**TWO-WAY FACTORIAL DESIGN ANOVA**

**SHORT ASSIGNMENT**

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**Course: SS3708- Design and Analysis for Psychological Research II**

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**Date of Submission: March 17, 2017**

**TWO-WAY FACTORIAL DESIGN ANOVA**

A) <u>Name the IV's and DV's and describe briefly the method of coding/recoding where necessary.</u>

The dependent variable used in this design is the <u>General Happiness</u> of the participants. The independent variables used in this design are whether or not they belief in <u>Life After Death (post-life)</u> and how often the selected participants <u>Attend Religious Services</u>

The first independent variable of whether or not participants believed in life after death (post-life) was originally coded into four categories, as seen below in Table 1.

**Table 1.** Original Codes of Independent Variable 1: Belief in Life After Death (Post-Life)

| Code Number | Code Representation |
|:---:|:---:|
| 1 | Yes |
| 2 | No |
| 3 | Don't Know |
| 4 | No Answer |

The categories were recoded to fit a 4 x 3 factorial design, with this variable being put into 3 categories. The first two, yes and no, remained the same, whereas the last two were recoded into being one category named undecided. Group 3 and 4, Don't Know and No Answer, were re-grouped into one category as the participant chose not to provide a concrete answer of their belief, either because they haven't established it yet or they don't want to share it. The lack of an answer was not eliminated from the data, as it was still an answer, assumable to represent confusion on their belief. Since the two appropriately fell into the same category, they were regrouped or recoded together. Therefor, it would be as shown below in Table 2.

**Table 2.** Recoded Codes of Independent Variable 1: Belief in Life After Death (Post-Life)

| Original Code Number | Original Code Representation | Recoded Number | Recoded Representation |
|---|---|---|---|
| 1 | Yes | 1 | Yes |
| 2 | No | 2 | No |
| 3 | Don't Know | 3 | Undecided |
| 4 | No Answer | | |

The second independent variable of how often participants attended religious services was originally coded into 10 categories, as seen below in Table 3.

**Table 3.** Original Codes of Independent Variable 2: How often participants attend religious Services

| Code Number | Code Representation |
|---|---|
| 0 | Never |
| 1 | Less Than 1 Year |
| 2 | Once a Year |
| 3 | Several Times a year |
| 4 | Once a Month |
| 5 | 2-3 Times a Month |
| 6 | Nearly Every Week |
| 7 | Every Week |
| 8 | More than Once a Week |
| 9 | Don't Know / Not available |

**Table 6.** Descriptive Statistics from the SPSS Output

into 4 categories. The lack of an answer was eliminated from the data, as participants were given a choice to choose that they didn't attend any religious services. Code's 0-2 were regrouped into one group as they were closely linked to each other, being 1 time or less. Code's 3-4 were regrouped together as they represented the possibility of attending a service anywhere between 2-12 times a year. Though the numbers are a stretch, both represent ambiguities that could be close to each other; several times a year could represent 8, where once a month represents 12. Thus since the two, were closely related, they were grouped together. Next, Code's 5-7 were regrouped together as all three codes represented the likelihood of attending a service between 2-4 times a month. The last one, code 8, remained on its own because it represented a frequency that could range from 8 times a month to every single day, too large to be grouped with any other. The new groupings/recodes can be seen in Table 4.

**Table 4.** Recoded Codes of Independent Variable 2: How often participants attend religious Services

| Original Code Number | Original Code Representation | Recoded Number | Recoded Representation |
|---|---|---|---|
| 0 | Never | 1 | One time or Less a Year |
| 1 | Less Than 1 Year | 2 | Several Times a Year |
| 2 | Once a Year | 3 | 2-4 Times a Month |
| 3 | Several Times a year | 4 | More Than Once a Week |
| 4 | Once a Month | | |
| 5 | 2-3 Times a Month | | |
| 6 | Nearly Every Week | | |
| 7 | Every Week | | |
| 8 | More than Once a Week | | |
| 9 | Don't Know or N/A | | |

| BELIEF IN LIFE AFTER DEATH | HOW OFTEN R ATTENDS RELIGIOUS SERVICES | Mean | Std. Deviation | N |
|---|---|---|---|---|
| YES | ONCE OR LESS A YEAR | 1.89 | .911 | 235 |
| | SEVRL TIMES A YR | 1.88 | .879 | 161 |
| | 2-4 TIMES MONTH | 1.82 | .986 | 274 |
| | MORE THAN 1 A MONTH | 1.68 | .611 | 79 |
| | Total | 1.84 | .907 | 749 |
| NO | ONCE OR LESS A YEAR | 1.80 | .626 | 96 |
| | SEVRL TIMES A YR | 1.83 | .629 | 41 |
| | 2-4 TIMES MONTH | 1.66 | .582 | 38 |
| | MORE THAN 1 A MONTH | 2.00 | 1.000 | 3 |
| | Total | 1.78 | .622 | 178 |
| UNDECIDED | ONCE OR LESS A YEAR | 2.00 | .594 | 35 |
| | SEVRL TIMES A YR | 1.72 | .575 | 18 |
| | 2-4 TIMES MONTH | 2.08 | .494 | 13 |
| | MORE THAN 1 A MONTH | 2.00 | 1.000 | 3 |
| | Total | 1.94 | .591 | 69 |
| Total | ONCE OR LESS A YEAR | 1.88 | .819 | 366 |
| | SEVRL TIMES A YR | 1.85 | .815 | 220 |
| | 2-4 TIMES MONTH | 1.82 | .934 | 325 |
| | MORE THAN 1 A MONTH | 1.71 | .633 | 85 |
| | Total | 1.84 | .844 | 996 |

