1. The president of a large university has been studying the relationship between male/female supervisory structures in his institution and the level of employees' job satisfaction. The results of a recent survey are shown in the table below. Conduct a test at the 5% significance level to determine whether the level of job satisfaction depends on the boss/employee gender relationship.

| | Boss/Employee | | | |
|---|---|---|---|---|
| Level of Satisfaction | Male/ Female | Female/Male | Male/Male | Female/Female |
| Satisfied | 60 | 15 | 50 | 15 |
| Neutral | 27 | 45 | 48 | 50 |
| Dissatisfied | 13 | 32 | 12 | 55 |

$H_o$ = Level of satisfaction and boss/employee gender relationship are independent.
$H_1$ = Level of satisfaction and boss/employee gender relationship are dependent.

We need to calculate the expected frequency of the values;

| Level of Satisfaction | Male/ Female | Female/Male | Male/Male | Female/Female |
|---|---|---|---|---|
| Satisfied | 33.1754 | 30.5213 | 36.49 | 39.81043 |
| Neutral | 40.2844 | 37.0616 | 44.31 | 48.34123 |
| Dissatisfied | 26.5403 | 24.4171 | 29.19 | 31.84834 |

Next, calculate chi-square value for each cell and find out the grand chi-square by adding them.

| Level of Satisfaction | Male/ Female | Female/Male | Male/Male | Female/Female |
|---|---|---|---|---|
| Satisfied | 21.6896 | 7.89322 | 4.999 | 15.46221 |
| Neutral | 4.38071 | 1.70036 | 0.307 | 0.056919 |
| Dissatisfied | 6.90796 | 2.35495 | 10.13 | 16.82974 |

By adding these values, we can find the chi-square value of 92.7087. Also, by running the right-tailed chi-square distribution test (with degrees of freedom being 6), we calculate the p-value to be less than 0.0001. This p-value is less than our nominal alpha of .05, therefore we reject the null and conclude that the level of job satisfaction depends on the boss/employee gender relationship.

2. Using the Birthwgt file in the SASHELP directory (if you do not find it in the SASHELP directory, the data file is also posted on the datasets folder on blackboard so you can import it), examine if low birth weight and race are dependent. Also examine if low birth weight is related to married.

1. $H_o$ = Low birth weight and race are independent.
   $H_1$ = Low birth weight and race are dependent.

By conducting table analysis on SAS, we are given the expected frequency table (Appendix A.1), the chi-square value, and the corresponding p-value (Appendix A.2). With the p-value being less than the nominal alpha of .05, we can reject null and conclude that low birth weight and race are dependent.
Also, by looking at the distribution graph (Appendix A.3), we can observe that the frequency of low birth weight is higher for black babies compared to other races.

2. $H_o$ = Low birth weight and marital status are independent.
   $H_1$ = Low birth weight and marital status are dependent.

By conducting table analysis on SAS, we are given the expected frequency table (Appendix B.1), the chi-square value, and the corresponding p-value (Appendix B.2). With the p-value being less than the nominal alpha of .05, we can reject null and conclude that low birth weight and marital status are dependent.
Also, by looking at the distribution graph (Appendix B.3), we can observe that the frequency of low birth weight is higher for babies of married couples compared to unmarried couples.

3. A test was conducted to identify if "Weight_Status" and "BP_Status" are dependent. Interpret the results.

$H_o$ = Weight status and blood pressure status are independent.
$H_1$ = Weight status and blood pressure status are dependent.

Chi-square p-value (<0.0001) being less than alpha, we can reject null and conclude that the weight and blood pressure status are dependent.

By observing the distribution graph, we can see that for people with high blood pressure, the number of overweight people outnumbers the number of normal and underweight people. Also, for high BP, normal-weight people outnumber underweight people. For normal BP, we can observe a similar trend where overweight people outnumber normal and underweight people. However, for optimal BP, we can see normal weight and overweight are almost the same and they outnumber the underweight people. We can also observe that overweight people more frequently have high blood pressure followed by normal BP. Normal weight and underweight people more frequently have normal blood pressure.

