# TUTORIAL FIVE

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# LET'S CHECK

## AVG_CM

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 2.33 | 1 | .9 | .9 | .9 |
| | 3.00 | 1 | .9 | .9 | 1.8 |
| | 3.33 | 2 | 1.8 | 1.8 | 3.5 |
| | 3.67 | 3 | 2.7 | 2.7 | 6.2 |
| | 4.00 | 2 | 1.8 | 1.8 | 8.0 |
| | 4.33 | 4 | 3.5 | 3.5 | 11.5 |
| | 4.67 | 9 | 8.0 | 8.0 | 19.5 |
| | 5.00 | 9 | 8.0 | 8.0 | 27.4 |
| | 5.33 | 9 | 8.0 | 8.0 | 35.4 |
| | 5.67 | 20 | 17.7 | 17.7 | 53.1 |
| | 6.00 | 19 | 16.8 | 16.8 | 69.9 |
| | 6.33 | 17 | 15.0 | 15.0 | 85.0 |
| | 6.67 | 10 | 8.8 | 8.8 | 93.8 |
| | 7.00 | 7 | 6.2 | 6.2 | 100.0 |
| | Total | 113 | 100.0 | 100.0 | |

# LET'S CHECK

**AVG_EM**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 2.00 | 1 | .9 | .9 | .9 |
| | 2.20 | 1 | .9 | .9 | 1.8 |
| | 2.40 | 3 | 2.7 | 2.7 | 4.4 |
| | 2.60 | 1 | .9 | .9 | 5.3 |
| | 2.80 | 2 | 1.8 | 1.8 | 7.1 |
| | 3.00 | 3 | 2.7 | 2.7 | 9.7 |
| | 3.20 | 3 | 2.7 | 2.7 | 12.4 |
| | 3.40 | 5 | 4.4 | 4.4 | 16.8 |
| | 3.60 | 3 | 2.7 | 2.7 | 19.5 |
| | 3.80 | 3 | 2.7 | 2.7 | 22.1 |
| | 4.00 | 7 | 6.2 | 6.2 | 28.3 |
| | 4.20 | 2 | 1.8 | 1.8 | 30.1 |
| | 4.40 | 8 | 7.1 | 7.1 | 37.2 |
| | 4.60 | 9 | 8.0 | 8.0 | 45.1 |
| | 4.80 | 6 | 5.3 | 5.3 | 50.4 |
| | 5.00 | 12 | 10.6 | 10.6 | 61.1 |
| | 5.20 | 5 | 4.4 | 4.4 | 65.5 |
| | 5.40 | 9 | 8.0 | 8.0 | 73.5 |
| | 5.60 | 11 | 9.7 | 9.7 | 83.2 |
| | 5.80 | 8 | 7.1 | 7.1 | 90.3 |
| | 6.00 | 1 | .9 | .9 | 91.2 |
| | 6.20 | 5 | 4.4 | 4.4 | 95.6 |
| | 6.40 | 2 | 1.8 | 1.8 | 97.3 |
| | 6.80 | 2 | 1.8 | 1.8 | 99.1 |
| | 7.00 | 1 | .9 | .9 | 100.0 |
| | Total | 113 | 100.0 | 100.0 | |

