

**STAT 511**

**Spring 2002**

**Course Information**

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**Textbooks:**

Rencher, A. C.,  
*Linear Models in Statistics*  
Wiley, 2000.

Neter, Kutner, Nachtsheim & Kutner,  
*Applied Linear Statistical Models*, 4th  
edition, Irwin, Chicago, 1996.

**Course Web Page:**

[http://www.public.iastate.edu/~kkoehler/  
stat511/stat511.html](http://www.public.iastate.edu/~kkoehler/stat511/stat511.html)

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**Supplemental Readings:**

Supplemental readings will be posted on the Electronic Reserve System of the Parks' Library. A link to this site will be created on the course web page

Other books have been put on reserve at the Parks' Library Reference Desk. A list of these books is available from the course web page.

**Course Notes:**

As they become available copies of transparencies will be available from the course web page. These are dbf files with four slides per page.

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## Computation:

One objective of this course is to introduce S-PLUS. Data files and files containing examples of S-PLUS and SAS code can be copied from the course web page. One book that provides information and examples for performing calculations and making graphs and displays with S-PLUS is

Venables, W. N. and Ripley, B. D.,  
*Modern Applied Statistics with S-PLUS, third edition,*  
Springer, 1999

References to this book appear in the course notes.

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## S-Plus 6 for Windows

On the PC's in Snedecor 321

For a free copy for your own PC contact

Sheri Martinez, 117 Snedecor

## S-Plus 5.2 for Unix

On the VINCENT network of workstations

## SAS

Available on PC's and on the VINCENT network of workstations

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**Grades:** About nine assignments (15%)  
Midterm exam (25%)  
Take home exam (25%)  
Final Exam (35%)

You should have a calculator that you can bring to exams.

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## Course Outline

<u>Topic</u>	<u>Readings</u>
1. Matrix algebra, graphs, S-PLUS computations	Rencher, Chapters 1-3 Getting Started with S-PLUS 6 for Windows (S-Plus online help)
2. Linear Models: Least Squares Estimation	Rencher, Ch. 11 (ANOVA) Chapter 7 (Regression)
3. Linear Models: Normal Theory Inference	Rencher, Chapters 4&5
4. Linear Models: ANOVA, Unbalanced Experiments	Rencher, Chapters 13&14 NKNW, Chap. 22, Sec. 23.6
5. Mixed Models (linear models with both fixed and random components)	Rencher, Chapter 16 NKNW, Chapters 24, 28, 29 SR1: Engel, <i>Stat.Neer.</i> ,1990
6. Non-linear Models	Rencher, Section 17.1 NKNW, Chapter 13 SR2: Bates & Watts, 1988, pp 67-131.
7. Generalized Linear Models	Rencher, Chapter 17 NKNW, Chapter 14
8. The Bootstrap and Simulation in S-PLUS	SR4: Efron & Tibshirani, <i>Stat. Sci.</i> 1986
9. Model Free Curve Fitting	SR5: Hastie & Tibshirani, 1990, pp 9-35.
10. Generalized Additive Models	SR6: Hastie & Tibshirani, <i>Stat. Sci.</i> 1986

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## References

### I. Matrix Algebra:

1. Searle, S. R., 1982, *Matrix Algebra Useful for Statistics*,
2. Graybill, F. A. 1983, *Matrices with Applications in Statistics*, 2nd edition.
3. Harville, D. A., 1997, *Matrix Algebra for a Statistician's Perspective*, Springer-Verlag, New York.
4. Scheffe', H., 1959, *The Analysis of Variance*, Wiley, New York. (Appendix 1)

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### II. Linear Models:

1. Searle, S. R. 1971, *Linear Models*, Wiley, New York.
2. Searle, S. R., 1987, *Linear Models for Unbalanced Data*, Wiley, New York.
3. Christenson, R. 1987, *Plane Answers to Complex Questions: The Theory of Linear Models*, Springer-Verlag, New York.
4. Jorgensen, B., 1993, *The Theory of Linear Models*, Chapman & Hall
5. Stapleton, J. H., 1995, *Linear Statistical Models*, Wiley, New York.
6. Wang, S. G. and Chow, S.-C., 1994, *Advanced Linear Models – Theory and Applications*, Marcel-Dekker

