Handout #3

Bumpus (1898) collected data on $n = 49$ moribund female sparrows after a severe storm. Measurements were made on $p = 5$ characteristics: X_1=total length (mm); X_2=alar (wing) length (mm); X_3=length of beak and head (mm); X_4=length of humerus (mm); and X_5=length of keel of sternum (longitudinal length of breast bone, mm). Subsequently, 28 of the 49 female sparrows died.

Run the R-code below and examine the results. Note that the 3d plot appears in a new window and is interactive.

```
#
# R commands for multivariate data description and graphical calculation
#
# Bumpus Sparrow Data from Manly
#
TX <- c(1,156,245,31.6,18.5,20.5,1,
2,154,240,30.4,17.9,19.6,1,
3,153,240,31,18.4,20.6,1,
4,153,236,30.9,17.7,20.2,1,
5,155,243,31.5,18.6,20.3,1,
6,163,247,32,19,20.9,1,
7,157,238,30.9,18.4,20.2,1,
8,155,239,32.8,18.6,21.2,1,
9,164,248,32.7,19.1,21.1,1,
10,158,238,31,18.8,22,1,
11,158,240,31.3,18.6,22,1,
12,160,244,31.1,18.6,20.5,1,
13,161,246,32.3,19.3,21.8,1,
14,157,245,32,19.1,20,1,
15,157,235,31.5,18.1,19.8,1,
16,156,237,30.9,18,20.3,1,
17,158,244,31.4,18.5,21.6,1,
18,153,238,30.5,18.2,20.9,1,
19,155,236,30.3,18.5,20.1,1,
20,163,246,32.5,18.6,21.9,1,
21,159,236,31.5,18,21.5,1,
22,155,240,31.4,18,20.7,0,
23,156,240,31.5,18.2,20.6,0,
24,160,242,32.6,18.8,21.7,0,
25,152,232,30.3,17.2,19.8,0,
26,160,250,31.7,18.8,22.5,0,
27,155,237,31,18.5,20,0,
28,157,245,32.2,19.5,21.4,0,
29,165,245,33.1,19.8,22.7,0,
30,153,231,30.1,17.3,19.8,0,
31,162,239,30.3,18,23.1,0,
32,162,243,31.6,18.8,21.3,0,
33,159,245,31.8,18.5,21.7,0,
34,159,247,30.9,18.1,19,0,
35,155,243,30.9,18.5,21.3,0,
36,162,252,31.9,19.1,22.2,0,
37,152,230,30.4,17.3,18.6,0,
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38,159,242,30.8,18.2,20.5,0,
39,155,238,31.2,17.9,19.3,0,
40,163,249,33.4,19.5,22.8,0,
41,163,242,31,18.1,20.7,0,
42,156,237,31.7,18.2,20.3,0,
43,159,238,31.5,18.4,20.3,0,
44,161,245,32.1,19.1,20.8,0,
45,155,235,30.7,17.7,19.6,0,
46,162,247,31.9,19.1,20.4,0,
47,153,237,30.6,18.6,20.4,0,
48,162,245,32.5,18.5,21.1,0,
49,164,248,32.3,18.8,20.9,0)
#
X <- matrix(data=TX,ncol=7,byrow=TRUE)
#
Xdata <-
data.frame(Bird=X[,1],TotalLength=X[,2],AlarExtent=X[,3],BeakandHead=X[,4],Humerus=X[,
5],KeelofSternum=X[,6],Survived=X[,7])
#
summary(Xdata[,2:6])
cov(Xdata[,2:6])
cor(Xdata[,2:6])
#
# To use spm (ScatterPlotMatrix), must have "car" package installed
#
library(car)
#
# ?spm gives information about the spm command
#
?spm
#
# Basic Scatterplot Matrix
#
spm(Xdata[,2:6],
diagonal=list(method="boxplot"),smooth=FALSE,regLine=FALSE,main=c("Bumpus Sparrow
Data"))
#
# To use plot3d, must have "rgl" package installed
#
library(rgl)
?plot3d
#
# Construct interactive 3d plot of Alar Extent, Beak and Head, and Humerus
#
plot3d(Xdata[,3:5],main="Bumpus Sparrow Data")
#
```