

Statistics for Analytics

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ASSIGNMENT 1:

HYPOTHESIS TESTING

Question 1: Analysis of Cooperation vs Competition

In comparing student performance between cooperation and competition teaching methods, we found the following:

Statistics for Cooperation Group

The MEANS Procedure

Analysis Variable : Cooperation				
Mean	Median	Std Dev	Variance	Skewness
75.3571429	73.0000000	5.1680549	26.7087912	0.8181303

Statistics for Competition Group

The MEANS Procedure

Analysis Variable : Competition				
Mean	Median	Std Dev	Variance	Skewness
77.7857143	80.0000000	9.0057979	81.1043956	-0.3969923

Mean Grades: The competition group had a higher mean grade (77.79) compared to the cooperation group (75.36).

Variability: The competition group showed more variability in performance (Std Dev: 9.01), while the cooperation group exhibited more consistency.

Skewness: The cooperation group had positive skewness (0.82), indicating more lower grades. In contrast, the competition group showed a slight negative skewness (-0.40), indicating higher grades were more common.

Descriptive Statistics for Cooperation Approach

The MEANS Procedure

Results: Program 1

Analysis Variable : Cooperation					
Mean	Median	Std Dev	Variance	Skewness	Kurtosis
75.3571429	73.0000000	5.1680549	26.7087912	0.8181303	-0.7898024

Descriptive Statistics for Competition Approach

The MEANS Procedure

Analysis Variable : Competition					
Mean	Median	Std Dev	Variance	Skewness	Kurtosis
77.7857143	80.0000000	9.0057979	81.1043956	-0.3969923	-1.1717322

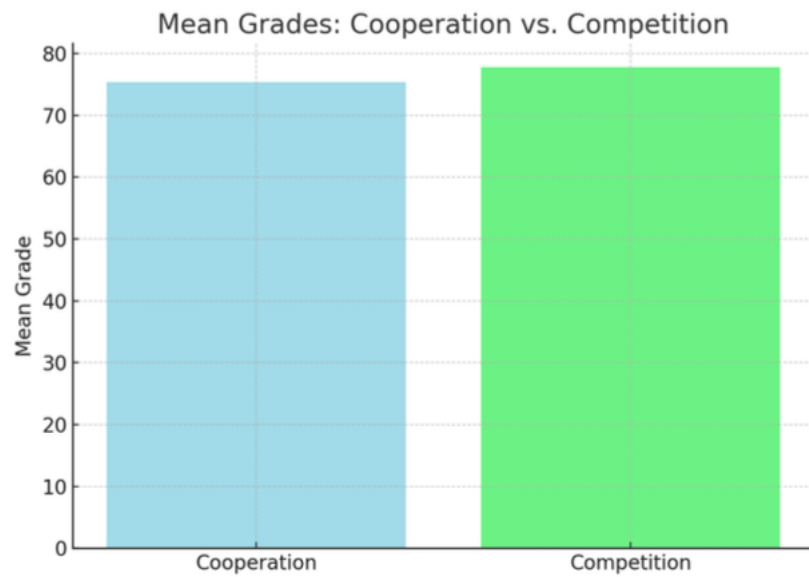
Statistics for Cooperation Approach

Obs	_TYPE_	_FREQ_	mean_coop	median_coop	std_coop	var_coop	skew_coop	kurt_coop
1	0	14	75.3571	73	5.16805	26.7088	0.81813	-0.78980

Statistics for Competition Approach

Obs	_TYPE_	_FREQ_	mean_comp	median_comp	std_comp	var_comp	skew_comp	kurt_comp
1	0	14	77.7857	80	9.00580	81.1044	-0.39699	-1.17173

In conclusion, competition leads to higher average performance but with greater variability, whereas cooperation produces more consistent results.



Mean Grades: Cooperation vs. Competition:

This chart shows the average grades of students under two teaching methods. It highlights that the competition group had a slightly higher mean grade compared to the cooperation group. This indicates that competitive learning might push students to perform better overall, but with more variability in the results.

