sigma Σ Centre for excellence in mathematics and statistics support | Coventry University

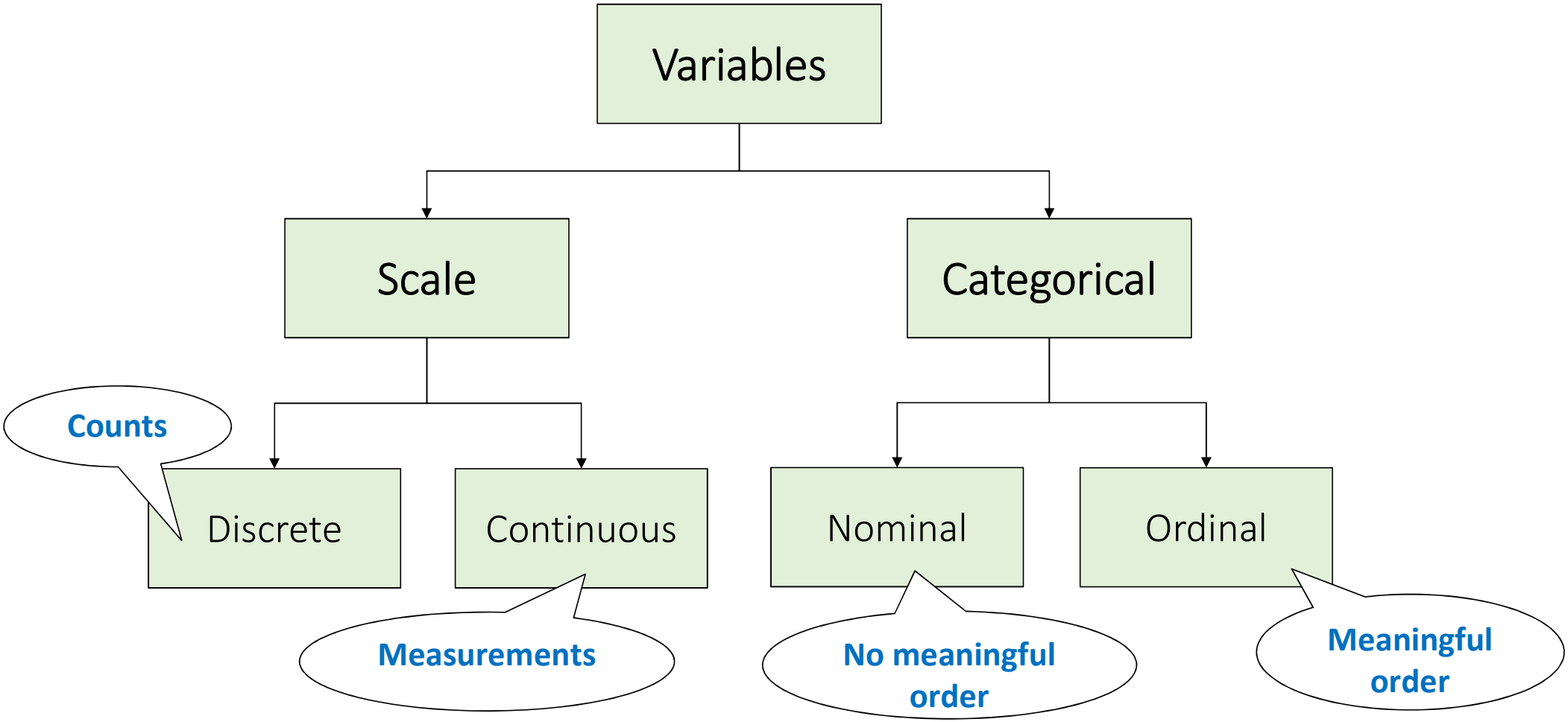
Choosing a Statistical Test

Website: http://sigma.coventry.ac.uk
Email: sigma_staff@live.coventry.ac.uk

Key factors to consider when choosing a statistical test

1. Type of data

Types of data



Key factors to consider when choosing a statistical test

1. Type of data
   - What type of data do you have (scale or categorical)?
   - Your variable of interest is often referred to as the outcome variable (or dependent variable)

Key factors to consider when choosing a statistical test

2. Nature of test
   - Are you looking for a difference?
   - Are you looking for a relationship/association/correlation?

