite CyberStats feature: WebStat and possibility to analyze data directly; not so popular: message board and e-notes
 - Time and difficulty level of exams appropriate for most students
 - Favorite exam questions: multiple-choice; least-favorite: text-based questions, with or without interactive tools

Conclusions

- Overall positive experience for US Instructor
- “Convenient, user-friendly, excellent aid from calculators and WebStat during the class.” (Alex, Local Hong Kong Instructor)
- We continued to use CyberStats in Fall 2005
- Changes to be expected due to new CyberStats owner (Thomson Publishing)

Part II: Exam Question Order and Student Behavior

Exam Structure (1)

- Analysis of Spring 2004 exam data only
- 3 electronic exams through CyberStats
- 2 question types:
 - multiple-choice (m)
 - text-based (t)
- Midterm 1: 60 min -15 m, 10 t - 59 students
- Midterm 2: 60 min -15 m, 10 t - 57 students
- Final: 180 min - 25 m, 25 t - 58 students

Exam Structure (2)

- For each student, for each exam, question order randomized as:
 - [1] first multiple-choice, then text
 - [2] first text, then multiple-choice
 - [3] multiple-choice & text fully randomized
- Each student had each order type once, e.g., [2] in Mid 1, [3] in Mid 2, [1] in Final
- About 10 students for each of the 6 permutations of question order type
- Record each answer and time of submission

Exam Structure (3)

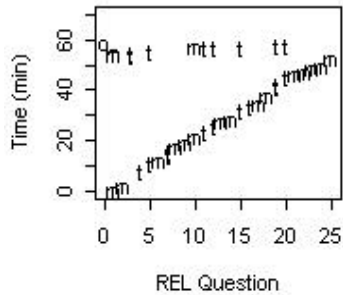
- All 25 (or 50) questions displayed via a single html page
- Students allowed (and encouraged) to answer questions in any order:
 - You have **exactly 60 minutes** to complete the exam. Any items submitted after 60 minutes will not be graded. Try to correctly answer as many questions as possible during this time period. **You are allowed to answer questions in any order.** Start with a question that seems the easiest for you. If you cannot answer a question within a short time, move to another question, and come back to the previously unanswered questions toward the end of the exam. [Introduction for Midterm 1]

Research Questions

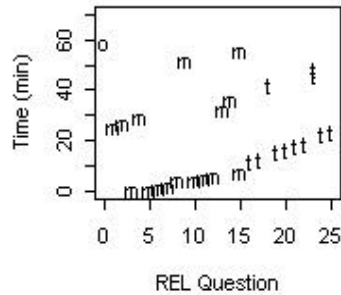
- *Fact: Question Order Effect well-known for Sample Surveys*
- In which order do students answer the questions?
- Do students speed up towards the end of the exam period?
- Do students have a preference when to answer multiple-choice and text questions?

