FA8: Independent Samples t-Test for Invisibility Cloak Dataset

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Independent Samples t-Test: Invisibility Cloak Dataset

This report performs an independent samples t-test to compare the mean number of mischievous acts (Mischief) between two groups: participants without an invisibility cloak (Cloak = 0) and participants with an invisibility cloak (Cloak = 1). The analysis follows the specified assumptions (1 to 5 only) and includes the computation of the t-test.

Data Loading and Preparation

The dataset is provided as a table of participants, their cloak status, and mischief scores. We load it into R as a data frame for analysis.

```
# Create the dataset as a data frame
data <- data.frame(
  Participant = 1:24,
  Cloak = c(0,0,0,0,0,0,0,0,0,0,0,0,1,1,1,1,1,1,1,1,1,1,1,1),
  Mischief = c(3,1,5,4,6,4,6,2,0,5,4,5,4,3,6,6,8,5,5,4,2,5,7,5)
)

# Display the first few rows to verify
head(data)
```

```
##   Participant Cloak Mischief
## 1           1     0        3
## 2           2     0        1
## 3           3     0        5
## 4           4     0        4
## 5           5     0        6
## 6           6     0        4
```

The data consists of 24 participants: 12 without a cloak (Cloak = 0) and 12 with a cloak (Cloak = 1). Mischief is the dependent variable (continuous scores).

Assumption Checks

We now check Assumptions 1 to 5. Each assumption is stated, explained, and tested where applicable.

Assumption 1: The dependent variable (Mischief) is measured at a continuous level.

Explanation:

This assumption requires that the dependent variable (Mischief, the number of mischievous acts) is measured on a continuous scale (e.g., ratio or interval level). In this dataset, Mischief is a count of acts, which can be treated as continuous for parametric tests like the t-test, especially with a reasonable sample size (n=24 total, 12 per group). No statistical test is needed here; it's a design check. If Mischief were ordinal or categorical, a non-parametric test would be required instead.

```
# Check the data type of Mischief
str(data$Mischief)
```

```
##  num [1:24] 3 1 5 4 6 4 6 2 0 5 ...
```

Mischief is numeric (continuous), satisfying Assumption 1.

Assumption 2: The independent variable (Cloak) consists of two categorical, independent groups (Without a cloak, With a cloak).

Explanation:

The independent variable (Cloak) must be categorical with exactly two independent groups, and participants must be randomly assigned or naturally independent. Here, Cloak has two levels: 0 (without cloak) and 1 (with cloak). These groups are independent because each participant is in only one group, and there's no pairing or relationship between groups. This is a design assumption; violation would require a different test (e.g., paired t-test).

```
# Check the levels of Cloak and group sizes
table(data$Cloak)
```

```
##
##  0  1
## 12 12
```

There are two groups: 12 participants without a cloak and 12 with a cloak, satisfying Assumption 2.

Assumption 3: Each participant is present in only one group.

Explanation:

```
# Check for unique participants
length(unique(data$Participant)) == nrow(data)  # Should be TRUE
```

```
## [1] TRUE
```

```r
# Check that no participant is in both groups (though unlikely with unique IDs)
table(data$Participant, data$Cloak)  # Should show 1 in one column per row
```

```
##
##      0 1
##   1  1 0
##   2  1 0
##   3  1 0
##   4  1 0
##   5  1 0
##   6  1 0
##   7  1 0
##   8  1 0
##   9  1 0
##   10 1 0
##   11 1 0
##   12 1 0
##   13 0 1
##   14 0 1
##   15 0 1
##   16 0 1
##   17 0 1
##   18 0 1
##   19 0 1
##   20 0 1
##   21 0 1
##   22 0 1
##   23 0 1
##   24 0 1
```