Key factors to consider when choosing a statistical test

2. Nature of test
   - Are you looking for a difference?
     - Are your groups independent or matched/dependent?
   - Are you looking for a relationship/association/correlation?

Key factors to consider when choosing a statistical test

2. Nature of test
   - Are you looking for a difference?
     - Are your groups independent or matched/dependent?
     - E.g. Does having a choice of diet impact how much weight a patient loses?
   - Are you looking for a relationship/association/correlation?
     - E.g. Is there a association between gender and choice of diet?

Tests for differences between 2 groups

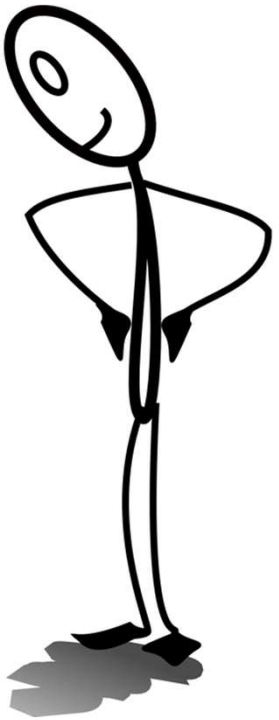
Scale outcome variable	**Ordinal** outcome variable
• Independent Samples t-test • Paired Samples t-test	• Mann-Whitney test • Wilcoxon Signed Rank test

Tests for differences between 3 or more groups

Scale outcome variable	**Ordinal** outcome variable
Analysis of variance (ANOVA)	Kruskal-Wallis test

Methods to investigate association/relationship

Two scale outcome variables	**Two ordinal** outcome variables or **one ordinal and one scale**	**Two nominal** outcome variables or **one nominal and one ordinal**
• Pearson's Correlation • Regression	Spearman's Rank Correlation	Chi-Squared test



Methods to explore more complex relationships

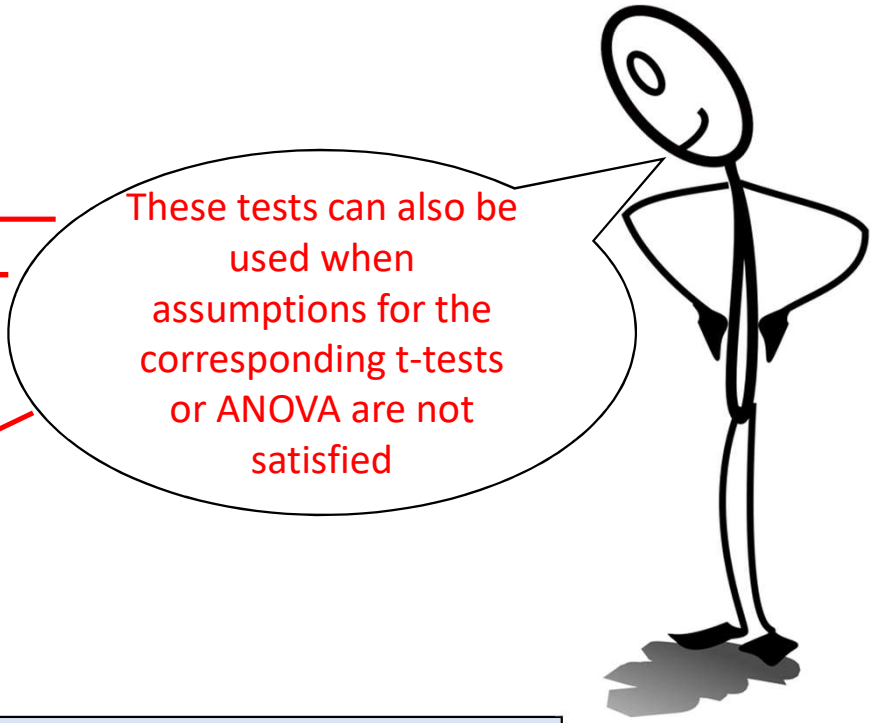
Multiple regression, Analysis of Covariance (ANCOVA), and lots more….