VA2: Answer Time for each Question

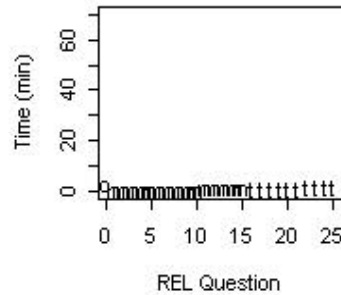
Mid 1: Student 1



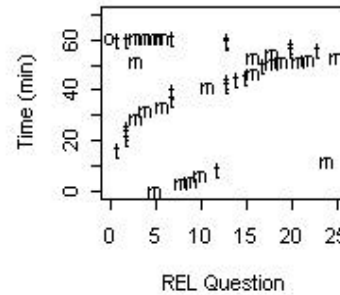
Mid 1: Student 2



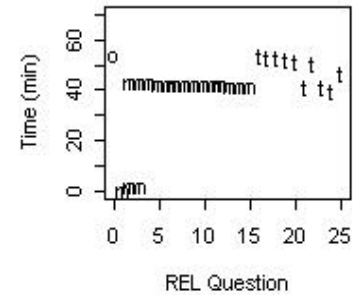
Mid 1: Student 3



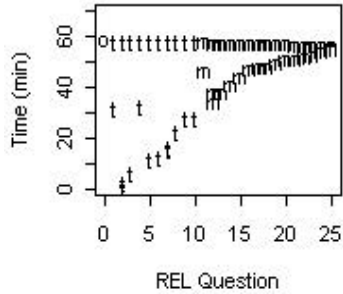
Mid 1: Student 4



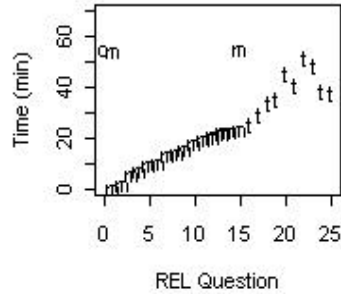
Mid 1: Student 5



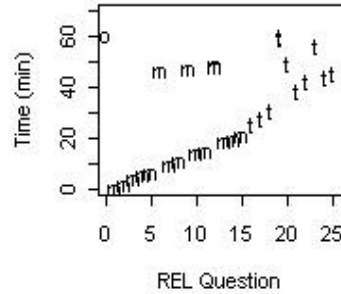
Mid 1: Student 6



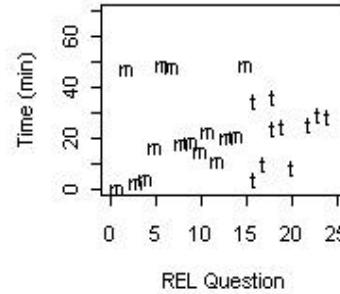
Mid 1: Student 7



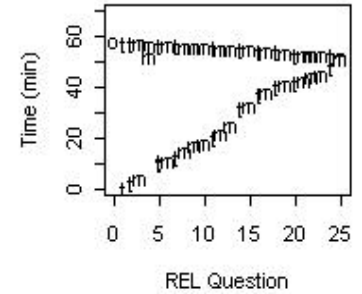
Mid 1: Student 8



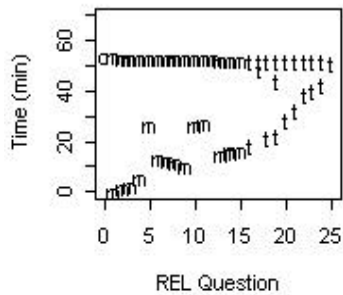
Mid 1: Student 9



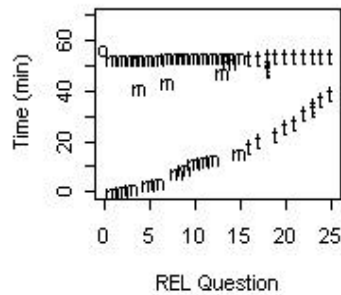
Mid 1: Student 10



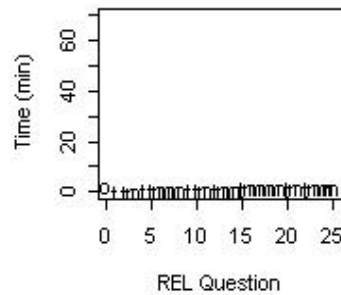
Mid 1: Student 11



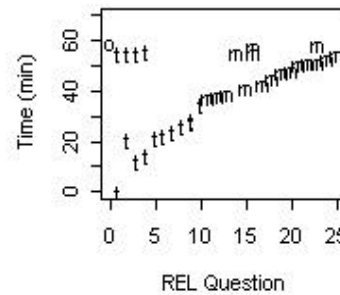
Mid 1: Student 12



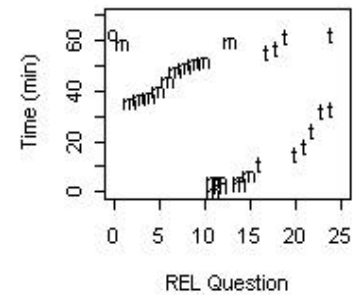
Mid 1: Student 13



Mid 1: Student 14

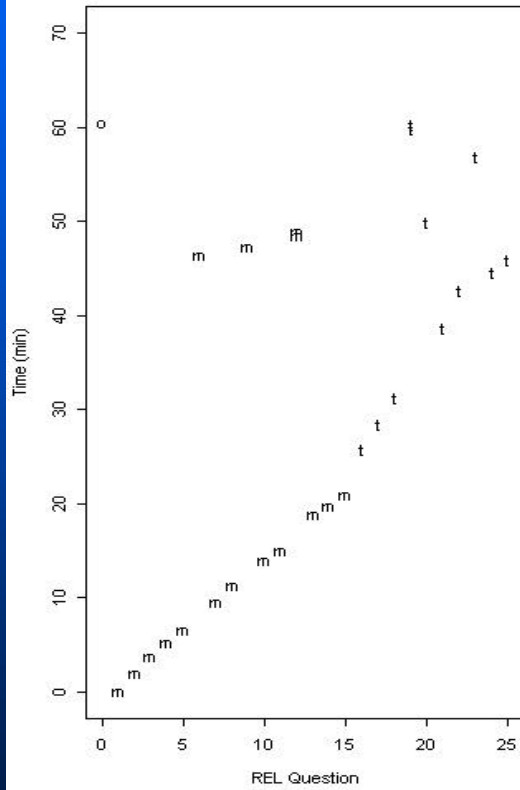


Mid 1: Student 15

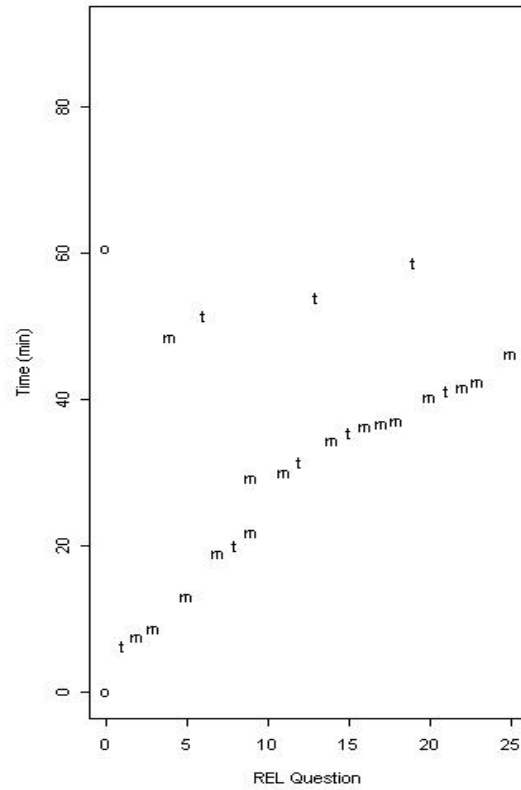


VA3: Sequential Answers (1 Student)