Question2: Analysis of Birth Weight Factors

The birth weight analysis revealed several important findings:

T-test for Smoking vs Non-Smoking Mothers on Weight

The TTEST Procedure

Variable: Weight (Weight)

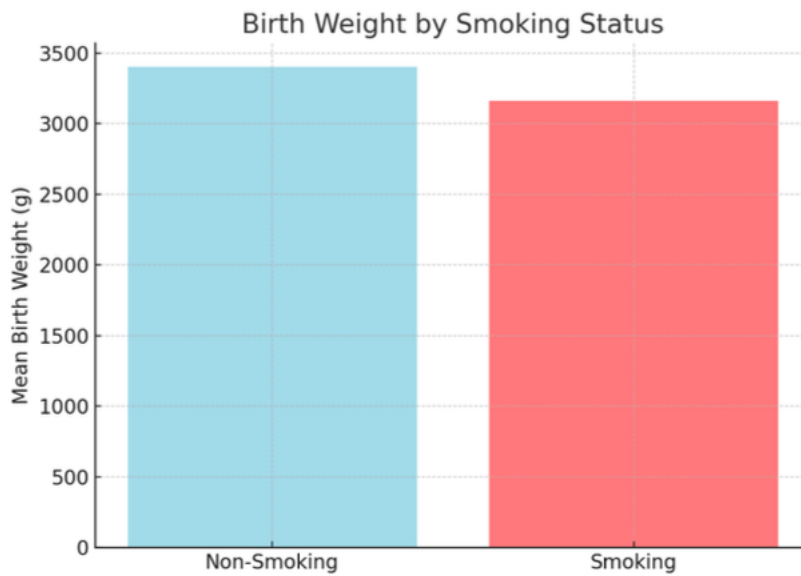
MomSmoke	Method	N	Mean	Std Dev	Std Err	Minimum	Maximum
0		43467	3402.3	558.0	2.6766	240.0	6350.0
1		6533	3160.9	576.8	7.1358	312.0	5245.0
Diff (1-2)	Pooled		241.5	560.5	7.4376		
Diff (1-2)	Satterthwaite		241.5		7.6213		

MomSmoke	Method	Mean	95% CL Mean		Std Dev	95% CL Std Dev	
0		3402.3	3397.1	3407.6	558.0	554.3	561.8
1		3160.9	3146.9	3174.8	576.8	567.0	586.8
Diff (1-2)	Pooled	241.5	226.9	256.0	560.5	557.1	564.0
Diff (1-2)	Satterthwaite	241.5	226.5	256.4			

Method	Variances	DF	t Value	Pr > t
Pooled	Equal	49998	32.46	<.0001
Satterthwaite	Unequal	8474.1	31.68	<.0001

Equality of Variances				
Method	Num DF	Den DF	F Value	Pr > F
Folded F	6532	43466	1.07	0.0004

Smoking: There is a significant difference in birth weight between babies born to smoking and non-smoking mothers (p-value < 0.0001). Babies of non-smoking mothers had an average birth weight of 3402.3g compared to 3160.9g for smokers.



Birth Weight by Smoking Status:

This chart illustrates that babies born to non-smoking mothers have significantly higher birth weights than those born to smoking mothers. This suggests a direct negative impact of smoking on infant health.

T-test for Married vs Non-Married Mothers on Weight

The TTEST Procedure

Variable: Weight (Weight)

