

Tutorial Concept Sheet 4

Listwise Operations and Vulnerability Box:

“Information in a List of N Numbers” and “Partitioning of Information”

- Location (1 value) (e.g. central tendency)
- Spread (1 value) (variability)
- Shape ($N - 2$ values) (relative spacing)

Listwise Operations

- $Y = X + b$ (Addition/Subtraction)
- $Y = aX$ (Multiplication/Division)
- $Y = aX + b$ (Linear Transformation)

Note: Any complicated series of additions/subtractions and multiplications/divisions can be changed into the simple form $Y = aX + b$!

Vulnerability Box

- Effect on Location, Spread, Shape
- Rules of Vulnerability Box = Rules of Linear Transformations

Scaling Course Grades

- Transformation $Y = aX + b$
- Start with Spread
- Adjust Location using addition/subtraction
- $a = \frac{S_Y}{S_X}$, $b = (\bar{Y} - a\bar{X})$

Z-scores:

- $z_{x_i} = \frac{X_i - \bar{X}}{S_X}$
- Mean = 0 Standard Deviation = 1 Relative spacing same as X scores
- The further a z-score is from 0, the more different it is from most scores
- Largest possible z-score
- Good for “fairly” comparing two groups

Introduction to R

Setting up a working directory

Arithmetic Operations in R

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R Functions to memorize

Concatenating a list of numbers and assigning it to a variable

```
x <- c(1,2,3,4,5)
```

Listwise operations

```
y <- x^2
```

```
y <- 2*x + 2
```

Summing a list

```
y <- sum(x)
```

Summing a Listwise operation

```
y <- sum(x^2)
```

Computing a mean

```
Xbar <- mean(x)
```

Computing a variance

```
Ssquared <- var(x)
```

Computing a standard deviation

```
S <- sd(x)
```

Computing N , the length of a list

```
N <- length(x)
```

Creating our own functions

```
Myfunction <- function(input1, input2)
{
  function calculations go here
}
```

A deviation score function

```
dev <- function(x)
```

```
{
  x - mean(x)
}
```

A variance function

```
myvar <- function(x)
{
  N <- length(x)
  sum ( dev(x)^2 ) / (N-1)
}
```

Random Number Generation

Seeding the generator with a “start value” to enable replication

```
set.seed(12345)
```

Getting a pseudorandom sample of 200 observations from a normal distribution with a mean of 70 and a standard deviation of 12

```
y <- rnorm(200,70,12)
```

Plotting a histogram

```
hist(x)
```

Getting help for the histogram function

```
?hist
```

Plotting a stem-leaf diagram

```
stem(x)
```

Plotting a boxplot

```
boxplot(x)
```

Plotting side-by-side boxplots for two groups

```
boxplot(x,y)
```

Creating a sequence of numbers

```
w <- 1:100
```

Plotting a function curve of the function x^2 from -3 to $+3$

```
curve(x^2,-3,3)
```

Plotting the normal curve probability density for $\mu = 100, \sigma = 15$, from 50 to 150

```
curve(dnorm(100,15),50,150)
```