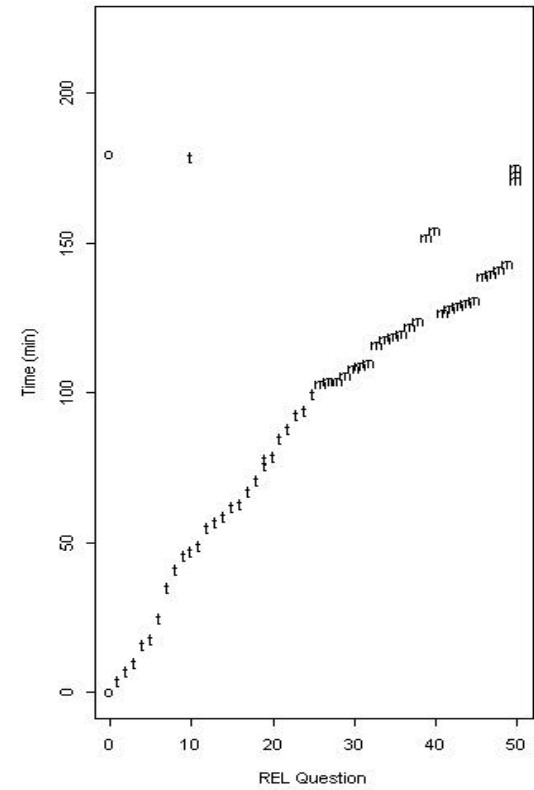
Mid 1: Student 8



Mid 2: Student 8

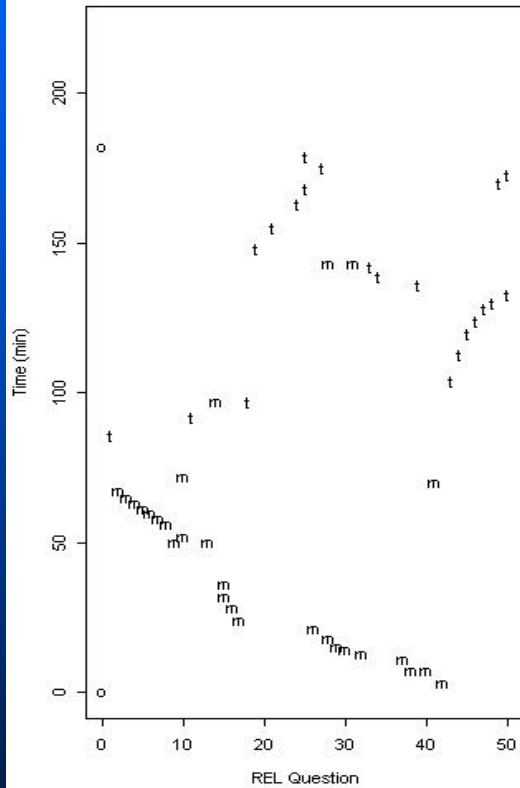


Final: Student 8

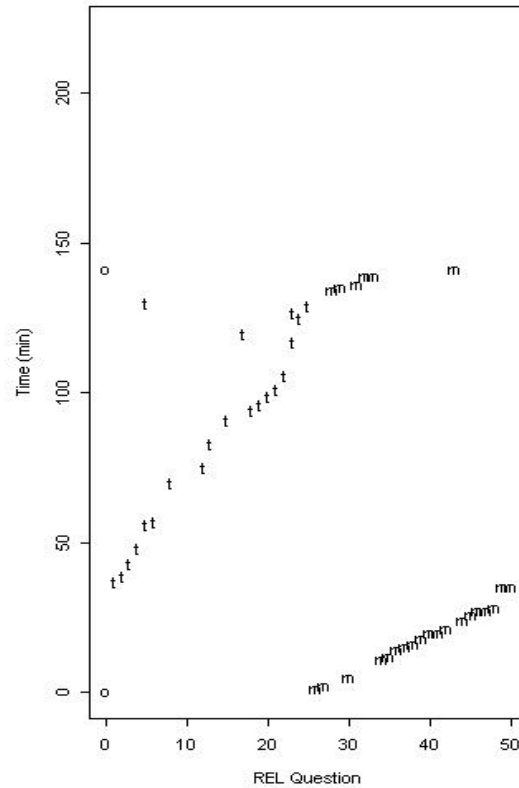


VA4: M-first Answers (3 Students)

