STAT1010: Exercise Sheet 4

1. a) Use the Descriptive Statistics and Normality tool from the Real Statistics toolbox and Levene's test in order to clarify, whether the share type returns in the attached excel file satisfy the assumptions for ANOVA modelling.

   b) Even though the assumptions for ANOVA modelling are not fully satisfied (why not?), do an ANOVA analysis using the Real Statistics One Factor Anova tool and interpret the result in the framework of the fixed effects model. The interpretation should include
      i) a formulation of the null and the alternative hypothesis,
      ii) the p-value of the appropriate test-statistic,
      iii) an estimation of the effects in case H_0 is rejected.

2. A study at an agricultural experiment station with many stables wishes to determine whether there is any impact of the stable upon the weight gain of swine. For that purpose two boars were taken randomly from each of four different randomly selected stables. The average weekly gains in pounds were

stable	1	2	3	4
boar 1	1.18	1.36	1.37	1.07
boar 2	1.11	1.65	1.40	0.90

   Assuming that the impact of the stable is normally distributed, show in that random effects model that σ_A^2 differs significantly from zero and estimate it. Do this exercise both in excel and by hand.

3. Three teamwork production methods are to be compared to see if they are equally effective. Random samples of daily production volume were

   Method A: 5, 7, 19, 8, 10, 16, 14, 9, 22, 4, 7, 8, 15, 18, 7
   Method B: 8, 12, 15, 28, 5, 14, 19, 16, 23, 19, 25, 17, 20
   Method C: 14, 28, 13, 10,8, 29, 30, 26, 17, 13, 10, 31, 27, 20

   a) Use the Real Statistics ANOVA tool to test the hypotheses $H_1: \mu_A = (\mu_B + \mu_C)/2$ and $H_2: \mu_B = \mu_C$ against their two-sided alternatives using contrasts and confirm the results by pen and paper calculations.

   b) Are H_1 and H_2 orthogonal?

4. Continuation of the previous excercise. Compare all production methods pairwise by using the Bonferroni method. Do this exercise only in excel. Which production methods do significantly ($\alpha = 5\%$) differ from each other in terms of efficiency?