Results: Program 1

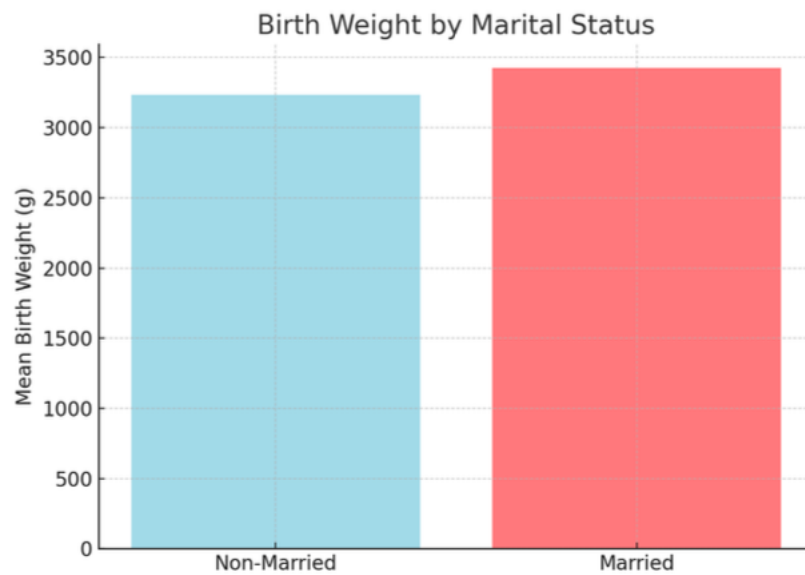
Married	Method	N	Mean	Std Dev	Std Err	Minimum	Maximum
0		14369	3234.4	579.0	4.8302	284.0	6350.0
1		35631	3425.7	551.8	2.9231	240.0	5970.0
Diff (1-2)	Pooled		-191.3	559.7	5.5315		
Diff (1-2)	Satterthwaite		-191.3		5.6459		

Married	Method	Mean	95% CL Mean		Std Dev	95% CL Std Dev	
0		3234.4	3225.0	3243.9	579.0	572.4	585.8
1		3425.7	3420.0	3431.5	551.8	547.8	555.9
Diff (1-2)	Pooled	-191.3	-202.1	-180.5	559.7	556.3	563.2
Diff (1-2)	Satterthwaite	-191.3	-202.4	-180.2			

Method	Variances	DF	t Value	Pr > t
Pooled	Equal	49998	-34.58	<.0001
Satterthwaite	Unequal	25443	-33.88	<.0001

Equality of Variances				
Method	Num DF	Den DF	F Value	Pr > F
Folded F	14368	35630	1.10	<.0001

Marital Status: Married mothers had babies with higher birth weights (3425.7g) compared to non-married mothers (3234.4g), and the difference was statistically significant (p-value < 0.0001).



Birth Weight by Marital Status:

This chart shows that babies born to married mothers have higher birth weights compared to those born to non-married mothers. The higher birth weights in married mothers could be attributed to better socio-economic or healthcare factors associated with marriage.

T-test for Boy vs Girl on Weight

The TTEST Procedure

Variable: Weight (Weight)

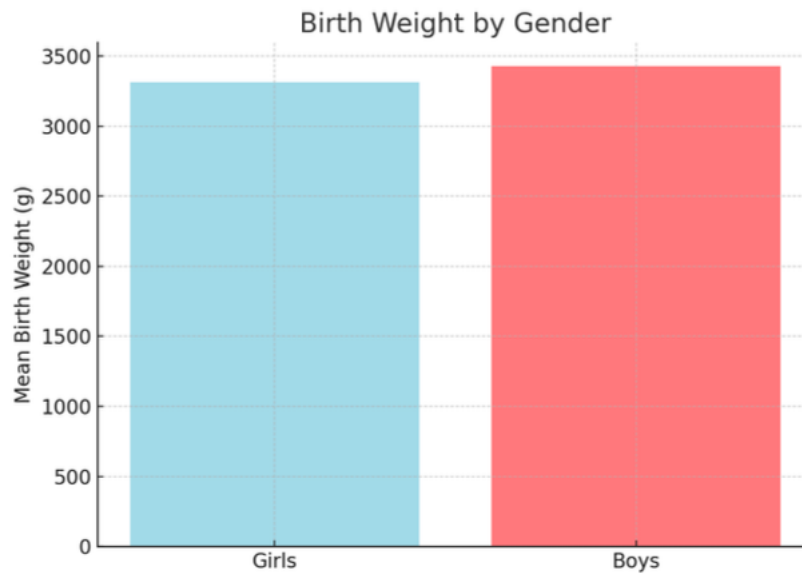
Boy	Method	N	Mean	Std Dev	Std Err	Minimum	Maximum
0		24208	3310.6	547.7	3.5204	240.0	6350.0
1		25792	3427.3	577.7	3.5970	284.0	5970.0
Diff (1-2)	Pooled		-116.7	563.4	5.0416		
Diff (1-2)	Satterthwaite		-116.7		5.0331		