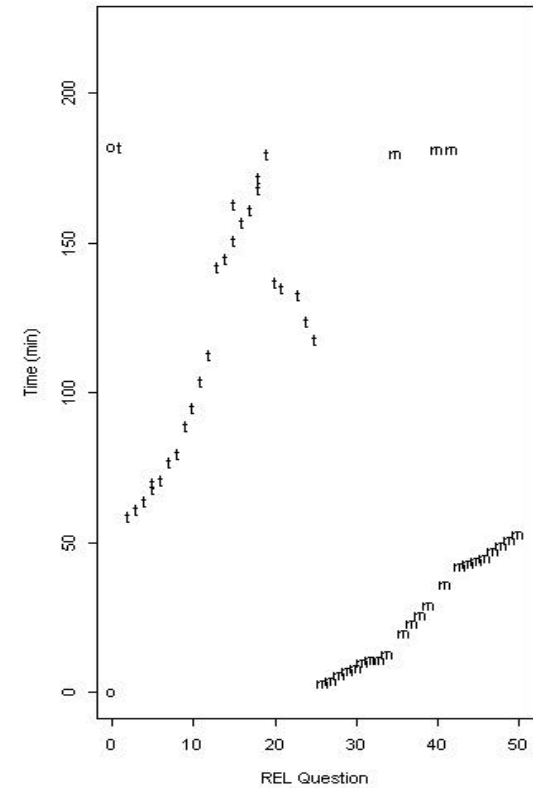
Final: Student 5



Final: Student 16

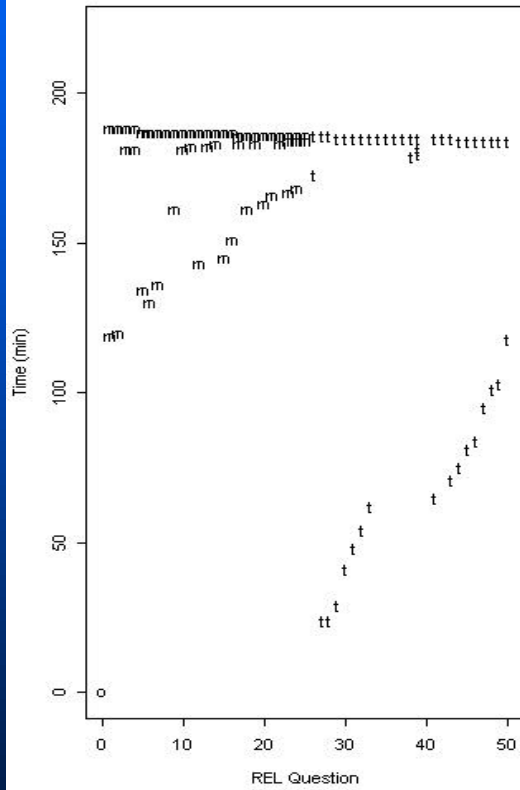


Final: Student 25

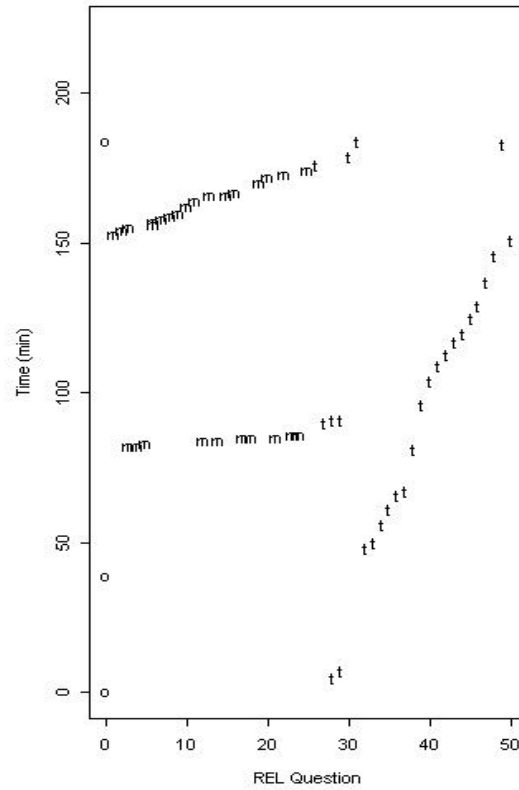


VA5: T-first Answers (3 Students)

