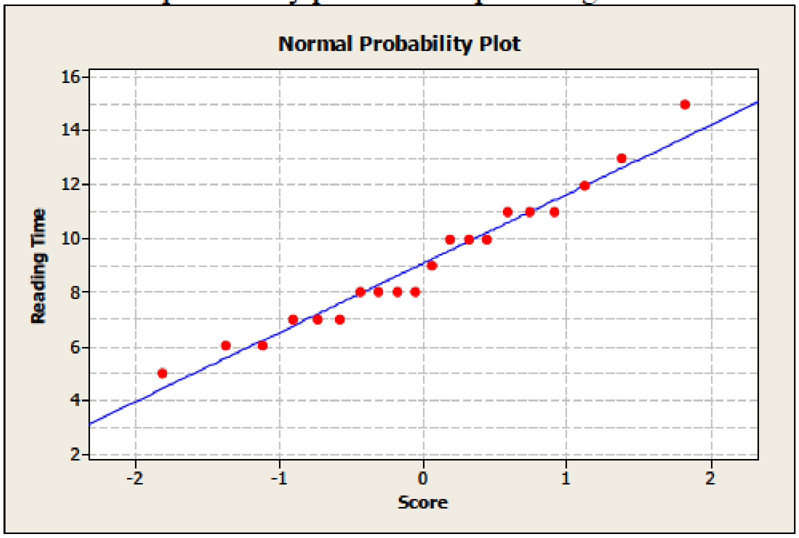
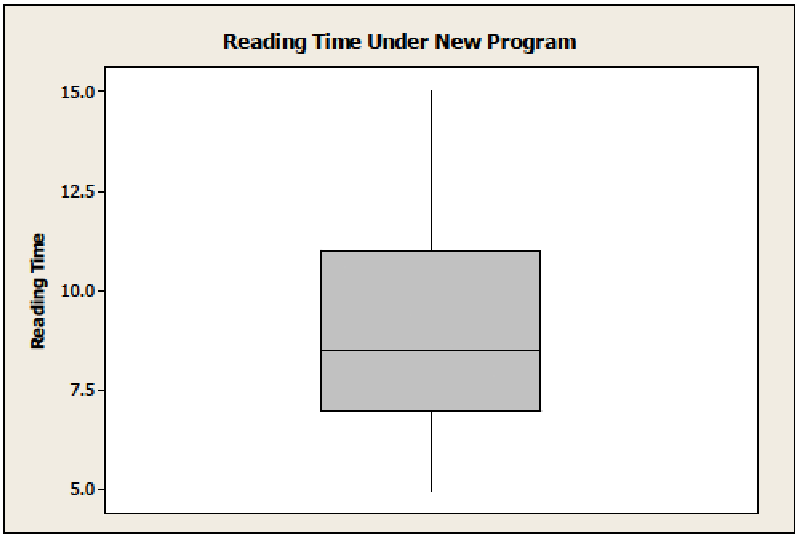
5.38 $n = 20$, $\overline{y} = 9.10$, $s = 2.573$, $t_{0.025,19} = 2.093$

a. $9.10 \pm 2.093 \frac{2.573}{\sqrt{20}} = 9.10 \pm 1.20 = (7.9, 10.3)$ is a 95% CI on μ

b. The normal probability plot and boxplot are given here:





The data set appears to be a sample from a normal distribution.

c. We are 95% confident that the mean reading speed for the population is between 7.9 and 10.3 minutes.

6.13 $H_0 : \mu_F = \mu_M$ versus $H_a : \mu_F \neq \mu_M$

a. Pooled variance t-test: $t = -4.04$, df $= 58$, p-value $= 0.0001$

b. Separate-variance t-test: $t = -3.90$, df $= 43$, p-value $= 0.0002$

c. Since the p-value for both t-tests is very small, we would reject H_0 using either of the two test statistics and conclude that there is a significant difference in the average bonus percentage between males and females.