# LET'S CHECK

**AVG_HRM**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 1.00 | 1 | .9 | .9 | .9 |
| | 1.83 | 1 | .9 | .9 | 1.8 |
| | 2.00 | 1 | .9 | .9 | 2.7 |
| | 2.33 | 1 | .9 | .9 | 3.5 |
| | 2.50 | 1 | .9 | .9 | 4.4 |
| | 2.67 | 1 | .9 | .9 | 5.3 |
| | 3.00 | 1 | .9 | .9 | 6.2 |
| | 3.17 | 3 | 2.7 | 2.7 | 8.8 |
| | 3.33 | 2 | 1.8 | 1.8 | 10.6 |
| | 3.50 | 2 | 1.8 | 1.8 | 12.4 |
| | 3.67 | 3 | 2.7 | 2.7 | 15.0 |
| | 3.83 | 1 | .9 | .9 | 15.9 |
| | 4.00 | 3 | 2.7 | 2.7 | 18.6 |
| | 4.17 | 3 | 2.7 | 2.7 | 21.2 |
| | 4.33 | 7 | 6.2 | 6.2 | 27.4 |
| | 4.50 | 3 | 2.7 | 2.7 | 30.1 |
| | 4.67 | 4 | 3.5 | 3.5 | 33.6 |
| | 4.83 | 4 | 3.5 | 3.5 | 37.2 |
| | 5.00 | 5 | 4.4 | 4.4 | 41.6 |
| | 5.17 | 7 | 6.2 | 6.2 | 47.8 |
| | 5.33 | 3 | 2.7 | 2.7 | 50.4 |
| | 5.50 | 4 | 3.5 | 3.5 | 54.0 |
| | 5.67 | 6 | 5.3 | 5.3 | 59.3 |
| | 5.83 | 9 | 8.0 | 8.0 | 67.3 |
| | 6.00 | 11 | 9.7 | 9.7 | 77.0 |
| | 6.17 | 7 | 6.2 | 6.2 | 83.2 |
| | 6.33 | 3 | 2.7 | 2.7 | 85.8 |
| | 6.50 | 2 | 1.8 | 1.8 | 87.6 |
| | 6.67 | 4 | 3.5 | 3.5 | 91.2 |
| | 6.83 | 3 | 2.7 | 2.7 | 93.8 |
| | 7.00 | 7 | 6.2 | 6.2 | 100.0 |
| | Total | 113 | 100.0 | 100.0 | |

# PROBLEM

- Identify categorical vs. continuous variables
- Hypothesis
- T-Tests
- Interpret SPSS output for a t-test
- Dichotomous categorical vs. Polytomous Categorical Variables
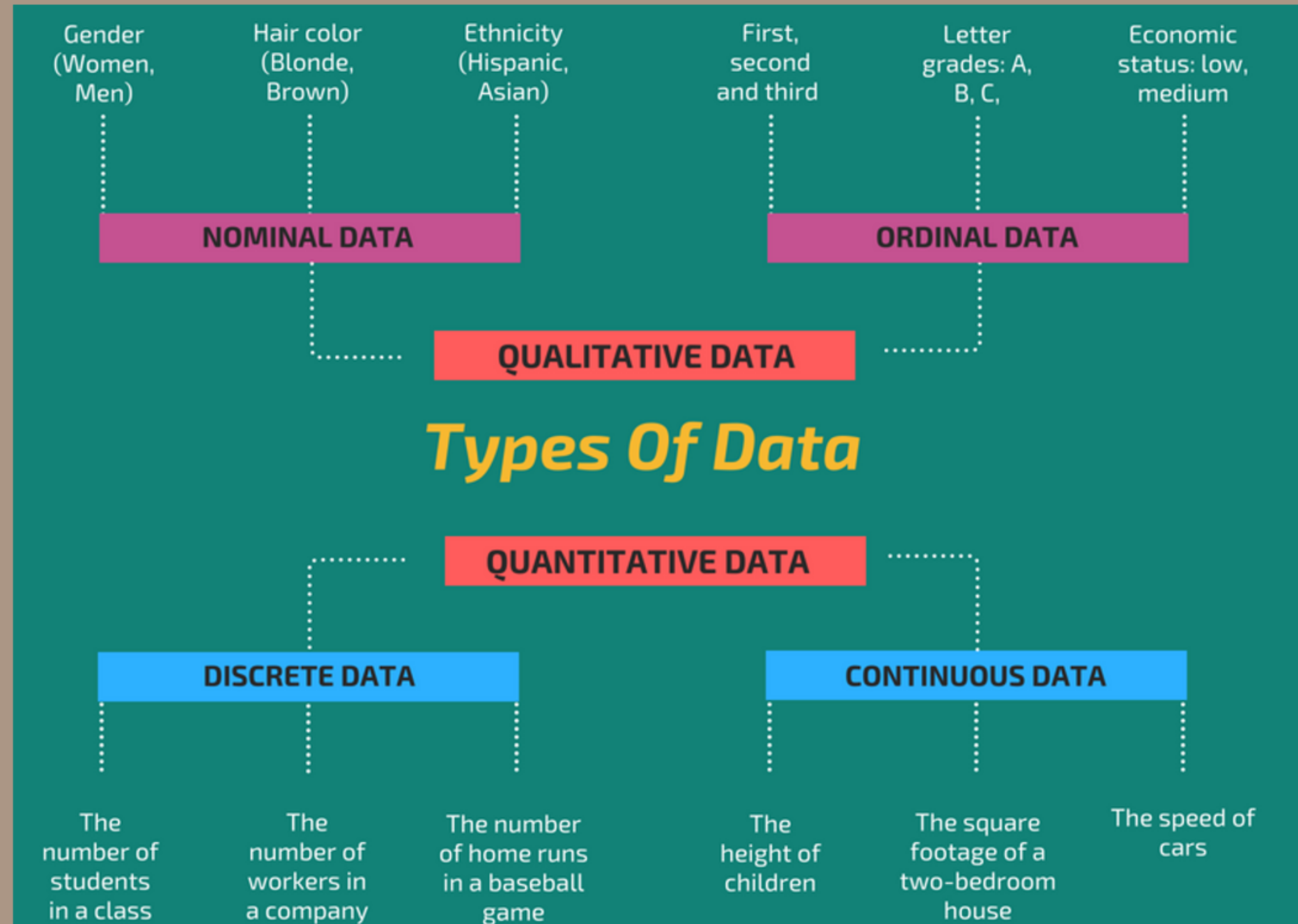- ANOVA Tests
- Interpret ANOVA output.