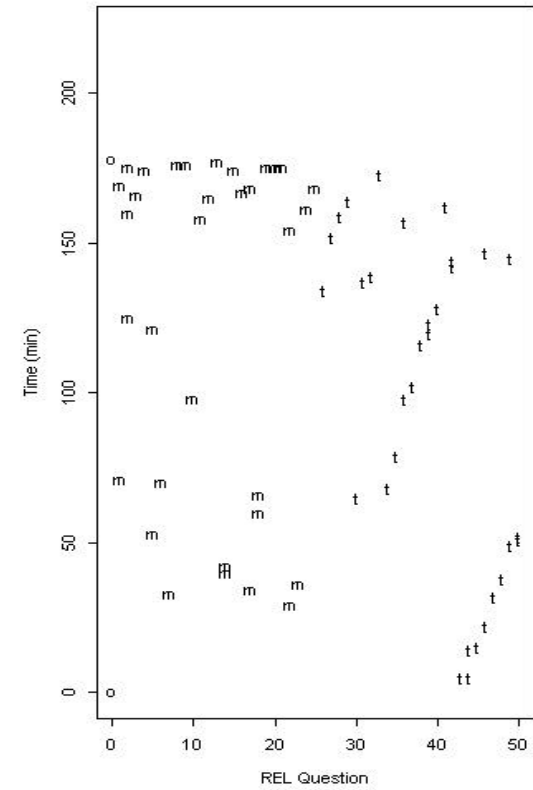
Final: Student 46



Final: Student 56

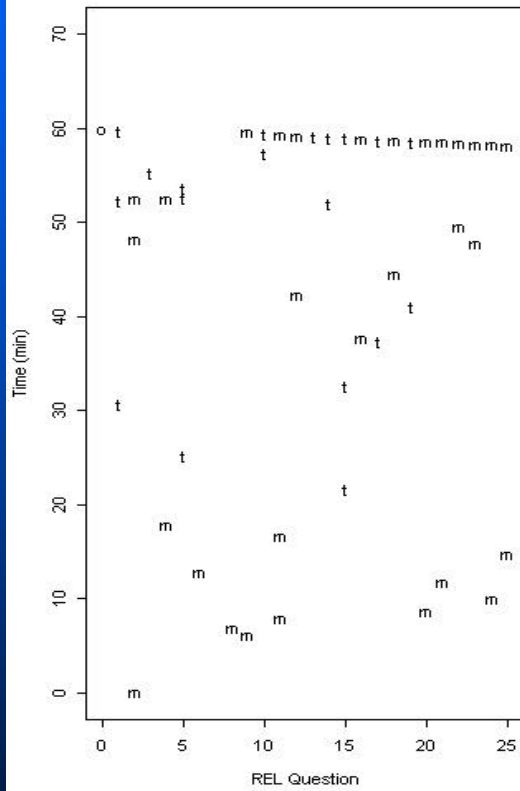


Final: Student 43

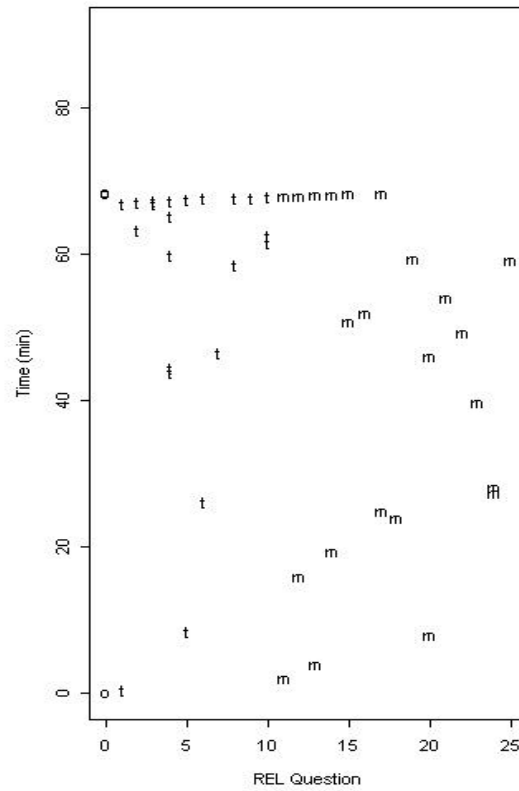


VA6: Random Answers (1 Student)