Boy	Method	Mean	95% CL Mean		Std Dev	95% CL Std Dev	
0		3310.6	3303.7	3317.5	547.7	542.9	552.7
1		3427.3	3420.2	3434.3	577.7	572.7	582.7
Diff (1-2)	Pooled	-116.7	-126.6	-106.8	563.4	559.9	566.9
Diff (1-2)	Satterthwaite	-116.7	-126.6	-106.8			

Method	Variances	DF	t Value	Pr > t
Pooled	Equal	49998	-23.15	<.0001
Satterthwaite	Unequal	49993	-23.18	<.0001

Equality of Variances				
Method	Num DF	Den DF	F Value	Pr > F
Folded F	25791	24207	1.11	<.0001

Gender: Boys had significantly higher birth weights (3427.3g) compared to girls (3310.6g), with a p-value < 0.0001. These results suggest that smoking status, marital status, and the gender of the baby are important factors in determining birth weight.



Birth Weight by Gender:

This chart compares the birth weights of boys and girls. Boys tend to have higher birth weights compared to girls, which is consistent with general biological patterns observed in birth weight studies.

SAS Output Results

Results from Cooperation vs. Competition:

Mean (Cooperation): 75.36

Mean (Competition): 77.79

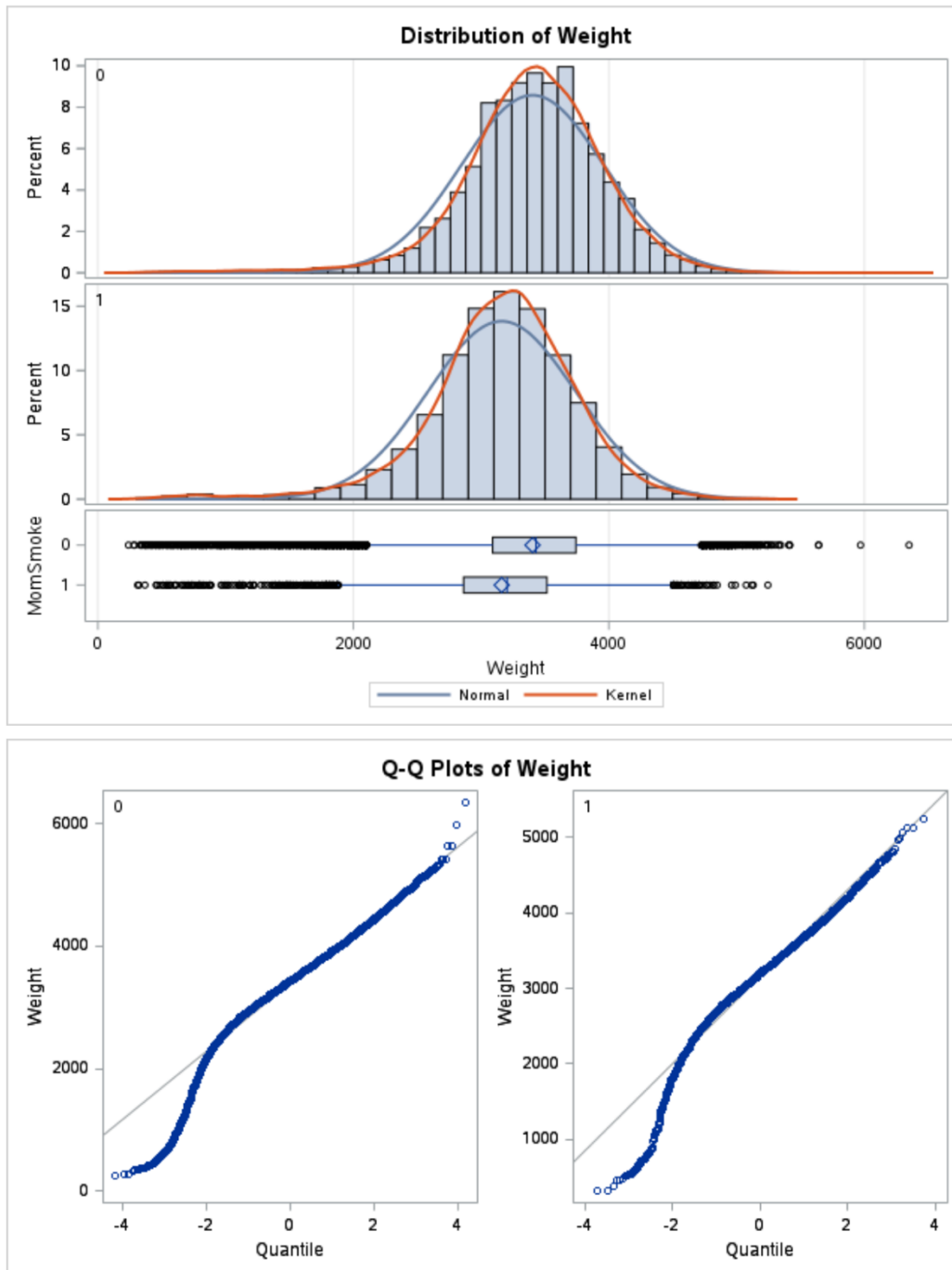
Variability (Std Dev): Higher in competition group (9.01 vs 5.17 in cooperation)