## B) Provide the Descriptive Statistics of the data.

**Table 5.** Descriptive Statistics of the Raw Data

| | General Happiness | Belief in Life After Death (Post-life) | How Often Attend Religious Services |
|---|---|---|---|
| No. of Participants | 1000 | 1000 | 996 (4 missing) |
| Mean | 1.84 | 1.32 | 2.13 |
| Median | 2.00 | 1.00 | 2.00 |
| Mode | 2 | 1 | 1 |
| Standard Deviation | 0.843 | 0.598 | 1.010 |
| Variance | 0.711 | 0.358 | 1.019 |

\* Dependent Variable: General Happiness

### C) Provide the SPSS ANOVA Summary Outputs of the data.

**Table 7.** SPSS ANOVA SUMMARY OUTPUT

**Tests of Between-Subjects Effects**

Dependent Variable:   GENERAL HAPPINESS

| Source | df | Mean Square | F | Sig. |
|--------|-----|--------|--------|------|
| Corrected Model | 11 | .573 | .803 | .637 |
| Intercept | 1 | 546.349 | 765.095 | .000 |
| postlife | 2 | .261 | .366 | .694 |
| attend | 3 | .195 | .272 | .845 |
| postlife * attend | 6 | .380 | .533 | .784 |
| Error | 984 | .714 | | |
| Total | 996 | | | |
| Corrected Total | 995 | | | |

a. R Squared = .009 (Adjusted R Squared = -.002)

### D) Provide the F- critical values for testing the main effects and interaction effects, including the significance levels.

1. Main effect Attend $Fc$ (3, 984) = 9.575                                  (≈ 9.58)
   $p < 0.01$, critical value 3.80

2. Main effect Postlife $Fc$ (2, 984) = 2.198                                  (≈ 2. 20)
   $p < 0.05$, critical value 3.00

3. Interaction effect Attend and Postlife $Fc$ (6, 984) = 0.922                 (≈ 0.92)
   $p < 0.05$, critical value 2.10

### E) Conduct relevant F-tests for all effects. Report the results in simple statements.

The main effect of attending a religious service was not significant, $Fc$ (3, 984) = 9.575,  $p < 0.01$, critical value 3.80. Participants who attending a religious service, once time or less a year, several times a year, 2-4 times a month, or, more than once a month did not report a significant difference in general happiness.

The main effect of belief in life after death (post-life) was not significant, $Fc$ (2, 984) = 2.198, $p < 0.05$, critical value 3.00. Participants who belief in life after death, did not belief in life after death or were undecided did not report a significant difference in general happiness.

**Multiple Comparisons**

Dependent Variable:  GENERAL HAPPINESS

Bonferroni

| (I) BELIEF IN LIFE AFTER DEATH | (J) BELIEF IN LIFE AFTER DEATH | Mean Difference (I–J) | Std. Error | Sig. | 95% Confidence Interval | |
|---|---|---|---|---|---|---|
| | | | | | Lower Bound | Upper Bound |
| YES | NO | .06 | .070 | 1.000 | −.11 | .23 |
| | 3 | −.10 | .106 | 1.000 | −.35 | .16 |
| NO | YES | −.06 | .070 | 1.000 | −.23 | .11 |
| | 3 | −.16 | .120 | .537 | −.45 | .13 |
| 3 | YES | .10 | .106 | 1.000 | −.16 | .35 |
| | NO | .16 | .120 | .537 | −.13 | .45 |

Based on observed means.
 The error term is Mean Square(Error) = .714.

**Multiple Comparisons**

Dependent Variable:  GENERAL HAPPINESS

Bonferroni

| (I) HOW OFTEN R ATTENDS RELIGIOUS SERVICES | (J) HOW OFTEN R ATTENDS RELIGIOUS SERVICES | Mean Difference (I–J) | Std. Error | Sig. | 95% Confidence Interval | |
|---|---|---|---|---|---|---|
| | | | | | Lower Bound | Upper Bound |
| LT ONCE A YEAR | ONCE A YEAR | .03 | .072 | 1.000 | −.17 | .22 |
| | SEVRL TIMES A YR | .06 | .064 | 1.000 | −.11 | .23 |
| | ONCE A MONTH | .17 | .102 | .526 | −.10 | .44 |
| ONCE A YEAR | LT ONCE A YEAR | −.03 | .072 | 1.000 | −.22 | .17 |
| | SEVRL TIMES A YR | .04 | .074 | 1.000 | −.16 | .23 |
| | ONCE A MONTH | .15 | .108 | 1.000 | −.14 | .43 |
| SEVRL TIMES A YR | LT ONCE A YEAR | −.06 | .064 | 1.000 | −.23 | .11 |
| | ONCE A YEAR | −.04 | .074 | 1.000 | −.23 | .16 |
| | ONCE A MONTH | .11 | .103 | 1.000 | −.16 | .38 |
| ONCE A MONTH | LT ONCE A YEAR | −.17 | .102 | .526 | −.44 | .10 |
| | ONCE A YEAR | −.15 | .108 | 1.000 | −.43 | .14 |
| | SEVRL TIMES A YR | −.11 | .103 | 1.000 | −.38 | .16 |

Based on observed means.
 The error term is Mean Square(Error) = .714.

Once a year stands for: SEVRL TIMES A YEARR

Several times a month stands for: 2-4 TIMES MONTH

Once a month stands for: MORE THAN 1 A MONTH

**F) Plot a graph by hand to show the two-way analysis.**



ESTIMATED MARGINAL MEANS OF GENERAL HAPPINESS