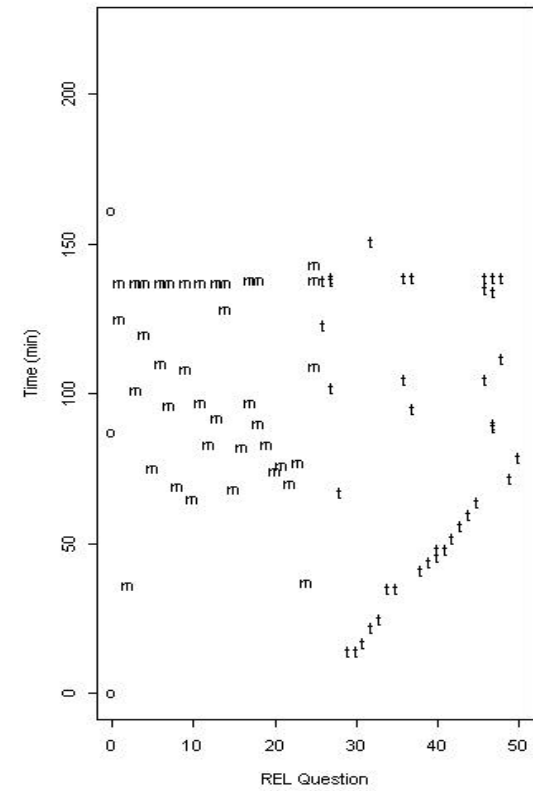
Mid 1: Student 27



Mid 2: Student 27

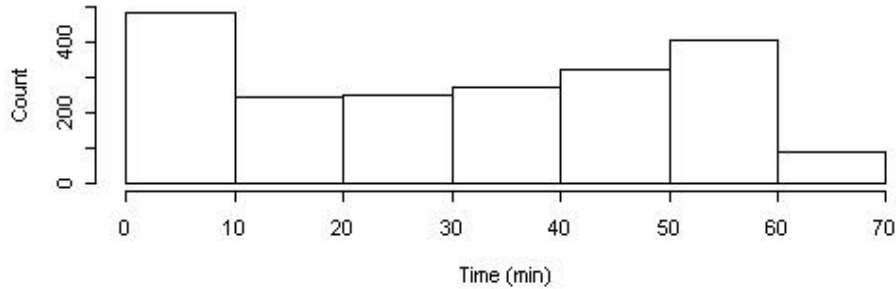


Final: Student 27

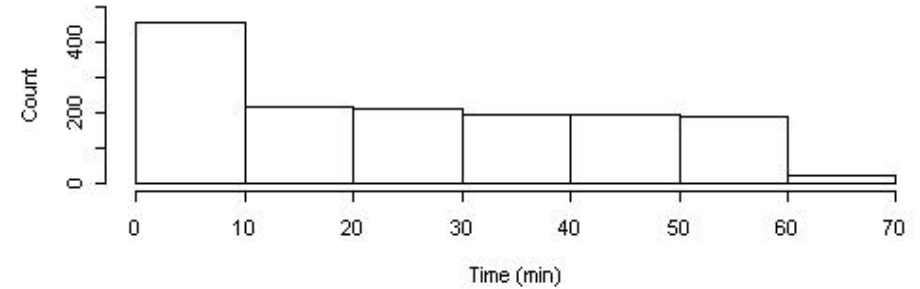


VA7: Answers per Time Interval

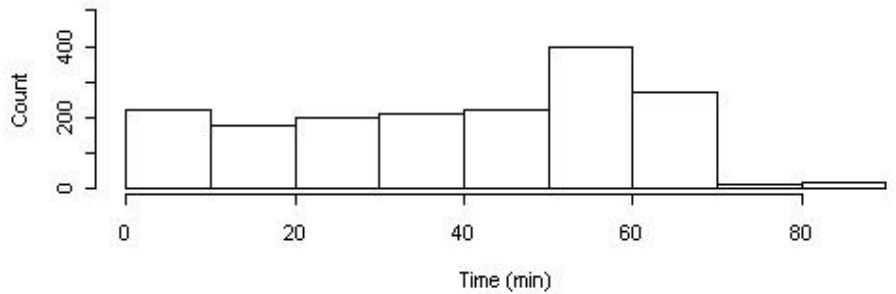
Mid 1: All Students - All Answers



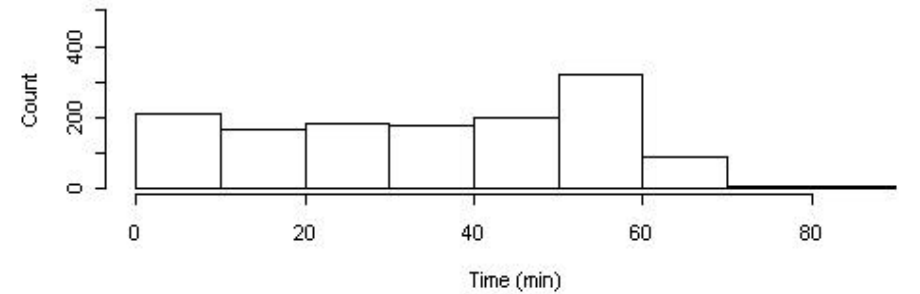
Mid 1: All Students - First Answer



