Mostly sample size extra problems

1 I wish to know whether studying more will improve a student's test scores from the first statistics test to the second. I randomly select 8 students from the class and forced them to study more the second time. The results were:

Student:	1	2	3	4	5	X	s
1st Test	77	89	89	54	82	78.2	14.4
2nd Test	82	79	95	77	87	84.0	7.2
Diff	5	-10	6	23	5	5.8	11.7

a) What is the appropriate null and alternative hypothesis:

H_o: d = 0

H_1: d > 0

b) What is the probability that you would be wrong to reject the null hypothesis?

$$t = \frac{\overline{X} - \mu}{s/\sqrt{n}} = \frac{5.8}{4.7732} = 1.2151$$

ν = 4

p = 0.1456

2 We believe that products A and B have the same mean weight, but we will sample to be sure. We wish to be 95% sure before we reject the belief that they are the same, and we want to be 90% sure we would reject equality if the difference was actually 0.75 kg. We believe the standard deviations are 1.2 kg and 1.6 kg. How many samples should we take?

Questions: $\mu_d = \mu_A - \mu_B$

1 Null hypothesis, Ho: $\mu_d = 0$

2 Alternate hypothesis, H1: $\mu_d <> 0$

3 Specific alternate null hypothesis: $\mu_{d\_1} = 0.75$

4 One sided or two sided? two

5 α = 5%
β = 10%
power = 90%

6 Minimum sample size =

$$n = \frac{(z_{\alpha/2} + z_{\beta})^2 (\sigma_1^2 + \sigma_2^2)}{\delta^2}$$

$$= \left(\frac{1.96 + 1.2816}{0.75}\right)^2 * (1.2^2 + 1.6^2)$$

= 74.719

= 75

3 John alleges that the error in weighing product A is less than 4.3 kg. We wish to be 98% sure before we reject equality. We also want to be 95% sure we would reject equality if the true error is 5.05 kg. We believe the standard deviation is 2 kg. How many samples should we take?

Questions:

1 Null hypothesis, Ho: $\mu = 4.3$

2 Alternate hypothesis, H1: $\mu < 4.3$

3 Specific alternate null hypothesis: $\mu_1 = 5.05$

4 One sided or two sided? one

5 $\alpha =$ 2%
$\beta =$ 5%
power = 95%

6 Minimum sample size =

$$n = \frac{(z_\alpha + z_\beta)^2 \sigma^2}{\delta^2} = \frac{(2.0537 + 1.6449)^2 * 2^2}{0.75^2}$$

= 97.278
= 98

4 John alleges that the average error in weighing product A = 0.1 kg. We wish to be 99% sure before we reject that claim and we want to be 80% sure we would reject his claim if the true error was ± 1.1 kg. We believe the standard deviation is 1.5 kg. How many samples should we take?

Questions:

1 Null hypothesis, Ho: $\mu = 0.1$

2 Alternate hypothesis, H1: $\mu <> 0.1$

3 Specific alternate null hypothesis: $\mu_1 = 1.1$

4 One sided or two sided? two

5 $\alpha =$ 1%
$\beta =$ 20%
power = 80%

6 Minimum sample size =

$$\boxed{n = \frac{(z_{\alpha/2} + z_\beta)^2 \sigma^2}{\delta^2}} = \frac{(2.5758 + 0.8416)^2 * (1.5}{1.1^2}$$

= 21.717
= 22

5 We believe that product A weighs more than B, but we want to sample to be sure. We wish to be 98% sure before we reject the belief that they are the same, and we want to be 80% sure we would reject equality if the true difference is 1 kg. We believe the standard deviations are 2 kg and 1.1 kg. How many samples should we take?

Questions: $\mu_d = \mu_A - \mu_B$

1 Null hypothesis, Ho: $\mu_d = 0$

2 Alternate hypothesis, H1: $\mu_d > 0$

3 Specific alternate null hypothesis: $\mu_{d\_1} = 1$

4 One sided or two sided? one

5 $\alpha =$ 2%
$\beta =$ 20%
power = 80%

6 Minimum sample size =

$$n = \frac{\left(z_\alpha + z_\beta\right)^2\left(\sigma_1^2 + \sigma_2^2\right)}{\delta^2}$$

$$= \left(\frac{2.0537 + 0.8416}{1} \right)^2 * \left(2^2 + 1.1^2 \right)$$

= 43.676
= 44