# TYPES OF DATA

Categories

Ordered/
Ranked

Gender
(Women,
Men)

Hair color
(Blonde,
Brown)

Ethnicity
(Hispanic,
Asian)

First,
second
and third

Letter
grades: A,
B, C,

Economic
status: low,
medium

**NOMINAL DATA**

**ORDINAL DATA**

**QUALITATIVE DATA**

## Types Of Data

**QUANTITATIVE DATA**

Whole
Numbers

Decimals

**DISCRETE DATA**

**CONTINUOUS DATA**

The
number of
students
in a class

The
number of
workers in
a company

The number
of home runs
in a baseball
game

The
height of
children

The square
footage of a
two-bedroom
house

The speed of
cars

# ONE SAMPLE T-TEST

T-tests are used to test hypotheses related to differences. Assume that your first hypothesis is:

*On average, our customers' purchase intention is relatively high.*

## For the tutorial we will use question 6

Q6   If you could make your computer purchase decision again, how likely would you be to choose DELL?

Definitely would ☐ –1
Probably would ☐ –2
Might or might not ☐ –3
Probably would not ☐ –4
or Definitely would not ☐ –5

**Does this data look right?**
**Recode**

**Tip: download the recoded data set**

# ONE SAMPLE T-TEST

To test the hypothesis "On average, our customers' purchase intention is relatively high"

**SPSS Guide:**

**Analyze > Compare Means > One Sample T-Test**

**Select Variable (Q6 Recoded)**

**Set Test Value to 3**

**Interpret Results**

# ONE SAMPLE T-TEST

**P-Value = Sig (2-Tailed)**

Remember from
STAT193/QUAN102

P < 0.05 = hypothesis is **supported**
P > 0.05 = hypothesis is **rejected**

**T-Test**

**What does the mean suggest?**

**One-Sample Statistics**

| | N | Mean | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|
| If you could make your computer purchase decision again, how likely would you be to choose Dell? [Recoded] | 372 | 4.6022 | .58073 | .03011 |

**One-Sample Test**

Test Value = 3

| | t | df | Sig. (2-tailed) | Mean Difference | 95% Confidence Interval of the Difference | |
|---|---|---|---|---|---|---|
| | | | | | Lower | Upper |
| If you could make your computer purchase decision again, how likely would you be to choose Dell? [Recoded] | 53.211 | 371 | .000 | 1.60215 | 1.5429 | 1.6614 |

