**EAB 743**

**Problem Set 1**

**Tamara A. Ferreira de Paiva / 2002704379**

1. A public health professor wanted to test the effectiveness of an intervention designed to decrease substance abuse for individuals with unstable housing in Las Vegas. They plan to compare the performance of the intervention against currently available resources provided by the federal and state governments. They plan to recruit participants from randomly selecting housing shelters in the Greater Las Vegas area and randomly assigning these participants to two groups: the control (current resources) group and the intervention group. The study participants will continue to live in the same shelters, i.e. no change in housing arrangements, during the study regardless of their treatment group.
   1. Identify one kind of validity that is threatened in this design.

Internal validity is a possible threat to the study design.

* 1. Specify a concrete, plausible threat to the validity you answered in (a).

The study designed by the professor aims to investigate the effectiveness of an intervention to reduce substance abuse among individuals experiencing unstable housing. However, a major threat to internal validity arises from the selection process. The study includes housing shelters based on convenience and responsiveness, which may not be representative of the broader population experiencing unstable housing. Additionally, because participants in both the control group (receiving current resources) and the intervention group are randomly selected from the same shelters in the Greater Las Vegas area, there is a risk of resource-sharing between groups. Participants in the intervention group may share strategies, information, or support with those in the control group, leading to unintended behavioral changes. This contamination could alter the study’s outcomes, affecting the reliability of the testing measures. Furthermore, differential attrition may occur, as participants exposed to different levels of support might drop out at varying rates. These factors threaten the study’s ability to establish a clear causal relationship between the intervention (independent variable) and substance abuse outcomes (dependent variable).

* 1. How might the design of his study be changed to address the threat mentioned in (b)?

To address threats to internal validity, it is essential to establish a true independent variable. One effective approach is to modify the study design by introducing cluster or block randomization, where entire shelters—rather than individual participants—are randomly selected as experimental units. This method ensures a more representative sample of shelters across the Greater Las Vegas area and reduces selection bias. Additionally, cluster randomization helps control for behavioral changes among participants by limiting the sharing of resources and information between intervention and control groups. By minimizing contamination, this approach strengthens the study’s ability to establish a clear causal relationship between the independent variable (the intervention) and the dependent variable (substance abuse outcomes).

1. A nonprofit agency reached out to you to design an experiment to develop an effective intervention for homeless alcoholics. Clients will be randomly assigned to three different treatments: standard therapy (std), Community Reinforcement Approach with disulfiram (CRA+D), and Community Reinforcement Approach without disulfiram (CRA-D). The response variable measured is the self-reported number of weeks. Suppose the researchers wanted to use ANOVA to test for an overall treatment effect. A pilot study was performed in 2022 and the statistics from this study are shown:

|  |  |
| --- | --- |
| Group | Mean |
| STD | 75 |
| CRA-D | 34 |
| CRA+D | 26 |

* 1. Assuming an error standard deviation of 100, what is the minimum total sample size for your experiment to attain 80% power in detecting an overall effect?

*Answer: A sample size of 17 per group (213 total) is enough to achieve 80% power*

*(Actual power (80.2%) in detecting overall group effect.*

*SAS CODE:*

proc power;

onewayanova test=overall

groupmeans=3.23|4.5|3.12|2.59

stddev=1.18

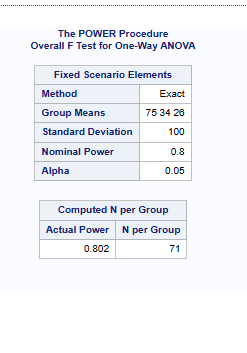
npergroup=.

power= 0.8 0.9

;

run;

*OUTPUT*

**

* 1. Create the corresponding ANOVA table for this design using the sample size calculated in

(a).

Table 1ANOVA TABLE

|  |  |  |
| --- | --- | --- |
| Source | DF | Answer |
| Treatment/ Factor | t-1 | 3-1=2 |
| Error | n-t | 213-3=210 |
| total | n-1 | 210+2=212 (checked with  n-1=213-1=212) |

* 1. The subject matter expert lets you know that they can only admit 50 participants for each group. Will this cause any problems in designing the experiment?

