ASSIGNMENT 1
TECHNICAL DECK
T-test to check difference in Weight with different Variables.

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Analysis of Birth Weight and Influencing Factors

Objective:
To investigate the relationship between birth weight and various maternal and infant factors.

Dataset Variables:

- Weight: Infant's birth weight
- Married: Marital status of the mother
- Boy: Gender of the baby
- MomSmoke: Whether the mother smokes
- MomAge: Mother's age (centered at 27)
- CigsPerDay: Number of cigarettes smoked per day by the mother
- MomWtGain: Mother's pregnancy weight gain
- Visit: Number of prenatal visits
- MomEdLevel: Mother's education level

Objective: Continued

- T-test shall be done using SAS to calculate and compare different means of baby weight in different groups with the overall population mean.

- This will include Mean Baby Weight for Married/Unmarried Moms, Black/Non-Black Babies, Smoker Mom/Non-Smoker Mom and Baby Boys/Baby Girls.

T-tests Overview

- **Objective:** To determine if the differences in mean birth weights between groups are statistically significant.

Hypotheses:

- **Null Hypothesis (H0):** No difference in mean birth weights i.e. **3370.8** between the groups or H0 : u1-u2=0
- **Alternative Hypothesis (H1):** Significant difference in mean birth weights between the groups .i.e. H1: u1>u2 OR u1<u2.
- **Level of Significance: 0.05**

T-TEST FOR OVERALL POPULATION SAMPLE

The TTEST Procedure

Variable: Weight (Weight)

N	Mean	Std Dev	Std Err	Minimum	Maximum
50000	3370.8	566.4	2.5330	240.0	6350.0

Mean	95% CL Mean		Std Dev	95% CL Std Dev	
3370.8	3365.8	3375.7	566.4	562.9	569.9

DF	t Value	Pr > |t|
49999	1330.76	<.0001

T-test for Marital Status

Comparison:

- **Married Women:** 3425.7 grams
- **Unmarried Women:** 3234.4 grams

Results:

- **T-statistic: 0.0998**
- **P-value: < 0.0001**

Data indicates towards rejection of Null Hypothesis as P value is significantly less than alpha value= 0.05. The test is statistically significant.

Hence, Baby Weight differs with marital status.

Babies born to unmarried moms tend to have lower than average weight.

AVERAGE BABY WEIGHTS FOR MARRIED AND UNMARRIED WOMEN

The TTEST Procedure

Variable: Weight (Weight)

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	-643.97	<.0001
Satterthwaite	Unequal	25443	-630.92	<.0001

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

T-test for Baby's Ethnicity

Comparison:

- **Black Baby:** 3162.7 grams
- **Non-Black Baby:** 3411.2 grams

Results:

- T-statistic: -0.3735
- P-value: <0.0001

Data indicates towards rejection of Null Hypothesis as P value is significantly less than alpha value= 0.05. The test is statistically significant.

Hence, Weight of Baby differs with ethnicity.

Babies of black ethnicity tend to have less than average weight.

AVERAGE BABY WEIGHTS FOR BLACK AND NON BLACK ETHNICITIES

The TTEST Procedure

Variable: Weight (Weight)

Black	Method	N	Mean	Std Dev	Std Err	Minimum	Maximum
0		41858	3411.2	547.6	2.6766	284.0	5970.0
1		8142	3162.7	613.7	6.8011	240.0	6350.0
Diff (1-2)	Pooled		248.6	558.9	6.7697		
Diff (1-2)	Satterthwaite		248.6		7.3088		

Black	Method	Mean	95% CL Mean		Std Dev	95% CL Std Dev	
0		3411.2	3406.0	3416.5	547.6	543.9	551.4
1		3162.7	3149.3	3176.0	613.7	604.4	623.3
Diff (1-2)	Pooled	248.6	235.3	261.8	558.9	555.5	562.4
Diff (1-2)	Satterthwaite	248.6	234.2	262.9			

Method	Variances	DF	t Value	Pr > |t|
Pooled	Equal	49998	-461.21	<.0001
Satterthwaite	Unequal	10808	-427.19	<.0001

Equality of Variances				
Method	Num DF	Den DF	F Value	Pr > F
Folded F	8141	41857	1.26	<.0001

T-test for Mother's Smoking Habit

Comparison:

- **Smoker Mom:** 3160.09 grams
- **Non-Smoker Mom:** 3402.3 grams

Results:

- T-statistic: -0.3778
- **P-value** < 0.0001

Data indicates towards rejection of Null Hypothesis as P value is significantly less than alpha value= 0.05. The test is statistically significant.

Hence, Mean baby weight differs with mother's smoking habit.

Babies born to smoker moms tend to weigh less than average.

AVERAGE BABY WEIGHTS FOR MOTHERS WHO SMOKED AND MOTHERS WHO DID NOT SMOKE

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	-420.74	<.0001
Satterthwaite	Unequal	8474.1	-410.61	<.0001

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

T-test for Baby's Gender

Comparison:

- **Baby Boy:** 3427.3 grams
- **Baby Girl:** 3310.6 grams

Results:

- T-statistic: 0.1028
- P-value < 0.0001

Data indicates towards rejection of Null Hypothesis as P value is significantly less than alpha value= 0.05. The test is statistically significant.

Hence, baby weight differs with gender.

Baby boys tend weigh more than baby girls.

AVERAGE WEIGHT FOR BABY BOYS AND BABY GIRLS

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	-691.75	<.0001
Satterthwaite	Unequal	49993	-692.91	<.0001

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

Statistics

Group	Mean Baby Weight (grams)	Standard Deviation (grams)	Z-score	p-value
Total Population	3370.08	556.4	0	-
Married Women	3425.7	551.8	0.0998	< 0.0001
Unmarried Women	3234.4	579	-0.2436	< 0.0001
Black Baby	3162.7	613.7	-0.3735	< 0.0001
Non-Black Baby	3411.2	547.6	0.0739	< 0.0001
Smoker Mom	3160.09	576.8	-0.3778	< 0.0001
Non-Smoker Mom	3402.3	558	0.0578	< 0.0001
Baby Boy	3427.3	577.7	0.1028	< 0.0001
Baby Girl	3310.6	547.7	-0.1075	< 0.0001

Interpretation of Results

- **Marital Status:** Higher mean birth weight for married women.
- **Ethnicity:** Lower mean birth weight for black babies.
- **Smoking Habit:** Lower mean birth weight for babies of smoking mothers.
- **Gender:** Slightly higher mean birth weight for boys.
- **Statistical Significance:**

Significance determined by **p-values** from T-tests.

Conclusion

Summary:

- The analysis highlights potential differences in birth weights based on marital status, race, smoking habits, and gender.
- Statistical significance of these differences have ben confirmed with p-values