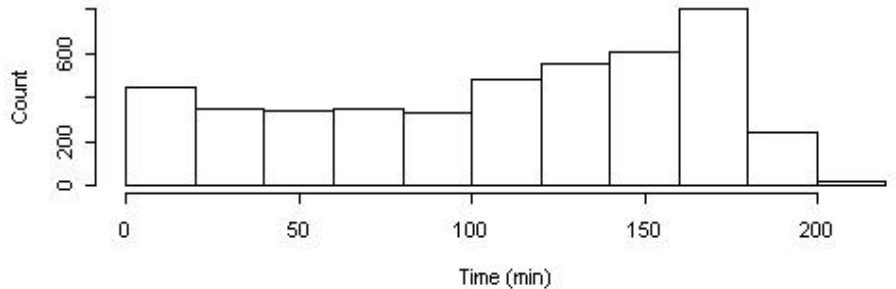
Mid 2: All Students - All Answers



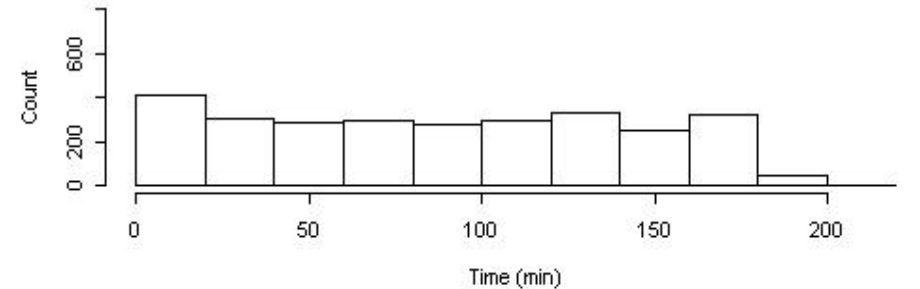
Mid 2: All Students - First Answer



Final: All Students - All Answers

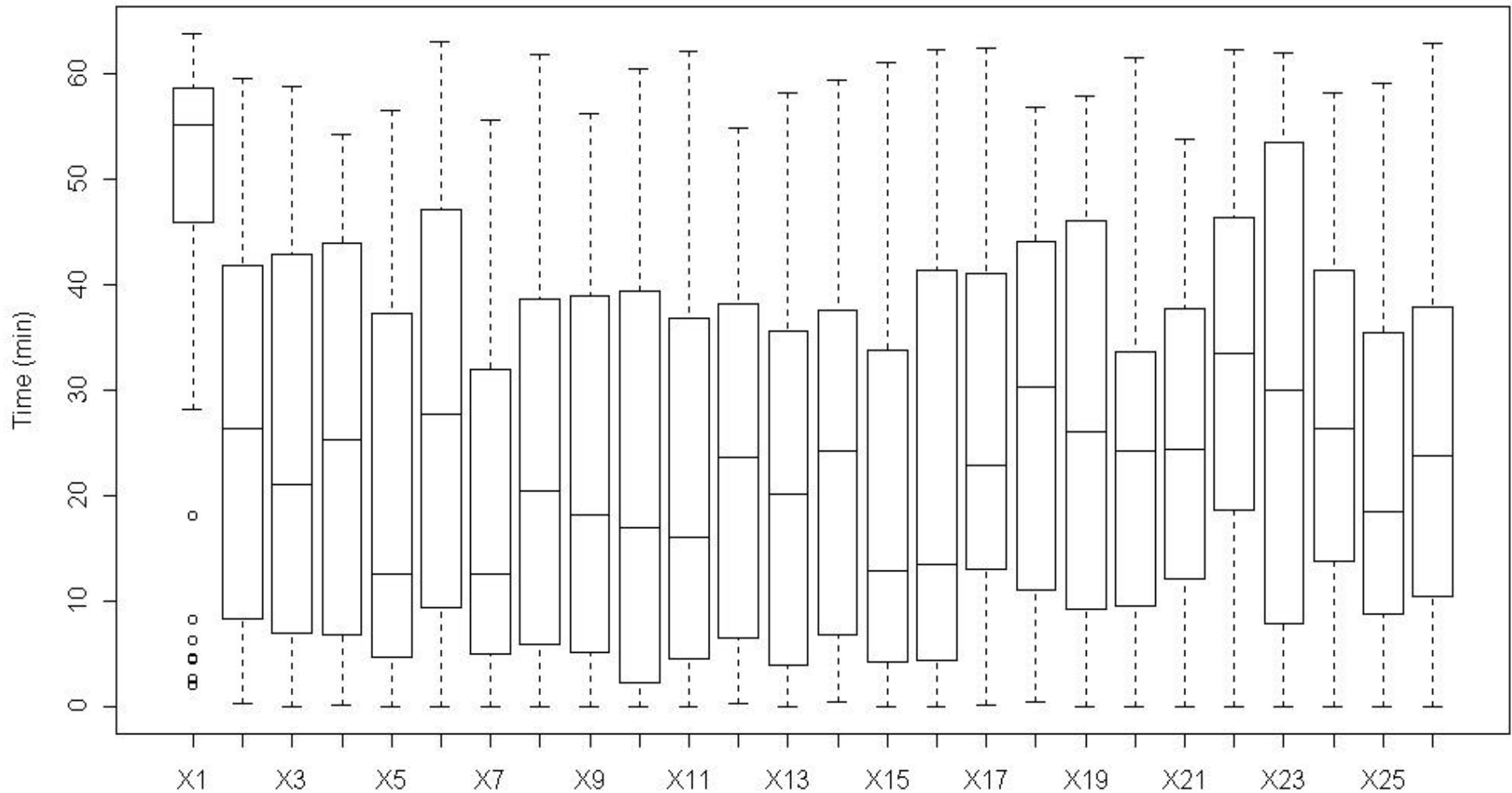


Final: All Students - First Answer



VA8: Answers per Time Interval

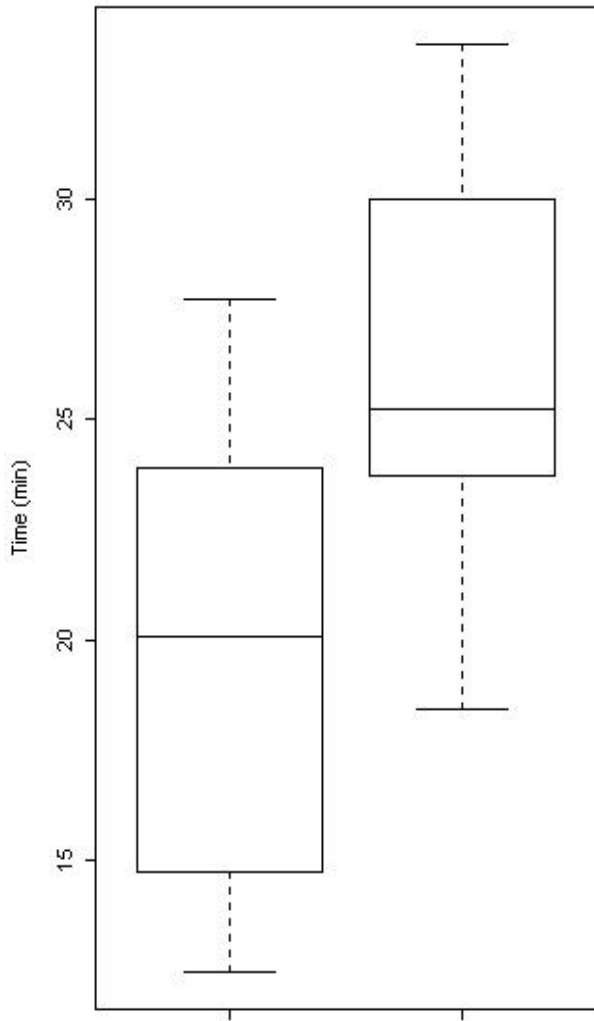
Mid 1: Boxplot of First Answer Times by Question



