PhD-course in ANOVA and Repeated Measurements, Fall 2016

Exercises day 1

Exercise 1

Twenty-two patients undergoing cardiac bypass surgery were randomized to one of three groups:

1. Patients received a 50% nitrous oxide and 50% oxygen mixture continuously for 24 hours.

2. Patients received a 50% nitrous oxide and 50% oxygen mixture only during the operation.

3. Patients received no nitrous oxide but received 35-50% oxygen for 24 hours.

The table shows red cell folate levels (ng/ml) for the three groups after 24 hours ventilation. The question of interest is whether the three ventilation methods result in a different mean red cell folate level.

Group 1	Group 2	Group 3
243	206	241
251	210	258
275	226	270
291	249	293
347	255	328
354	273	
380	285	
392	295	
309		

The data can be found in `folate.dta` and `folate.xls`.

1. Calculate relevant summary statistics using the `tabstat` command. Make a scatter plot of the data. What would you expect to find in a statistical analysis of the data?

2. Test the hypothesis of equal variations in the three groups using the `oneway` command. Test for equal levels. How would you formulate the conclusions of the tests?

3. Calculate estimates and 95%-confidence intervals for the expected red cell folate levels using the `margins` command. Make a plot of the estimates with 95%-confidence intervals using the `marginsplot` command. Why are the intervals not of equal width?

4. Make pairwise comparisons of the three groups using the `pwcompare` command. Do any two groups differ from each other?

5. Check the assumptions behind the model by plotting the residuals against percentiles from the normal distribution. Does the plot give you reason to doubt the appropriateness of the model to describe the data?

6. Write a short summary of statistical methods used in the analysis and the findings.

Exercise 2

Every year The Department of Sport Science at The University of Copenhagen enrolls the first year sport science students in an athletic tournament. The results in the shot put competition (in meters) for 9 men and 9 women in each of the years 1998, 1999, and 2000 are given in the table below.

Men			Women		
1998	1999	2000	1998	1999	2000
11.17	8.80	9.30	7.16	9.49	8.59
12.57	11.57	11.60	10.45	6.69	8.80
9.33	12.48	11.80	8.47	8.01	11.61
12.53	9.83	12.20	9.40	11.01	10.65
11.25	12.91	12.50	7.22	8.11	8.21
7.54	11.50	10.50	8.51	8.72	9.18
9.69	11.90	9.70	9.62	7.94	8.65
10.70	11.52	11.90	6.27	8.03	8.45
9.33	9.90	9.20	9.18	9.12	7.79

The data can be found in `shotput.dta` and `shotput.xls`.

1. Make a scatter plot of the data and calculate relevant summary statistics. Make interaction plots.

2. Compare the six groups using a one-way analysis of variance model. Include a test for equal variances in the six groups in the analysis.

3. Compare the six groups using a two-way analysis of variance model. Make a QQ-plot of the residuals.

4. Write a short summary of statistical methods used in the analysis and the findings.

Exercise 3

Consider the following weight and height measurements for 25 people in each of 3 groups. The data can be found in `wh.dta` and `wh.xls`.

Group 1		Group 2		Group 3	
Weight	Height	Weight	Height	Weight	Height
78.8	178	95.2	195	81.6	168
76.7	173	89.8	191	63.7	151
78.0	176	92.8	192	79.9	174
66.5	161	83.6	179	86.3	185
87.1	183	89.3	188	61.5	151
57.4	151	90.8	186	79.5	177
96.5	197	67.3	163	72.4	165
91.2	193	75.0	169	89.5	176
52.1	143	74.5	166	78.2	169
73.7	165	67.7	160	77.2	168
67.3	162	96.3	196	71.6	166
62.6	158	76.4	164	85.8	181
91.1	186	86.2	189	84.2	173
77.4	171	113.9	212	79.1	178
76.9	167	74.8	171	81.7	167
89.7	183	81.9	181	94.0	186
80.9	174	67.4	160	93.8	186
52.3	152	78.2	169	81.2	173
73.0	173	92.8	191	62.1	154
91.5	188	56.5	154	87.6	173
70.6	162	88.2	184	70.2	157
63.4	158	77.9	174	72.1	163
66.4	163	74.6	168	91.1	192
84.8	179	88.4	181	78.2	168
94.7	187	99.0	197	60.0	153

1. Compare group 1 and group 2 with respect to the weight and height measurements using two t-tests.

2. Compare group 1 and group 2 with respect to the weight and height measurements using MANOVA.

3. Make a scatter plot similar to that on slide 1-34. What are your comments?

4. Repeat questions 1 to 3 for group 1 and 3.

5. What are the assumptions behind the analyses? Do they seem reasonable in this situation?

6. Write a short summary of statistical methods used in the analysis and the findings.