APPENDIX A

A.1

Frequency
Expected

Table of LowBirthWgt by Race

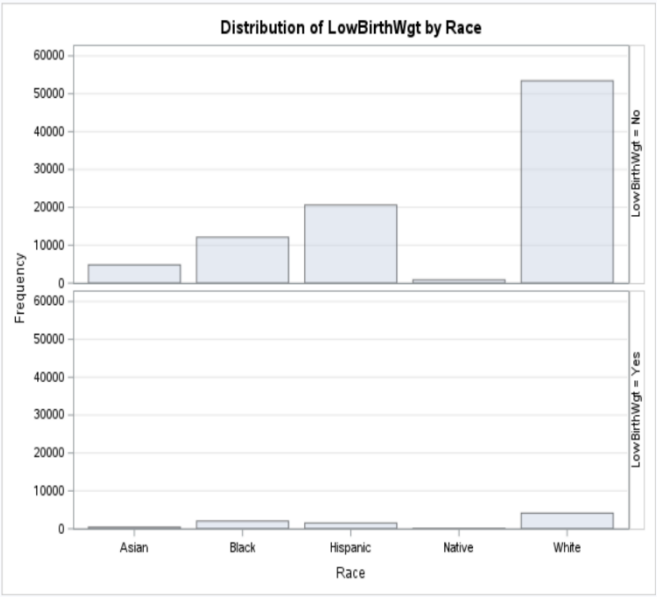
| LowBirthWgt | Race | | | | | |
|---|---|---|---|---|---|---|
| | Asian | Black | Hispanic | Native | White | Total |
| No | 4821<br>4798.7 | 12115<br>12982 | 20623<br>20337 | 869<br>865.31 | 53431<br>52876 | 91859 |
| Yes | 403<br>425.29 | 2018<br>1150.6 | 1516<br>1802.3 | 73<br>76.688 | 4131<br>4686.1 | 8141 |
| Total | 5224 | 14133 | 22139 | 942 | 57562 | 100000 |

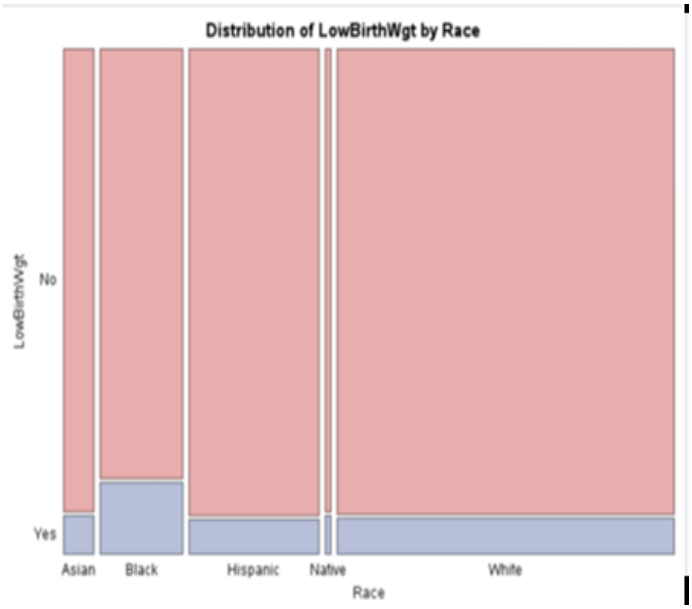
A.2

Statistics for Table of LowBirthWgt by Race

| Statistic | DF | Value | Prob |
|---|---|---|---|
| Chi-Square | 4 | 834.5047 | <.0001 |
| Likelihood Ratio Chi-Square | 4 | 720.0042 | <.0001 |
| Mantel-Haenszel Chi-Square | 1 | 274.8167 | <.0001 |
| Phi Coefficient | | 0.0914 | |
| Contingency Coefficient | | 0.0910 | |
| Cramer's V | | 0.0914 | |

A.3



APPENDIX B

B.1

Frequency

Table of Married by LowBirthWgt

| Married | LowBirthWgt | | |
|---|---|---|---|
| | No | Yes | Total |
| No | 61245 | 4585 | 65830 |
| Yes | 30614 | 3556 | 34170 |
| Total | 91859 | 8141 | 100000 |

B.2

Statistics for Table of Married by LowBirthWgt

| Statistic | DF | Value | Prob |
|---|---|---|---|
| Chi-Square | 1 | 356.3369 | <.0001 |
| Likelihood Ratio Chi-Square | 1 | 344.6650 | <.0001 |
| Continuity Adj. Chi-Square | 1 | 355.8768 | <.0001 |
| Mantel-Haenszel Chi-Square | 1 | 356.3333 | <.0001 |
| Phi Coefficient | | 0.0597 | |
| Contingency Coefficient | | 0.0596 | |
| Cramer's V | | 0.0597 | |

B.3