Questions: X1 = Intro, X2 = Q1, ..., X26 = Q25

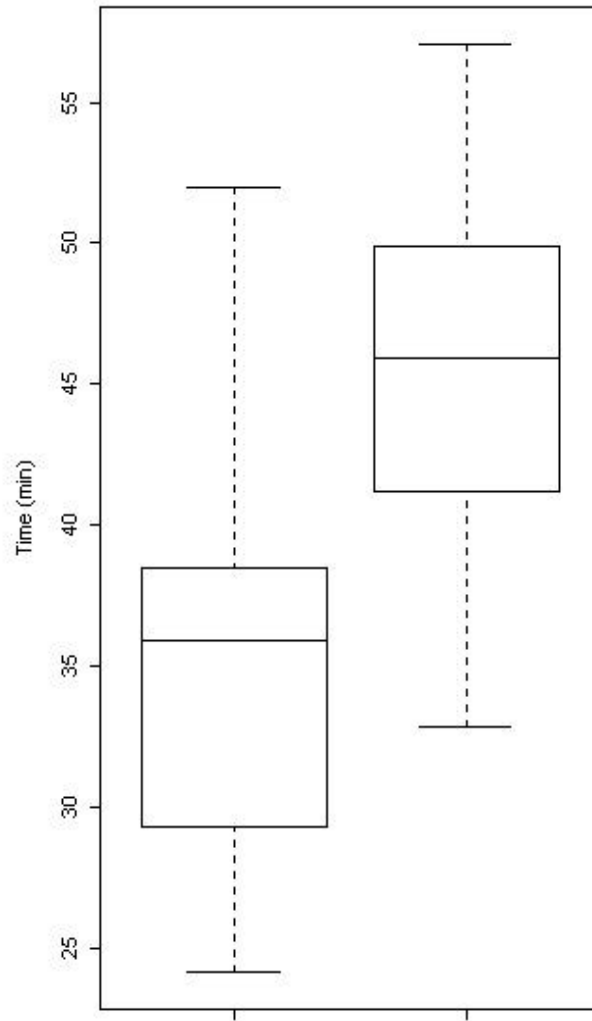
VA9: Answers per Time Interval

Mid 1: Boxplot of Median First Answer Times



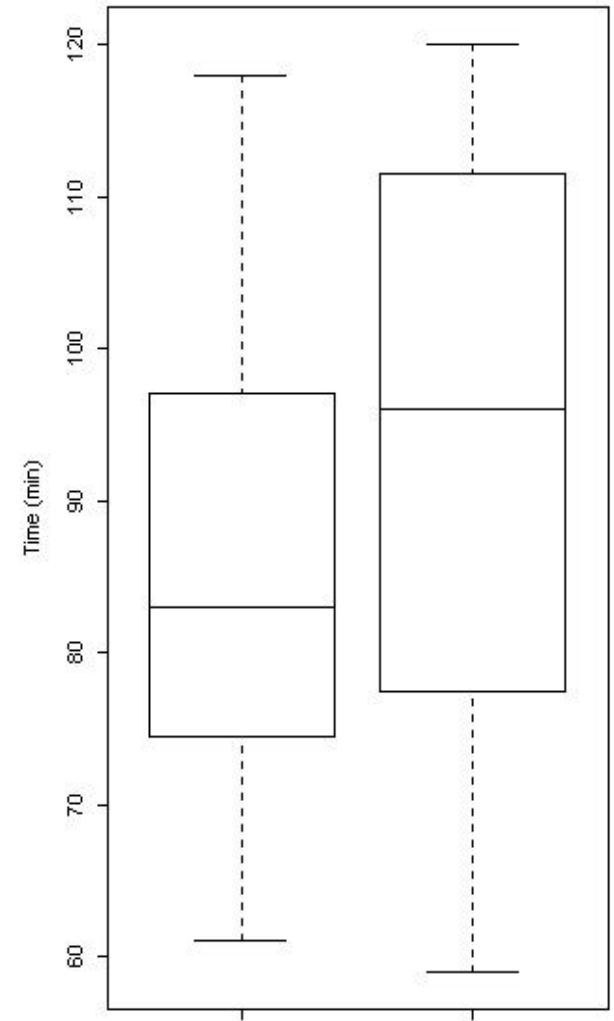
Question Type: left = Multiple Choice, right = Text

Mid 2: Boxplot of Median First Answer Times



Question Type: left = Multiple Choice, right = Text

Final: Boxplot of Median First Answer Times



Question Type: left = Multiple Choice, right = Text

Conclusions (1)

- Q: In which order do students answer the questions?
- A: There are different student “types”:
 - mostly sequential
 - multiple-choice first
 - text first
 - random

Conclusions (2)

- Q: Do students speed up towards the end of the exam period?
- A: Student frequently change (or resubmit) answers towards the end. No noticeable increase in Midterm 1 & Final, but some increase in Midterm 2.

Conclusions (3)

- Q: Do students have a preference when to answer multiple-choice and text questions?
- A: The medians of the times multiple-choice questions get answered are smaller than the medians of the times text questions get answered.

Future Work (1)

- Continue visual analysis to generate further hypotheses:
 - associate scores with question order type
 - associate scores with student “type” (e.g., does random answering order result in more/less points?)
- Use additional data (Summer 2004/1: 29 students, Summer 2004/2: 87 students) for statistical inference

Future Work (2)

- Link survey answers to overall student performance
- Further analysis of repeated / changed student exam answers (@ JSM 2006)

References

- Symanzik, J., Erbacher, R., Gaenir, P., Vukasinovic, N., Wun, A. C. K. (2004): On the Effect of the Ordering of Questions in Exams - A Visual Analysis, 2004 Proceedings, American Statistical Association, Alexandria, Virginia, CD.
- Symanzik, J., Vukasinovic, N. (2003): Comparative Review of ActivStats, CyberStats, and MM*Stat, MSOR Connections (LTSN Maths, Stats & OR Newsletter), 3(1): 37-42.
- Symanzik, J., Vukasinovic, N. (2006): Teaching Introductory Statistics with CyberStats, Journal of Statistics Education, Accepted.
- Symanzik, J., Vukasinovic, N., Wun, A. C. K. (2005): Experiences with International Web-Based Introductory Long-Distance Statistics Courses, 2005 Proceedings, American Statistical Association, Alexandria, Virginia, CD, Forthcoming.

The background is a blue gradient, transitioning from a lighter blue at the top to a darker blue at the bottom. Overlaid on this gradient are several diagonal stripes of a slightly different shade of blue, running from the top-left towards the bottom-right.

Questions ?