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### III. Mixed models

1. Pinheiro, J. C. and Bates, D. M., 2000, *Mixed-Effects Models in S and S-PLUS*, Springer-Verlag, New York. ISBN 0-387-98957-9 QA76.73.S15 P56 2000
2. Littell, R. C., Milliken, G. A., Stroup, W. W., and Wolfinger, R. D., 1996, *SAS System for Mixed Models*, Cary, N.C., SAS Institute, Inc.
3. Engel, B., 1990, The Analysis of Unbalanced Linear Models with Variance Components, *Statistica Neerlandica*, 44, pp 195-219.
4. Searle, S. R., Casella, G. and McCulloch, C. E., 1992, *Variance Components*, Wiley, New York.

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### IV. Bootstrap and resampling methods

1. B. Efron and R. Tibshirani, 1986, Bootstrap Methods for Standard Errors, Confidence Intervals, and other Measures of Statistical Accuracy *Statistical Science*, **1**, pp 54-77.
2. B. Efron and R. Tibshirani, 1993, *An Introduction to the Bootstrap*, Chapman & Hall, London.
3. A. C. Davison and D. V. Hinkley, 1997, *Bootstrap Methods and their Applications*, Cambridge University Press
4. Chernick, M. C. 1999, *Bootstrap Methods: A Practitioner's Guide*, Wiley, New York.

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## V. Non-linear Models:

1. Bates, D. M. and Watts, D. G., 1988, *Nonlinear Regression Analysis and Its Applications*, Wiley, New York.

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## VI. Generalized Linear Models:

1. McCullagh, P. and Nelder, J. A., 1989, *Generalized Linear Models*, 2nd edition, Chapman & Hall
2. Dobson, A. J., 1990, *An Introduction to Generalized Linear Models*, Chapman & Hall
3. D. Firth, Generalized Linear Models in *Statistical Theory and Modelling*, (D.V. Hinkley, N. Reid, E.J. Snell, eds.) 1991, Chapman & Hall (Chapter 3)
4. Collett, D., 1991, *Modelling Binary Data*, Chapman & Hall

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## VII. Model Free Curve Fitting

1. T. J. Hastie and R. J. Tibshirani, 1986, Generalized Additive Models, *Statistical Science*, 1, pp 297-318.
2. T. J. Hastie and R. J. Tibshirani, 1990, *Generalized Additive Models*, Chapman & Hall

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## Information on S-PLUS:

Manuals: (Available in Snedecor 115)

- S-PLUS 5: Guide to Statistics for UNIX
- S-PLUS 5: User's Guide for UNIX
- S-PLUS 5: Guide to Statistics, Vol 1 & 2

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- S-PLUS 6 for Windows: Getting Started
- S-PLUS 6 for Windows: Programmer's Guide
- S-PLUS 6 for Windows: User's Guide
- S-PLUS 6 for Windows: Guide to Statistics,  
Vol 1 & 2

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## Books

1. Krause, A., and Olsen, M., 2000, *The Basics of S and S-PLUS*, 2nd edition, Springer-Verlag.
2. Venables, W. N., and Ripley, B. D., 1999, *Modern Applied Statistics with S-PLUS*, 3rd edition, Springer-Verlag.

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## Websites:

- Insightful's S-plus home page  
<http://www.splus.com/>
- FAQ by Insightful (frequently asked questions)  
<http://www.insightful.com/support/faq.asp>
- FAQ for S-Plus  
<http://www.stat.math.ethz.ch/S-FAQ/>
- S-News (a mailing list for S and S-Plus)  
<http://www.biostat.wustl.edu/s-news/>
- Venables & Ripley  
<http://www.stats.ox.ac.uk/pub/MASS/>

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- Statlib: <http://lib.stat.cmu.edu>
  - click on S Archive to see a list of contributed S software
  - Click on S-News to access a searchable database of mail messages to the S-News mailing list.
- R home page (free system)  
<http://www.stat.auckland.ac.nz/rproj.html>

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