Skewness: Cooperation shows positive skewness (0.82), competition shows slight negative skewness (-0.40)

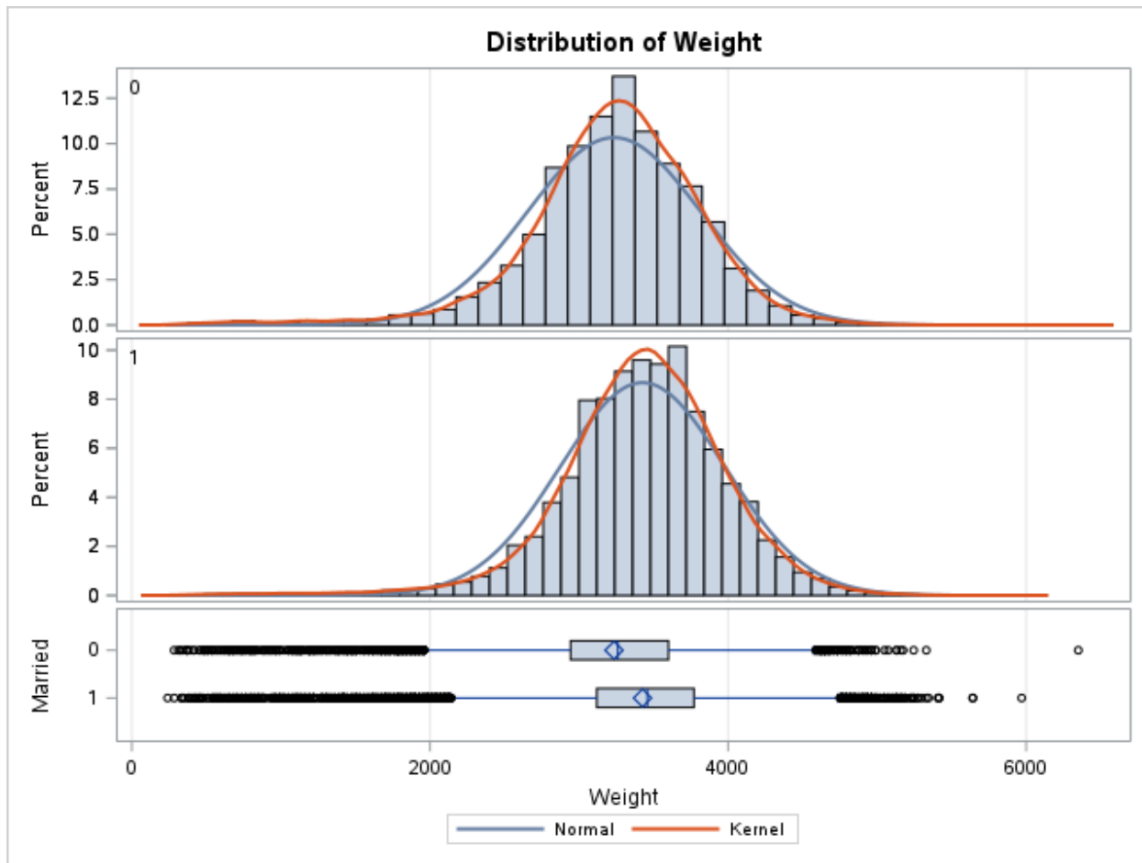
Results from Birth Weight Study:

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Results: Program 1

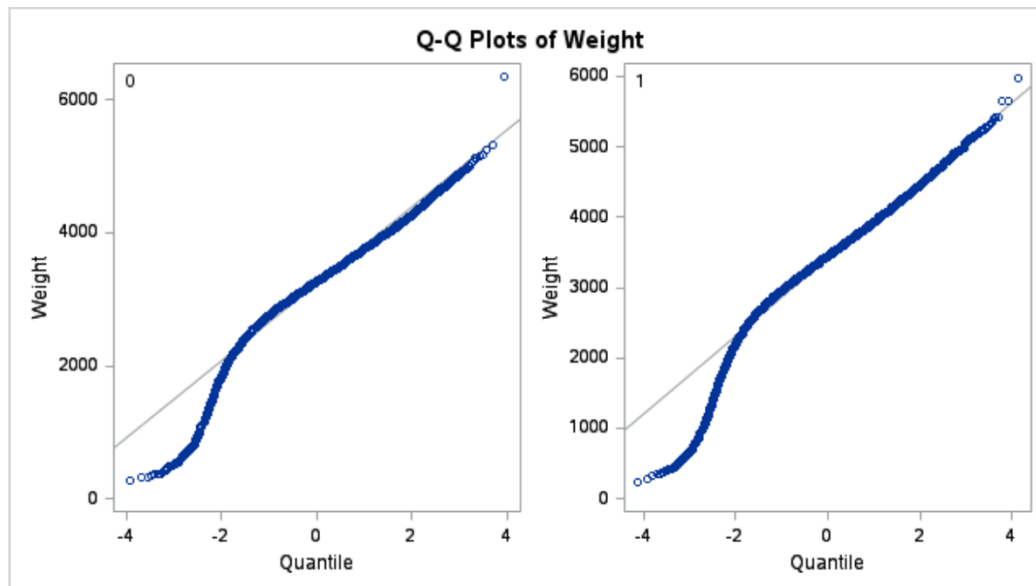


Smoking: Significant difference in birth weight (Non-smokers: 3402.3g, Smokers: 3160.9g),
p-value < 0.0001

