Word Equations

```
outcome = explanatory + other stuff
Y = X + other stuff
```

Basics

```
print("Hello world!")

# assign value to object
myNumber <- 5
# combine values into vector
myVector <- c(1, 2, 3)
# first element in vector
myVector[1]

# arithmetic operations
sum(1, 2, 100), +, -, *, /

# logical operations
>, <, >=, <=, ==, !=, |, &
```

Summary Tables

```
# compute five-number summary
favstats(~ Y, data = data_set)

# create frequency table
tally(data_set$Y)
tally(~ Y, data = data_set)

# tally by condition
tally(~ Y < 1900, data =
data_set)

# two-way frequency table
tally(Y ~ X, data = data_set)
```

Simulation

```
# sample without replacement
sample(data_set, 6)
# sample with replacement
resample(data_set, 10)

# randomize sampling
distribution
# of b1s, centered on 0
sdob1 <- do(1000) *
  b1(shuffle(Y) ~ X, data =
data_set)

# bootstrap sampling
distribution
# of b1s, centered on sample
b1 sdob1_boot <- do(1000) *
  b1(Y ~ X, data =
resample(data_set))

# return TRUE for
# middle 95% of distribution
middle(sdob1$b1, .95)

# randomize sampling distribution
# of PREs
sdoPRE <- do(1000) *
  pre(shuffle(Y)~ X,
  data = data_set)

# randomize sampling distribution
# of Fs
sdoF <- do(1000) *
  f(shuffle(Y)~ X, data = data_set)
```

Data Frame

```
# view first/last six rows
head(data_set)
tail(data_set)

# structure of data frame
str(data_set) glimpse(data_set)

# select variable (a column)
data_set$Y

# select multiple variables
select(data_set, Y1, Y2)

# select first row
data_set[1, ]

# find rows that meet condition
data_set[data_set$Y > 40]
filter(data_set, Y > 300)

# arrange rows by variable
arrange(data_set, Y)

# sort in a descending order
arrange(data_set, desc(Y))

# get rid of all cases with any
# missing values
na.omit(data_set)

# convert quantitative variable
# to categorical
factor(data_set$Y)

# convert categorical variable
# to quantitative
as.numeric(data_set$Y)
```

Fitting Models to Data

```
# empty model
empty_model <- lm(Y ~ NULL, data = data_set)

# use one explanatory variable
one_model <-
  lm(Y ~ X, data = data_set)

# extract the best fitting b1
b1(shuffle(Y) ~ X, data = data_set)

# multivariate model
multi_model <-
  lm(Y ~ X1 + X2, data = data_set)

# model predictions and residuals
data_set$empty_predict <- predict(empty_model)
data_set$empty_resid <- resid(empty_model)
```

Comparing Models

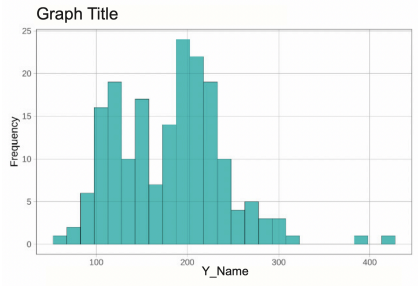
```
pre(Y ~ X, data = data_set)
f(Y ~ X, data = data_set)

# sample F for X2
f(Y ~ X1 + X2,
data = data_set, predictor = ~X2)

# all the model comparisons that can be
# made in relation to the multivariate model
generate_models(multi_model)
```

Evaluating Models of DGP

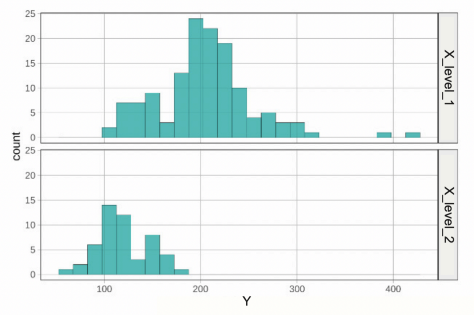
```
# produce ANOVA table
supernova(empty_model)
supernova(multi_model)

# t-test, using pooled variance
t.test(Y ~ X, data =
  data_set, var.equal=TRUE)

# confidence interval
confint(lm(Y ~ X,
  data = data_set))

# pairwise comparison
# corrections: "Bonferroni" or "none"
pairwise(one_model, correction = "none")
```