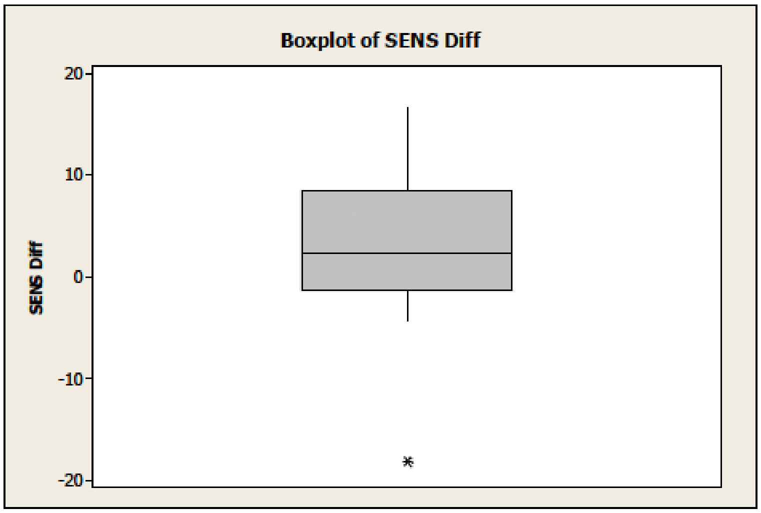
6.28

a. $H_0 : \mu_d \geq 0$ versus $H_a : \mu_d < 0$

The paired t-test yields $t = \dfrac{2.58}{9.49/\sqrt{10}} = 0.86$, df = 9 $\Rightarrow$ p-value = $P(t \geq 0.86)$ $\Rightarrow$ $0.10 <$ p-value < 0.25. There is not significant evidence that the mean SENS value decreased.

b. $\mu_d \pm t\dfrac{s_d}{\sqrt{n}} = 2.58 \pm 2.262\dfrac{9.49}{\sqrt{10}} = 2.58 \pm 6.79 = (-4.21, 9.37)$ We are 95% confident that the decrease in the mean SENS value is between −4.21 and 9.37.

c. The boxplot (below) indicates that the results from patient number 9 are an outlier relative to the other patients. The remaining values appear to have a fairly normal (albeit somewhat right skewed) distribution. The results from patient 9 should be carefully checked. The researchers should be interviewed to confirm that the results from the ten patients are truly independent, i.e., the differences form a random sample from a normal distribution.



6.29

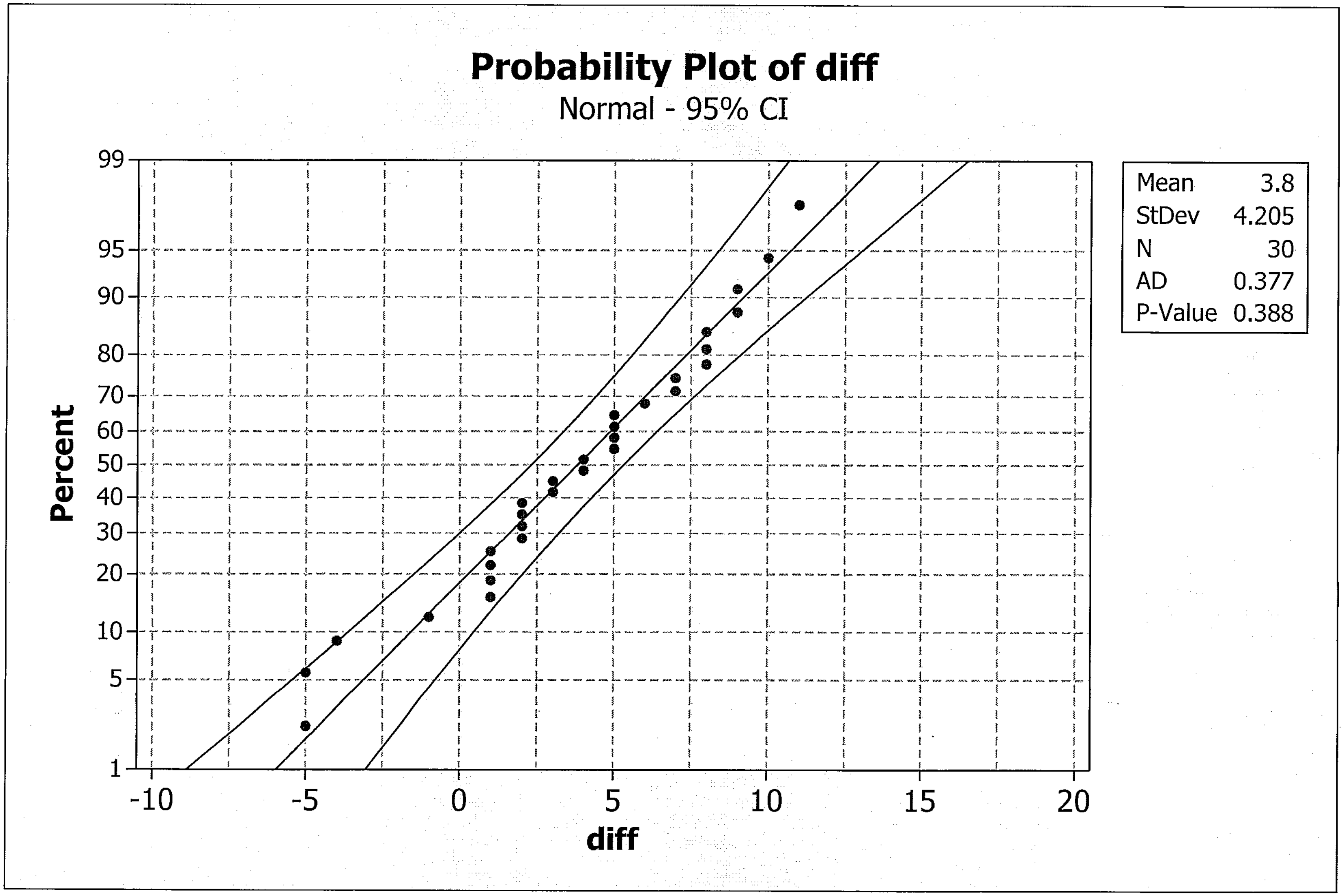
a. $H_0 : \mu_d = 0$ versus $H_a : \mu_d \neq 0$