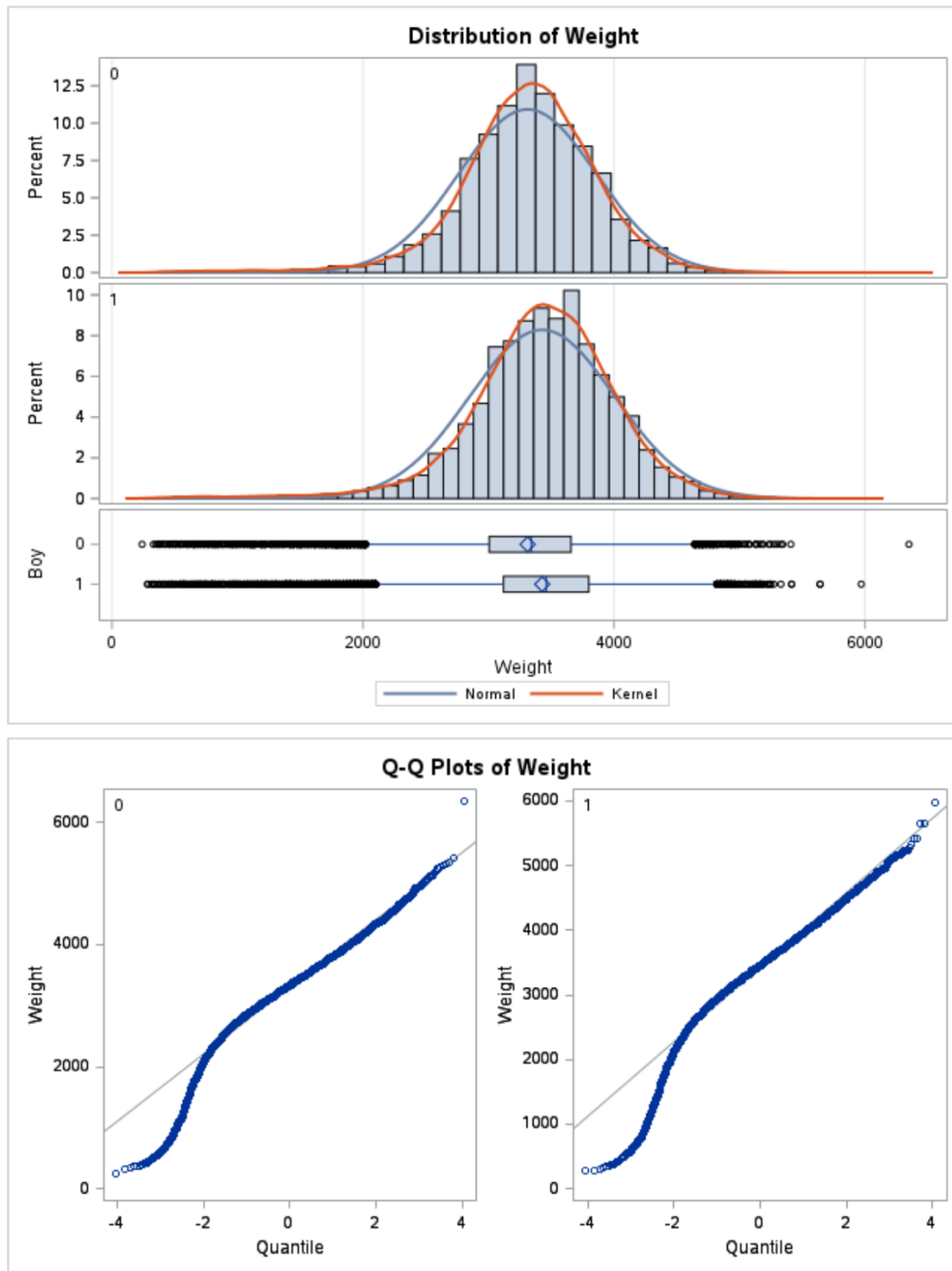


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Results: Program 1



Marital Status: Significant difference in birth weight (Married mothers: 3425.7g, Non-married: 3234.4g), p-value <0.0001



Gender: Significant difference in birth weight (Boys: 3427.3g, Girls: 3310.6g), p-value < 0.0001

Hypothesis Testing and Conclusion

Based on the data analysis, we conducted hypothesis tests to determine the effects of **teaching methods**, **smoking**, **marital status**, and **gender** on the relevant outcomes. For each test, we evaluated the null hypothesis (H_0) and alternative hypothesis (H_1). The null hypothesis was rejected in favor of the alternative hypothesis in all cases due to the significant p-values observed, which indicate a strong effect of these factors on student performance and birth weight.

Business Deck: Key Insights

- **Performance:** Students who learned through competition scored slightly higher than those who worked together.
 - **Consistency:** Competition created more variation in scores, while cooperation led to more stable results.
 - **Conclusion:** Competition pushes for higher performance, but cooperation produces more consistent outcomes.
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- **Smoking:** Babies born to non-smoking mothers weighed more on average than those born to smoking mothers.
 - **Marriage:** Babies born to married mothers weighed more than those born to single mothers.
 - **Gender:** Baby boys generally weighed more than baby girls.
 - **Conclusion:** Smoking, marriage, and the baby's gender all play a role in how much a baby weighs at birth.
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These insights show that whether students learn better through competition or cooperation affects their results, and factors like smoking, marriage, and gender impact a baby's weight at birth. These findings can help make more informed decisions in education and healthcare.