Chi Square Crater Hemisphere v Presence of Primary Morphology

To conduct a Chi Square test I needed two categorical variables. The two cariables I constructed were HEMISPHERE and PRIMARY_MORPHOLOGY.

I divided the data based on whether the crater was in the Northern or Southern hemisphere. To do this I created a new variable called HEMISPHERE. I assigned the Northern hemisphere (latutude 0 or greater) the dummy code 1 and the Southern hemisphere (latitude less than 0) the dummy code 0. Because all 384,343 crater records included a latitude value, all 384,343 records we assigned a HEMISPHERE value.
The SAS statement for assigning the HEMISPHERE variable:

```
if LATITUDE_CIRCLE_IMAGE lt 0 then HEMISPHERE = 0;
else HEMISPHERE = 1;
```

For simplicity, I categorized all craters based on whether there was morphology data in the MORPHOLOGY_EJECTA_1 column. I hadn't used the variable in my analysis yet. Unfortunately, this field may contain multiple values, separated by slashes. Further subdividing that data seemed difficult. It turns out that only 44,625 craters of the 384,343 in the study have any data at all in this column. So I decided to create a categorical variable called PRIMARY_MORPHOLOGY which I defined as the existence (dummy value 1) or absence (dummy value 0) of MORPHOLOGY_EJECTA_1 data. The SAS statement for assigning the PRIMARY_MORPHOLOGY variable:

```
if MORPHOLOGY_EJECTA_1 = "" then PRIMARY_MORPHOLOGY = 0;
else PRIMARY_MORPHOLOGY = 1;
```

Finally, I ran the procedure and analyzed the output.

The Chi Square value for the comparison was 163.5012 with a p value less than 0.0001. This is a statistically significant value that allowed me to reject the null hypothesis.

- H_0 There is no association between a crater's hemisphere and the existence of a classifiable primary morphology.
- H_A There is an association between a crater's hemisphere and the existence of a classifiable primary morphology.

Southern Hemisphere Col Pct 11.08
Northern Hemisphere Col Pct 12.43

Chi Square 163.5012
P < 0.0001

Accept H_A

When examining the association between the presences of classifiable primary morphology (categorical response variable) hemisphere (North or South) in which a crater is located (categorical explanatory variable), a chi-square test of independence revealed that craters in

the Northern hemisphere are more likely to have a classifiable primary morphology (12.43%) compared to those in the Southern hemisphere (11.08%), X2 = 163.5012, 1 df, p < 0.0001.

Table of PRIMARY_MORPHOLOGY by HEMISPHERE				
		HEMISPHERE(Hemisphere with respect to equator (0=South, 1=North))		
		0	1	Total
PRIMARY_MORPHOLOGY(Crater has a classifiable primary morphology (1) or does not (0))				
0	Frequency	207584	132134	339718
	Percent	54.01	34.38	88.39
	Row Pct	61.10	38.90	
	Col Pct	88.92	87.57	
1	Frequency	25865	18760	44625
	Percent	6.73	4.88	11.61
	Row Pct	57.96	42.04	
	Col Pct	11.08	12.43	
Total	Frequency	233449	150894	384343
	Percent	60.74	39.26	100.00

2

Statistics for Table of PRIMARY_MORPHOLOGY by HEMISPHERE

Statistic	DF	Value	Prob
Chi-Square	1	163.5012	<.0001
Likelihood Ratio Chi-Square	1	162.4879	<.0001
Continuity Adj. Chi-Square	1	163.3693	<.0001
Mantel-Haenszel Chi-Square	1	163.5007	<.0001
Phi Coefficient		0.0206	
Contingency Coefficient		0.0206	
Cramer's V		0.0206	

1

Fisher's Exact Test	
Cell (1,1) Frequency (F)	207584
Left-sided Pr <= F	1.0000
Right-sided Pr >= F	1.794E-37
Table Probability (P)	2.516E-38
Two-sided Pr <= P	3.441E-37

Sample Size = 384343