$t = 4.95$, df = 29 $\Rightarrow$ p-value = $2P(t \geq 4.95) < 0.001$ There is significant evidence of a difference in the mean final grades.

b. A 95% confidence interval estimate of the mean difference in mean final grades is (2.23, 5.37).

c. We would need to verify that the differences in the grades between the 30 twins are independent. The normal probability plot would indicate that the differences are a random sample from a normal distribution. Thus, the conditions for using a paired t-test appear to be valid. (n = 30, ok)

d. Yes. The purpose of pairing is to reduce the subject-to-subject variability, and there appears to be considerable differences in the students in the study. Also, a scatterplot of the data yields a strong positive correlation between the scores for the twins.


Probability Plot of diff
Normal - 95% CI
Percent
99
95
90
80
70
60
50
40
30
20
10
5
1
-10
-5
0
5
10
15
20
diff
Mean 3.8
StDev 4.205
N 30
AD 0.377
P-Value 0.388

6.37 One-sided research hypothesis: $\mu_T > \mu_P$; $\sigma \approx 18.6$; $\alpha = 0.05$; $\beta \le 0.20$ whenever $\mu_T - \mu_P > 5$; $n_T = n_P = n$

$$n \approx \frac{2\sigma^2(z_\alpha + z_\beta)^2}{\Delta^2} = \frac{2(18.6)^2(1.645+0.84)^2}{5^2} = 170.9 \Rightarrow n = 171$$

6.44 Let d = $F_1 - F_2$

a. The population of interest is tobacco plants which may be treated with one of the two fumigants.

b. $H_0 : \mu_d = 0$ versus $H_a : \mu_d \neq 0$; $t = \dfrac{1.556-0}{0.527/\sqrt{9}} = 8.85$, df = 8 $\Rightarrow$ p-value < 0.0005 $\Rightarrow$

Reject H_0 and conclude that the data indicates significant evidence of a difference in the mean level of parasites for the two fumigants.

c. A 90% CI on $\mu_{F_1} - \mu_{F_2}$ is (1.23 , 1.88)

6.57 Let d = Before – After

a. $H_0 : \mu_{\text{Before}} = \mu_{\text{After}}$ versus $H_a : \mu_{\text{Before}} \neq \mu_{\text{After}}$;

$t = \dfrac{-0.122}{0.106/\sqrt{15}} = -4.45$ with df = 14, p-value < 0.0005 $\Rightarrow$ Reject H_0 and conclude that there is significant evidence that the mean soil pH has changed after mining on the land.

b. $H_a : \mu_{\text{Before}} \neq \mu_{\text{After}}$

c. A 99% CI on $\mu_{\text{Before}} - \mu_{\text{After}}$ is (0.04, 0.20).

d. The findings are highly significant (p-value < 0.0005), statistically. The question is, how significant are the results in a practical sense? Unless a change in pH of between 0.04 and 0.20 has an impact on the soil with respect to common usages of the soil, the mining company should not be cited.