# INDEPENDENT SAMPLES T-TEST

To test differences between two groups in one category

H1: "On average, males will have greater purchase intention compared to females"

**SPSS Guide:**

**Analyze > Compare Means > Independent Samples T-Test**
**Select Variable (Q6 Recoded)**
**Select Grouping Variable (Q14 as it asks for male/female)**
**Define Groups 1 and 2**
**Interpret Results**

# INDEPENDENT SAMPLES T-TEST

**Group Statistics**

| | Gender | N | Mean | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|---|
| If you could make your computer purchase decision again, how likely would you be to choose Dell? [Recoded] | Male | 183 | 4.5956 | .59335 | .04386 |
| | Female | 189 | 4.6085 | .56974 | .04144 |

**Independent Samples Test**

| | | Levene's Test for Equality of Variances | | t-test for Equality of Means | | | | | 95% Confidence Interval of the Difference | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | F | Sig. | t | df | Sig. (2-tailed) | Mean Difference | Std. Error Difference | Lower | Upper |
| If you could make your computer purchase decision again, how likely would you be to choose Dell? [Recoded] | Equal variances assumed | .070 | .791 | -.213 | 370 | .832 | -.01284 | .06030 | -.13142 | .10574 |
| | Equal variances not assumed | | | -.213 | 368.044 | .832 | -.01284 | .06034 | -.13150 | .10582 |

P < 0.05 = hypothesis is **supported**
P > 0.05 = hypothesis is **rejected**

**The hypothesis is?**

# PAIRED SAMPLES T-TEST

To compare the means of two variables for a single group (uses two different questions to do a comparison)

H1: "Consumers purchase intention will not be significantly different from their purchase intention if the price was 5% higher"

Continue using Q6 Recoded, will also need Q9A

Q9A  If the price of the DELL computer system you purchased had been **5%** higher, and all other personal computer prices had been the same, how likely would you have been to have purchased your DELL computer system?

Definitely would have purchased ☐ –1
Probably would have purchased ☐ –2
Might or might not have purchased ☐ –3
Probably would not have purchased ☐ –4
or Definitely would not have purchased ☐ –5

**Does this data look right? Recode?**
**Tip: download the recoded data set**

# PAIRED SAMPLES T-TEST

SPSS Guide:

Analyze > Compare Means > Paired Samples T-Test

Select Variable (Q6 Recoded) as Variable 1

Select Variable (Q9A Recoded) as Variable 2

Click OK

Interpret Results

# PAIRED SAMPLES T-TEST

**Paired Samples Test**

| | | Paired Differences | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | | | | | 95% Confidence Interval of the Difference | | | | |
| | | Mean | Std. Deviation | Std. Error Mean | Lower | Upper | t | df | Sig. (2-tailed) |
| Pair 1 | If you could make your computer purchase decision again, how likely would you be to choose Dell? [Recoded] - (Recoded) If the price of the Dell computer system you purchased had been 5% higher, and all other personal computer prices had been the same, how likely would you have been to have purchased your Dell computer system? | 1.68011 | 1.03696 | .05376 | 1.57439 | 1.78583 | 31.250 | 371 | .000 |