Tests for differences between 2 groups

Scale outcome variable	**Ordinal** outcome variable
• Independent Samples t-test • Paired Samples t-test	• Mann-Whitney test • Wilcoxon Signed Rank test

Tests for differences between 3 or more groups

Scale outcome variable	**Ordinal** outcome variable
Analysis of variance (ANOVA)	Kruskal-Wallis test



Methods to investigate association/relationship

Two scale outcome variables	**Two ordinal** outcome variables or **one ordinal and one scale**	**Two nominal** outcome variables or **one nominal and one ordinal**
• Pearson's Correlation • Regression	Spearman's Rank Correlation	Chi-Squared test

Methods to explore more complex relationships

Multiple regression, Analysis of Covariance (ANCOVA), and lots more….

Key factors to consider when choosing a statistical test

3. Are test assumptions satisfied?
   - When using a statistical test, certain assumptions must be checked (e.g. data type, Normality, equal variances, no outliers, independence etc)
   - You will need to check the required assumptions for each test
     - Google is a good starting point!
     - Pop along to see us in a sigma drop-in session (https://sigma.coventry.ac.uk/DropIns)

Example 1: Test for Difference

Does having a choice of diet (choice vs no choice) impact mean weight loss (kg)?

Example 1: Test for Difference

Does having a choice of diet (choice vs no choice) impact mean weight loss (kg)?

1.	Data type = **Scale**
2.	Nature of test = **Difference** …comparing weight loss between 2 *independent* groups

Example 1: Test for Difference

Does having a choice of diet (choice vs no choice) impact mean weight loss (kg)?

1.	Data type = **Scale**
2.	Nature of test = **Difference** …comparing weight loss between 2 *independent* groups

Independent samples t-test

Don't forget to check that the conditions/assumptions for the test are satisfied

Example 2: Test for Difference

Is there a difference in mean weight (kg) before and after attending an exercise programme?

Example 2: Test for Difference

Is there a difference in mean weight (kg) before and after attending an exercise programme?

1.	Data type = **Scale**
2.	Nature of test = **Difference** …comparing weight loss between 2 *dependent* groups

Example 2: Test for Difference

Is there a difference in mean weight (kg) before and after attending an exercise programme?

1.	Data type = **Scale**
2.	Nature of test = **Difference** …comparing weight loss between 2 *dependent* groups

Paired Samples t-test

Don't forget to check that the conditions/assumptions for the test are satisfied

Example 3: Test for an Association

Is there an association between gender (M/F/other) and choice of diet (choice vs. no choice)?

Example 3: Test for an Association

Is there an association between gender (M/F/other) and choice of diet (choice vs. no choice)?

1.	Data type = **Categorical (nominal)**
2.	Nature of test = **Association** …Association between two nominal outcome variables

Example 3: Test for an Association

Is there an association between gender (M/F/other) and choice of diet (choice vs. no choice)?

1.	Data type = **Categorical (nominal)**
2.	Nature of test = **Association** …Association between two nominal outcome variables

Chi-Squared Test

Don't forget to check that the conditions/assumptions for the test are satisfied

Example 4: Test for an Association

Is there a linear association between weight (kg) before and after a diet intervention?

Example 4: Test for an Association

Is there a linear association between weight (kg) before and after a diet intervention?

1.	Data type = **Scale**
2.	Nature of test = **Association** …Association between two scale variables (…draw a scatter plot)

Example 4: Test for an Association

Is there a linear association between weight (kg) before and after a diet intervention?

1.	Data type = **Scale**
2.	Nature of test = **Association** …Association between two scale variables (…draw a scatter plot)

Pearson's Correlation

** We need to check that some conditions/assumptions are satisfied to use this test*

Example 4: Test for an Association

Is there a linear association between weight (kg) before and after a diet intervention?

1.	Data type = **Scale**
2.	Nature of test = **Association** …Association between two scale variables (…draw a scatter plot)

Pearson's Correlation

…and perhaps regression too

Don't forget to check that the conditions/assumptions for the test are satisfied

Final Hints

- Always explore your data before choosing statistical tests
  - Histograms to visualise scale variables
  - Scatter plots to look at relationships between scale variables
  - Cross-tabulations to look at associations between categorical variables
  - Look for outliers
  - Think about what to do with missing data
- Check the test assumptions
- Don’t panic! Get in touch with **sigma** for help ☺

Some useful resources

sigma website

- http://sigma.coventry.ac.uk

Statistics Resources

- http://sigma.coventry.ac.uk/statistics-home

Drop-in

- We run drop-in sessions in our centre in the Lanchester Library as well as online. Check out the drop-in timetable at this link http://sigma.coventry.ac.uk/DropIns