Visualizations

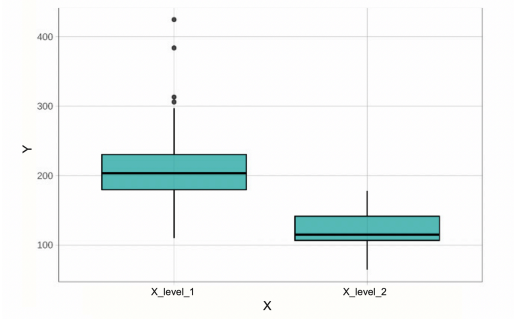
```
gf_histogram(~ Y, data = data_set) %>%
# change labels
  gf_labs(title = "Graph Title", x = "Y_Name",
y = "Frequency")
```



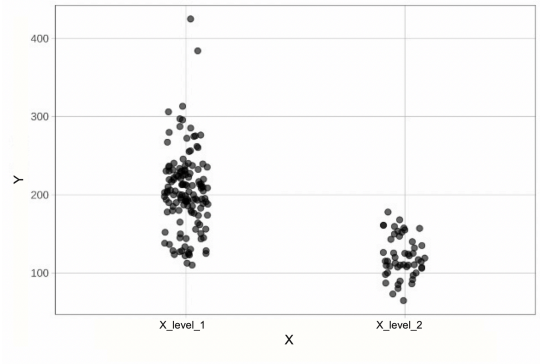

```
# faceted grid of histograms
gf_histogram(~ Y, data = data_set) %>%
  gf_facet_grid(X ~ .)
```



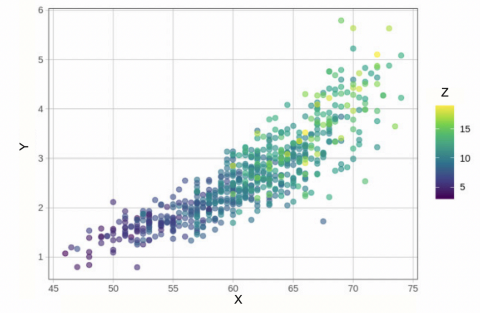

```
gf_boxplot(Y ~ X, data = data_set)
```



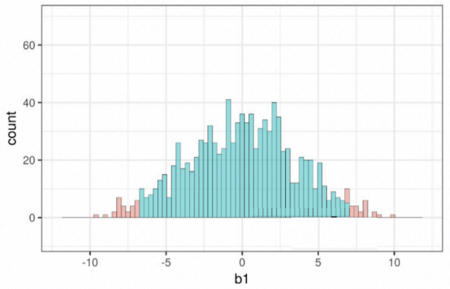

```
gf_jitter(Y ~ X, data = data_set)
```



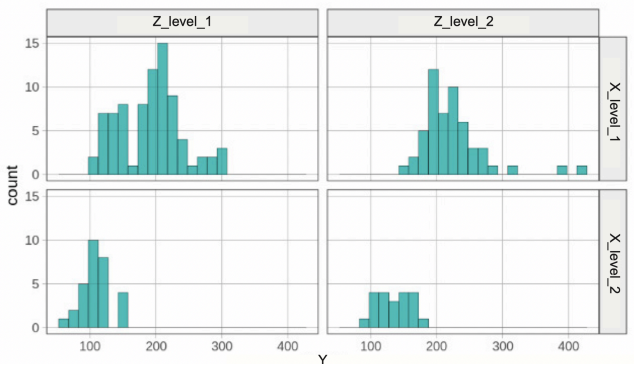

```
gf_point(Y ~ X, color = ~Z,
data = data_set)
```



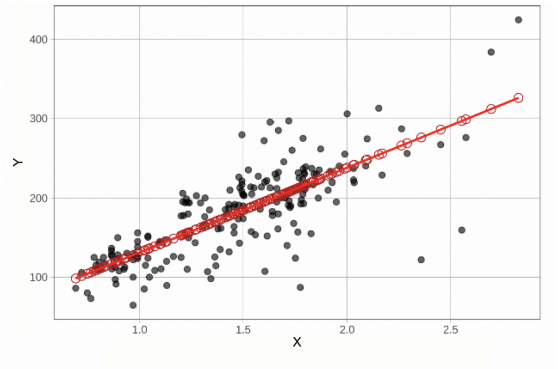

```
# sampling distribution of b1
gf_histogram(~b1, data = sdob1,
 fill = ~middle(b1, .95)) %>%
 # modify the limits on x- and y-axes
 gf_lims(x = c(-12, 12), y = c(0, 70))
```



```
gf_histogram(~ Y, data = data_set) %>%
 gf_facet_grid(X ~ Z)
```




```
gf_point(Y ~ X, data = data_set) %>%
 # add model predictions as red points
 gf_point(Y ~ X , shape = 1, size = 3,
color = "firebrick") %>%
 # add best fitting model as a red line
 gf_model(one_model, color = "red")
```




```
# F-distribution depicting p-value
sample_F <- f(Y ~ X, data = data_set)
xpf(sample_F, df1 = 1, df2 = 42)
```