Math 343 - Homework 2

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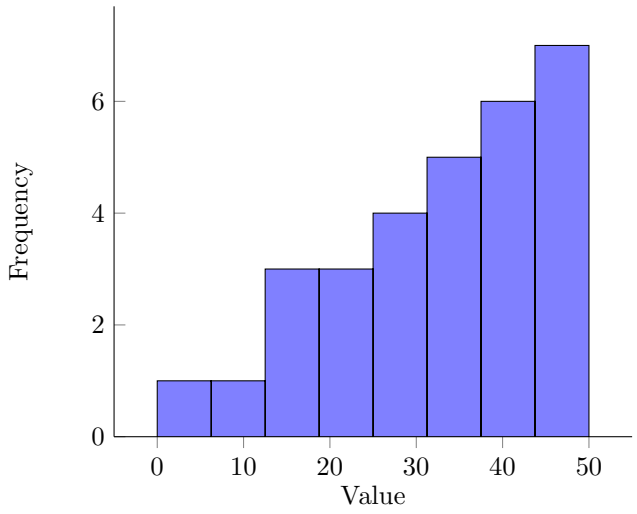
Question 1

Data with a rightward skew would produce a normal probability plot with a positive curvature. Below is an example of a histogram that would produce a positively curved normal probability plot.



Question 2

Question 3

a)

Test

Null hypothesis	$H_0: \sigma_1 / \sigma_2 = 1$
Alternative hypothesis	$H_1: \sigma_1 / \sigma_2 \neq 1$
Significance level	$\alpha = 0.05$

	Test			
Method	Statistic	DF1	DF2	P-Value
Bonett	0.00	1		0.963
Levene	0.00	1	18	1.000

Figure 1: The output of the test for two variances from Minitab.

Since the P-value $>$ α we can conclude the following. There is enough statistical evidence to support the hypothesis that both of the variances are equal.

b)

Test

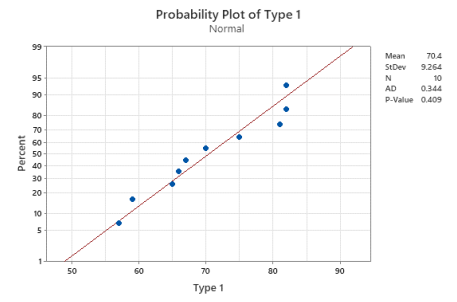
Null hypothesis	$H_0: \mu_1 - \mu_2 = 0$
Alternative hypothesis	$H_1: \mu_1 - \mu_2 \neq 0$

T-Value	DF	P-Value
0.05	18	0.962

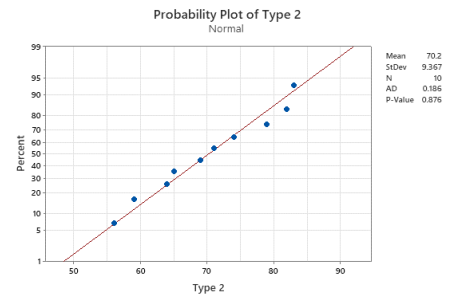
Figure 2: The output of the two sample t test from Minitab. Assuming equal variances.

Since the P-value $= 0.962 >$ α we can conclude the following. There is enough statistical evidence to support the hypothesis that the two means are equal.

c)



(a) Minitab output showing the probability plot of type 1.



(b) Minitab output showing the probability plot of type 2.

Note that for both Type 1 and Type 2, the hypothesis we will test is as follows,
H_0: The data are drawn from a normal distribution.
H_a: The data are not drawn from a normal distribution.

Type 1 Since the P-value $= 0.409 > \alpha$ we can conclude the following. The evidence of the data is consistent with the hypothesis that the data are drawn from a normal distribution.

Type 2 Similarly, since the P-value $= 0.876 > \alpha$ we can conclude the following. The evidence of the data is consistent with the hypothesis that the data are drawn from a normal distribution.

Question 4

Question 5

a/b)

Test

Null hypothesis	H_0: μ_difference = 0
Alternative hypothesis	H_1: μ_difference ≠ 0

T-Value	P-Value
0.43	0.674

Figure 4: The output of the paired t test from Minitab.

Since the P-value = 0.674 > α we can conclude the following. There is enough statistical evidence to support the hypothesis that the two means are equal.

c)

Estimation for Paired Difference

Mean	StDev	SE Mean	95% CI for μ_difference
0.000250	0.002006	0.000579	(-0.001024, 0.001524)

μ_difference: population mean of (Caliper 1 - Caliper 2)

Figure 5: The output of the paired t test containing the confidence interval from Minitab.

From the above confidence interval we can conclude the following. We are 95% confident that the true difference between the population means is between -0.001 and 0.001.

We can also note that the confidence interval contains 0, which is consistent with our hypothesis test.

Question 6

a)

Listing 1: R output of Shapiro-Wilk test on Birth Order: 1

```
Shapiro-Wilk normality test

data:  b1
W = 0.84597, p-value = 0.05201
```

Since the P-value = 0.05201 $> \alpha$ we can conclude the following. The evidence of the data is consistent with the hypothesis that the data are drawn from a normal distribution.

Listing 2: R output of Shapiro-Wilk test on Birth Order: 1

```
Shapiro-Wilk normality test

data:  b2
W = 0.92972, p-value = 0.4452
```

Since the P-value = 0.4452 $> \alpha$ we can conclude the following. The evidence of the data is consistent with the hypothesis that the data are drawn from a normal distribution.

b)

Listing 3: R output of a paired t test

```
Paired t-test

data:  b1 and b2
t = -0.36577, df = 9, p-value = 0.723
alternative hypothesis:
    true mean difference is not equal to 0
95 percent confidence interval:
    -0.3664148  0.2644148
sample estimates:
mean difference
    -0.051
```

The confidence intercal on the difference in mean score leads us to the following conclusion. We are 95% confident that the true difference in the population means is between -0.36 and 0.26. Since the confidence interval contains 0, we can also conclude that the two sample means may be equal.

c)

H_0: $\mu_1 = \mu_2$
H_a: $\mu_1 \neq \mu_2$

Since the P-value = $0.723 > \alpha$ we can conclude the following. There is enough statistical evidence to support the hypothesis that the sample means are equal, ie, $\mu_1 = \mu_2$.

Question 7

Question 8