Math 585, **Multivariate Analysis** Spring 2024. MWF 3:3:50, Neckers 156
Instructor: David Olive

Text: Olive, D.J. (2017), *Robust Multivariate Analysis*, Springer, New York, NY.

You may use the earlier online version (http://parker.ad.siu.edu/Olive/mrun.pdf): Olive (2012) *Robust Multivariate Analysis*.

Course Webpage:

This text is also useful. Johnson, R.A., and Wichern, D.W. (1988), *Applied Multivariate Statistical Analysis,* 2nd ed., Prentice Hall, Englewood Cliffs, NJ.

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I am also available by appointment and on a walkin basis, especially before and after class.

The *prerequisites* for this class are a Calculus based introduction to Probability or Statistics (eg Math 483 and Linear Algebra (eg Math 221). You should be familiar with vectors, matrices, eigenvalues, eigenvectors, inverse matrix, transpose, the normal and chisquare distributions, and hypothesis testing.

This course covers robust multivariate analysis. The classical multivariate method and a robust multivariate method will be given for several common techniques. Topics include i) classical and robust estimators of multivariate location and dispersion, ii) multivariate normal and elliptically contoured distributions, iii) the DD plot for outlier detection and for determining whether the data is from a multivariate normal distribution or some other elliptically contoured distribution, iv) generalized variance, v) classical and robust analogs of the Hotelling's T^2 test, vi) MANOVA, vii) Multivariate Regression, viii) classical and robust methods of Principal Component Analysis, ix) Factor Analysis, x) classical and robust methods of Canonical Correlation Analysis, xi) Discriminant Analysis. xii) Clustering may be covered if there is time.

The free statistical software *R* will be heavily used, and *SAS* will be used. and we will meet in the Math computer lab Neckers 258 several times.

Final: Day and time TBA week of May 6-May 10 in Neckers 156.

The grading and schedule below are tentative. (Drop paper work Friday March 29 with an advisor, last drop day Sunday, March 31 online.)

Except for the last week of classes, 2 homeworks may be turned in one class period late (ie on Monday) with no penalty. A third late will be accepted with 25% penalty. One or more sheets of notes will be allowed on quizzes and exams. A calculator is permitted. I sometimes give $A-$, $B+$, $B-$, and $C+$.

Grading:

HW	300		Quizzes	100	
exam1	100	exam 2	100	exam 3	100
final	300	or project		total	1000
min. grade	points	min. grade	points	min. grade	points
A	900-1000	B	800-899	C	700-799
D	550-699				

Parentheses for Johnson and Wichern (1988).

Week of	MON	WED	FRI
Jan 15	no class	2.1, (1.3)	2.2, (2.5,2.6)
Jan 22	2.2, (2.5, 2.6)	3.1 (4.2) (4.3), Q1	3.1, (4.3), HW1
Jan 29	3.2, (4.4, 4.5)	3.2, (4.6), Q2	3.2, (4.7), HW2
Feb 5	lab	2.3, (3.2, 3.3), Q3	3.1, (3.3), HW3
Feb 12	3.4, (3.4, 3.5)	Exam 1	6.1,(8.2)
Feb 19	6.1, (8.3)	6.2, (8.4, 8.5), Q4	7.1, (10.2), HW4
Feb 26	lab	7.1, (10.3), Q5	7.2, (10.4), HW5
March 4	7.2, 8.2, (10.6, 11.2)	Exam 2	8.2, (11.3, 11.4)
March 11	no class	no class	no class
March 18	lab	8.3, (11.5, 11.6), Q6	8.3, (11.7), HW6
March 25	8.5, (11.8)	9.1, (5.2), Q7	9.2, (5.3), HW7
April 1	9.2, (5.5)	10.3, (6.3), Q8	10.3, (6.4), HW8
April 8	no class	10.4, (6.7), Q9	11.1, (9.2, 9.3), HW9
April 15	11.2, (9.4, 9.5)	12.1, (7.2), Q10	HW10
April 22	lab	12.1, (7.2), Q11	12.2, (7.3), HW11
April 29	12.3, (7.3,7.4)	Exam 3	12.3 ,(12.3)

Similar material on multivariate linear regression is at (http://parker.ad.siu.edu/Olive/slch10.pdf) and (http://parker.ad.siu.edu/Olive/linmodch8.pdf). Similar material on one way MANOVA is at (http://parker.ad.siu.edu/Olive/linmodch9.pdf).