If we decrease the sample size from 71 to 50, the power of the study will be reduced from 80% to 64%, increasing the risk of a Type II error. This means there is a higher chance of failing to detect a true treatment effect when one actually exists. Consequently, the study may lack sufficient statistical strength to confirm whether the intervention is truly effective.

*SAS code*

proc power;

onewayANOVA test=overall

groupmeans=75|34|26

stddev=100

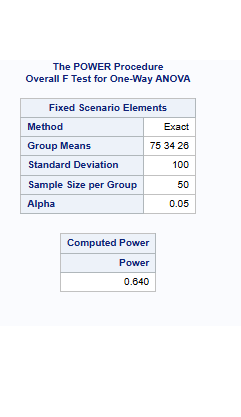
npergroup=50

power=.

;

run;

*SAS OUTPUT*



* 1. Use PROC FACTEX to randomly assign the participants to the treatment groups using your answer in (a) as the total sample size.

*SAS CODE*

PROC FACTEX ;

FACTORS TREATMENT/NLEV=3;

OUTPUT OUT= CRD\_FACTEX TREATMENT nvals= (1 2 3)

DESIGNREP=71 RANDOMIZE (123);

RUN;

QUIT;

DATA LIST ;

SET CRD\_FACTEX ;

PARTICIPANT= \_N\_; \*row number for each row is set as participant ;

PROC PRINT NOOBS;

RUN;

| **Treatment** | **PARTICIPANT** |
| --- | --- |
| 1 | 1 |
| 2 | 2 |
| 3 | 3 |
| 2 | 4 |
| 1 | 5 |
| 3 | 6 |
| 3 | 7 |
| 1 | 8 |
| 2 | 9 |
| 1 | 10 |
| 3 | 11 |
| 2 | 12 |
| 1 | 13 |
| 2 | 14 |
| 3 | 15 |
| 3 | 16 |
| 2 | 17 |
| 1 | 18 |
| 3 | 19 |
| 2 | 20 |
| 1 | 21 |
| 3 | 22 |
| 1 | 23 |
| 2 | 24 |
| 3 | 25 |
| 2 | 26 |
| 1 | 27 |
| 1 | 28 |
| 3 | 29 |
| 2 | 30 |
| 2 | 31 |
| 3 | 32 |
| 1 | 33 |
| 3 | 34 |
| 1 | 35 |
| 2 | 36 |
| 1 | 37 |
| 3 | 38 |
| 2 | 39 |
| 1 | 40 |
| 3 | 41 |
| 2 | 42 |
| 3 | 43 |
| 1 | 44 |
| 2 | 45 |
| 1 | 46 |
| 3 | 47 |
| 2 | 48 |
| 1 | 49 |
| 3 | 50 |
| 2 | 51 |
| 1 | 52 |
| 3 | 53 |
| 2 | 54 |
| 3 | 55 |
| 1 | 56 |
| 2 | 57 |
| 1 | 58 |
| 2 | 59 |
| 3 | 60 |
| 2 | 61 |
| 1 | 62 |
| 3 | 63 |
| 2 | 64 |
| 3 | 65 |
| 1 | 66 |
| 1 | 67 |
| 2 | 68 |
| 3 | 69 |
| 1 | 70 |
| 2 | 71 |
| 3 | 72 |
| 3 | 73 |
| 1 | 74 |
| 2 | 75 |
| 1 | 76 |
| 2 | 77 |
| 3 | 78 |
| 2 | 79 |
| 3 | 80 |
| 1 | 81 |
| 2 | 82 |
| 3 | 83 |
| 1 | 84 |
| 2 | 85 |
| 1 | 86 |
| 3 | 87 |
| 2 | 88 |
| 1 | 89 |
| 3 | 90 |
| 1 | 91 |
| 3 | 92 |
| 2 | 93 |
| 1 | 94 |
| 3 | 95 |
| 2 | 96 |
| 1 | 97 |
| 2 | 98 |
| 3 | 99 |
| 1 | 100 |
| 2 | 101 |
| 3 | 102 |
| 1 | 103 |
| 2 | 104 |
| 3 | 105 |
| 2 | 106 |
| 1 | 107 |
| 3 | 108 |
| 2 | 109 |
| 3 | 110 |
| 1 | 111 |
| 2 | 112 |
| 1 | 113 |
| 3 | 114 |
| 1 | 115 |
| 3 | 116 |
| 2 | 117 |
| 1 | 118 |
| 2 | 119 |
| 3 | 120 |
| 1 | 121 |
| 2 | 122 |
| 3 | 123 |
| 1 | 124 |
| 2 | 125 |
| 3 | 126 |
| 2 | 127 |
| 3 | 128 |
| 1 | 129 |
| 1 | 130 |
| 2 | 131 |
| 3 | 132 |
| 2 | 133 |
| 3 | 134 |
| 1 | 135 |
| 1 | 136 |
| 3 | 137 |
| 2 | 138 |
| 2 | 139 |
| 1 | 140 |
| 3 | 141 |
| 3 | 142 |
| 1 | 143 |
| 2 | 144 |
| 3 | 145 |
| 2 | 146 |
| 1 | 147 |
| 1 | 148 |
| 3 | 149 |
| 2 | 150 |
| 1 | 151 |
| 3 | 152 |
| 2 | 153 |
| 2 | 154 |
| 1 | 155 |
| 3 | 156 |
| 3 | 157 |
| 2 | 158 |
| 1 | 159 |
| 1 | 160 |
| 2 | 161 |
| 3 | 162 |
| 3 | 163 |
| 1 | 164 |
| 2 | 165 |
| 1 | 166 |
| 3 | 167 |
| 2 | 168 |
| 1 | 169 |
| 2 | 170 |
| 3 | 171 |
| 2 | 172 |
| 3 | 173 |
| 1 | 174 |
| 1 | 175 |
| 3 | 176 |
| 2 | 177 |
| 1 | 178 |
| 2 | 179 |
| 3 | 180 |
| 1 | 181 |
| 2 | 182 |
| 3 | 183 |
| 2 | 184 |
| 1 | 185 |
| 3 | 186 |
| 1 | 187 |
| 2 | 188 |
| 3 | 189 |
| 1 | 190 |
| 3 | 191 |
| 2 | 192 |
| 1 | 193 |
| 3 | 194 |
| 2 | 195 |
| 1 | 196 |
| 2 | 197 |
| 3 | 198 |
| 3 | 199 |
| 2 | 200 |
| 1 | 201 |
| 2 | 202 |
| 3 | 203 |
| 1 | 204 |
| 3 | 205 |
| 2 | 206 |
| 1 | 207 |
| 2 | 208 |
| 3 | 209 |
| 1 | 210 |
| 2 | 211 |
| 1 | 212 |
| 3 | 213 |

