Question 1. (*15 points*)

A study was carried out to evaluate and compare the efficicy of two treatments for a skin condition (chorioptic mange) in horses. The study included 17 cases of the skin condition which (article quote) "were allocated by random table to receive" either treatment D or F. Lesions were observed on the horses at day 0 (prior to treatment) and at days 14 and 28 after treatment. The lesions were scored on a scale from 0 (none) to 3 (severe) for each of the horse's four limbs and added up to a total score (thus, with a potential range of 0-12). Note that clinical signs of the skin condition can be present without qualifying as lesions. The observed scores are shown in the table below together with a few descriptive statistics.

Group D				Group F			
Case no.	Lesion score			Case no.	Lesion score		
	Day 0	Day 14	Day 28		Day 0	Day 14	Day 28
1	6	4	2	5	0	0	0
2	3	3	2	6	1	1	1
3	0	0	0	7	0	0	0
4	0	0	0	9	0	0	0
8	2	2	1	11	0	0	0
10	2	0	0	13	2	1	1
12	2	0	0	14	2	1	0
16	4	2	0	15	2	1	1
				17	2	0	0
median	2	1	0	median	1	0	0
mean	2.38	1.38	0.63	mean	1.00	0.44	0.33
std.dev.	2.00	1.60	0.92	std.dev.	1.00	0.53	0.50

The data were entered into a Minitab worksheet with 6 columns labeled `lscore0_D`, `lscore14_D`, `lscore28_D`, and similarly for group F.

Use the information about the study, in the table and the Minitab listing (for part **e)** to answer the following questions. Note that the questions for most parts can be answered independently of each other.

a) (*2 points*)
Characterize the study type (e.g., experimental or another type) and the statistical design (e.g., one-sample or another design). The journal article describing the study did not mention blinding — discuss briefly whether blinding would apply to the study and if so, how it could be implemented.

b) (*2 points*)
A (meticulous) reviewer of the manuscript wanted to check whether the descriptive statistics had been done correctly. Check whether the means and medians for lesion scores at day 14 were calculated correctly in both groups; include your calculations in your answer.

c) (*3 points*)
It is of interest to compare the lesion scores in the two groups prior to treatment. Compute the proportion of cases with no lesions in each group prior to treatment, and compare them descriptively (without attempting statistical inference). Explain how you

would compute — manually or using statistical software — a 95% confidence interval for the difference between the two proportions. Describe your approach in enough detail, e.g. by a formula with the relevant values inserted or by giving details on the use of a suitable menu in Minitab, for someone to reproduce your method. A bonus will be given for a correct calculation of such a confidence interval, but it is not required for a full score for part **c)**.

d) (*2 points*)
The article reporting the study summarized the lesion scores prior to treatment as follows: "The cases in group D were more severely affected." Do you think this is a fair summary of the data? — explain your reasoning. The authors then continued to state that the difference was not statistically significant, based on analysis by nonparametric statistical methods. Discuss whether nonparametric methods is a reasonable choice for analysis of the lesion score data; again, explain your reasoning and comment on at least one other possibility (and whether this/these would seem better or worse).

e) (*3 points*)
The efficacy of treatment is most naturally assessed by comparing the condition prior to and after treatment. We focus here on treatment D only. The article reported a reduction in severity of lesions on day 28, but noted that the reduction was not statistically significant. It appears that the assessment was based on the analysis shown in the Minitab listing (page 6).
Explain the analysis carried out in Minitab and the conclusions that can be drawn from it about a reduction in lesion score from day 0 to day 28. Discuss critically the adequacy of the analysis and its reporting.

f) (*3 points*)
Suggest (at least) one alternative way of carrying out statistical inference for a reduction in lesion scores in group D from day 0 to day 28. If possible from the information provided, carry out the proposed analysis and draw conclusions. If you cannot complete the proposed analysis from the information provided, describe how you would carry out the analysis if you had access to the data in Minitab (in the format described).

Minitab listing for Question 1:

```
MTB > Mann-Whitney 95.0 'lscore0_D' 'lscore28_D';
SUBC>   Alternative 0.
Mann-Whitney Test and CI: lscore0_D, lscore28_D

            N  Median
lscore0_D   8   2.000
lscore28_D  8   0.000

Point estimate for ETA1-ETA2 is 2.000
95.9 Percent CI for ETA1-ETA2 is (-0.000,4.000)
W = 86.0
Test of ETA1 = ETA2 vs ETA1 not = ETA2 is significant at 0.0661
The test is significant at 0.0512 (adjusted for ties)
```