**P < 0.05 = hypothesis is supported**

**P > 0.05 = hypothesis is rejected**

**Hypothesis is?**

# PAIRED SAMPLES T-TEST
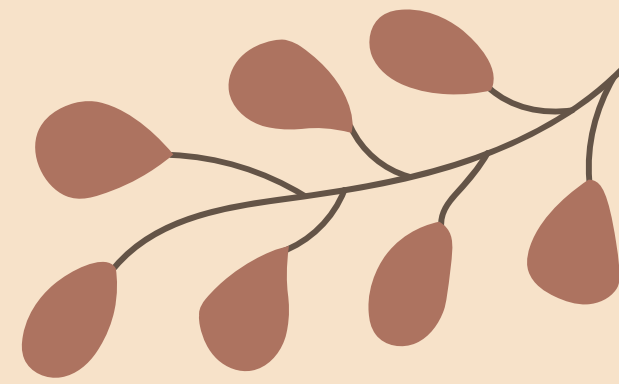
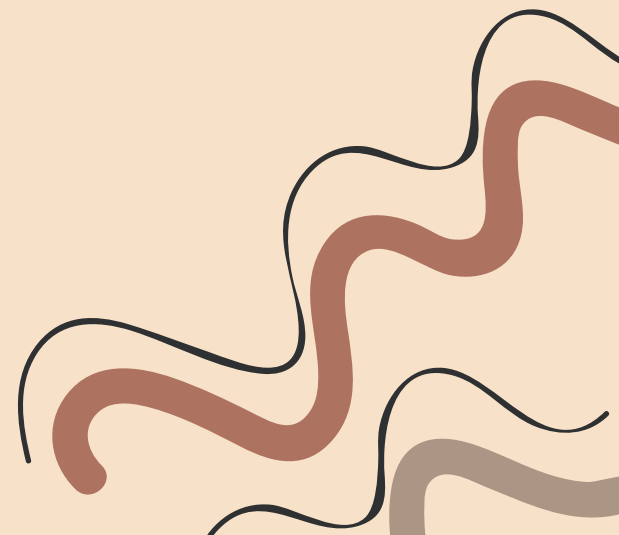The hypothesis is NOT supported this time. Why?

P < 0.05 = also means that there IS a significant difference

P > 0.05 = also means that there IS NOT a significant difference

H1 = "Consumers purchase intention will not be significantly different from their purchase intention if the price was 5% higher"

Be careful how you phrase your hypothesis

# WHEN TO USE THE DIFFERENT T-TESTS

**One sample t-test** = tests whether the sample mean is significantly different from a specified value

**Independent samples t-test** = test a difference in one continuous variable for two separate groups

**Paired samples t-test** = test difference in two continuous variables for one group. The means of two variables are compared that apply to everyone in the sample

# DICHOTOMOUS VS. POLYTOMOUS GROUPING VARIABLES

**Dichotomous = Two values**
**Polytomous = More than two values**

**Remember sometimes you can recode a variable from polytomous to dichotomous.**

**Sometimes you can't so you need to perform an ANOVA Test**

# ANOVA TESTS

Use ANOVA when independent variable is categorical (3 or more levels eg Q11) and the dependent variable is continuous.

ANOVA is used to measure the effect a categorical variable has on a continuous variable

**SPSS Guide:**

**Analyze > Compare Means > One-Way ANOVA**

**Select Variable (Q6 Recoded) place in Dependent List**

**Select Variable (Q11) place in Factor**

**Click Options > Check Descriptive and Mean Plots > OK**

**Interpret Results**

# ANOVA TESTS

**Oneway**

### Descriptives

If you could make your computer purchase decision again, how likely would you be to choose Dell? [Recoded]

| | N | Mean | Std. Deviation | Std. Error | 95% Confidence Interval for Mean | | Minimum | Maximum |
|---|---|---|---|---|---|---|---|---|
| | | | | | Lower Bound | Upper Bound | | |
| Some High School or less | 9 | 4.7778 | .44096 | .14699 | 4.4388 | 5.1167 | 4.00 | 5.00 |
| High School Graduate | 34 | 4.6471 | .54397 | .09329 | 4.4573 | 4.8369 | 3.00 | 5.00 |
| Some College/Technical School | 113 | 4.5487 | .64075 | .06028 | 4.4292 | 4.6681 | 2.00 | 5.00 |
| College Graduate or higher | 216 | 4.6157 | .55868 | .03801 | 4.5408 | 4.6907 | 2.00 | 5.00 |
| Total | 372 | 4.6022 | .58073 | .03011 | 4.5429 | 4.6614 | 2.00 | 5.00 |

### ANOVA

If you could make your computer purchase decision again, how likely would you be to choose Dell? [Recod

| | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Between Groups | .709 | 3 | .236 | .699 | .553 |
| Within Groups | 124.409 | 368 | .338 | | |
| Total | 125.118 | 371 | | | |

What can you conclude from the P-Value?
Purchase intention is **NOT** significantly different across education levels