User: u64138014

Messages: 17

1. In an experiment to determine the effect of time to rise on the height of bread dough, one homogeneous batch of bread dough would be divided into 12 loaf pans with an equal amount of dough in each. The pans of dough would then be divided randomly into 3 groups corresponding to the following rising times: 35 minutes, 40 minutes, and 45 minutes. Use the data statement below to access the data in SAS.
   1. Create the corresponding ANOVA table for this experimental design?
   2. Using a significance level of 0.05, do we have strong evidence that the rising time is associated with the height of the bread dough?

data bread ;

input time h1 -h4;

height =h1; output ;

height =h2; output ;

height =h3; output ;

height =h4; output ;

keep time height ;

datalines ;

35 4.5 5.0 5.5 6.75

40 6.5 6.5 10.5 9.5

45 9.75 8.75 6.5 8.25

run ;

data bread ;

input time h1 -h4;

height =h1; output ;

height =h2; output ;

height =h3; output ;

height =h4; output ;

keep time height ;

datalines ;

35 4.5 5.0 5.5 6.75

40 6.5 6.5 10.5 9.5

45 9.75 8.75 6.5 8.25

run ;

proc glm data=bread order=data;

class time;

model height=time/solution;

lsmeans time/cl;

run;

|  |  |  |
| --- | --- | --- |
| Source | DF | Answer |
| Treatment/ Factor | 3-1 | 3-1= 2 |
| Error | 12-3 | 12-3= 9 |
| total | 12-1 | 9+2= 11 (checked with  12-1= 11) |

A screenshot of a computer

AI-generated content may be incorrect.

The resulting F statistic is 𝐹 = 4.60, corresponding to 𝑝 = 0.04. Based on this result, we suggest the significance and reject the null hypothesis because we have strong evidence that the rising time is associated with the height of the bread dough.