JAMES COOK UNIVERSITY SINGAPORE

Chi-Square

Learning Centre

JAMES COOK UNIVERSITY AUSTRALIA

Cairns
Singapore
Townsville

www.jcu.edu.sg

CONTENTS

JAMES COOK UNIVERSITY SINGAPORE

1. What is a Chi-Square?
2. Types of Chi-Square Tests
3. A worked example on SPSS
4. Reporting

What is a Chi-Square?

- A Chi-Square is a non-parametric test that can be used if your data do not fulfil assumption requirements to conduct a parametric test
- Chi-Square tests are also used when a DV is ordinal or nominal

Types of Chi-Square Tests

Goodness of Fit

To assess if observed membership in a group is different from expected membership

Test of Independence

Used commonly to evaluate if two nominal variables are related

01

Goodness of Fit Example

The JCU cafeteria team was interested to find out if students prefer some flavours of Coca-Cola over others.

To test this, the staff of a drink stall asked 100 students of their preferred drink: Normal coke, Diet coke, Coke zero, or Vanilla coke.

More background info…

- In a Chi-Square analysis, we are assessing if there is a difference between an observed frequency and an expected frequency

- If students had no preference for any type of coke, we would expect to see roughly an equal number of 25 students in both observed and expected cells for each flavour

More background info…

- The observed frequency will come from the actual choices that the 100 students made
- We then compare the observed and expected frequencies if this happens by chance?

Location of SPSS Data Files

JAMES COOK UNIVERSITY SINGAPORE

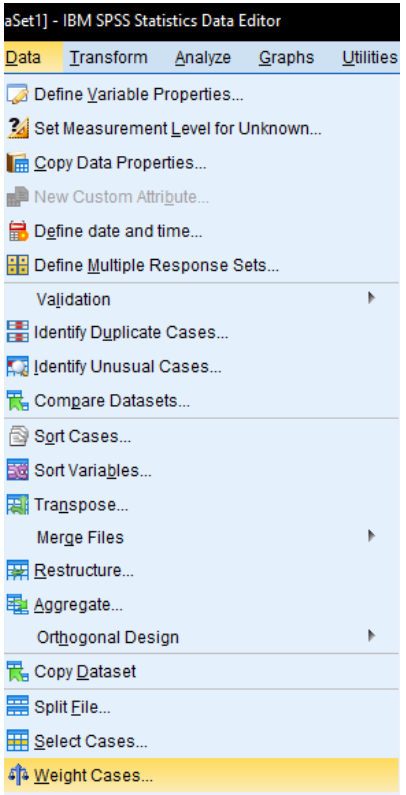
Example SPSS data for practice are available on LearnJCU:

Log in to LearnJCU -> Organisations -> Learning Centre JCU Singapore ->
Statistics Support -> Statistics Resources -> SPSS Data for Practice

Now onto SPSS…

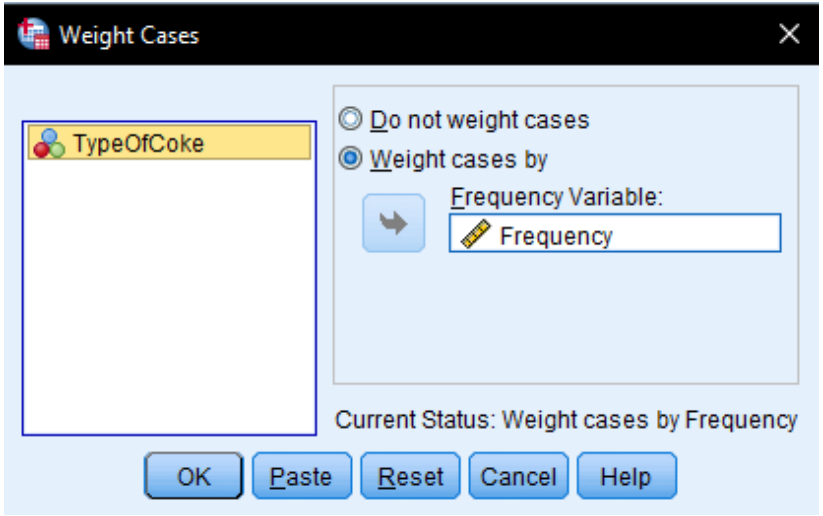
Before we run the analysis data, we will need to carry out an additional step:

- Click on Data -> Weight Cases



Now onto SPSS…

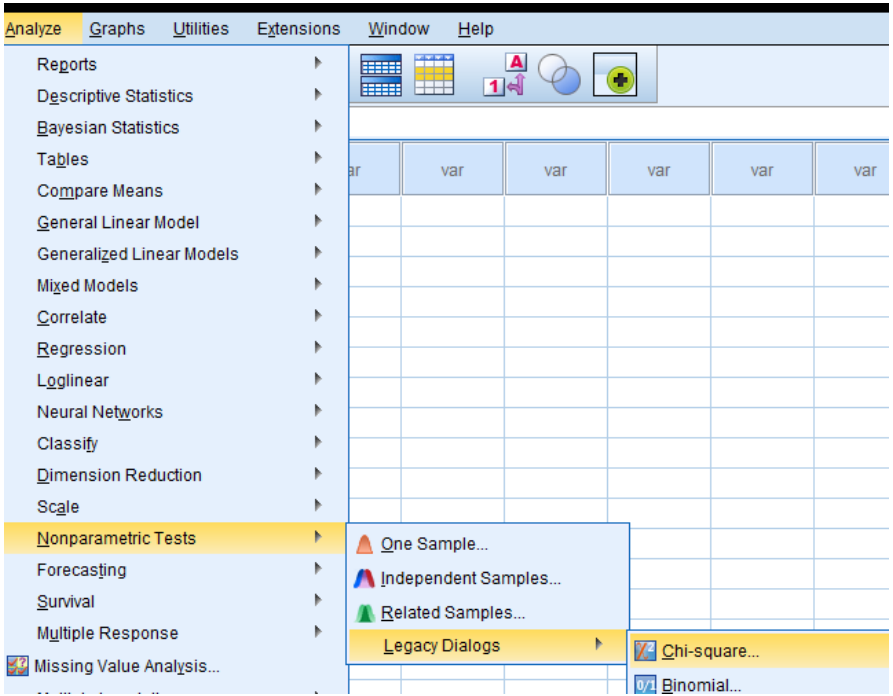
- Select Weight cases by, and bring the variable ‘Frequency’ over to the right
- Click OK, we can now run the goodness of fit analysis



Now onto SPSS…

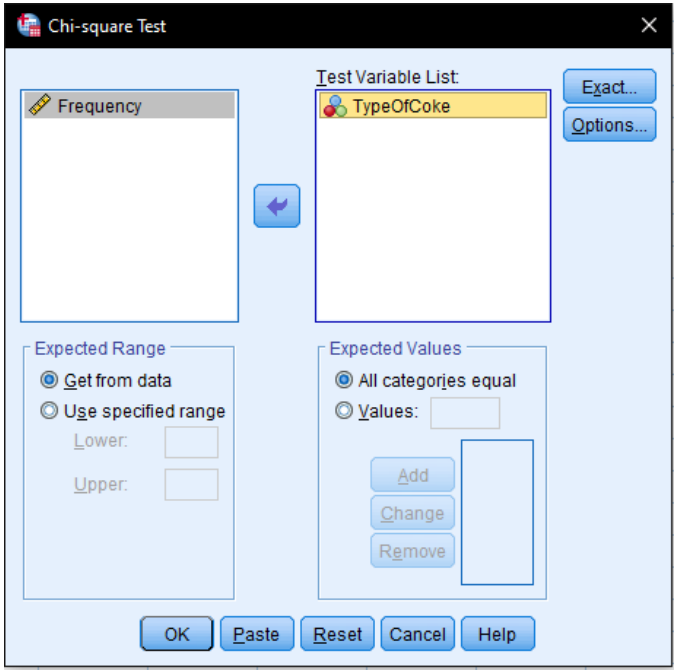
To run a Goodness of Fit test:

- Click on Analyze -> Nonparametric Tests -> LegacyDialogs -> Chi-square



Now onto SPSS…

- Select ‘TypeOfCoke’ and move it to under the Test Variable List
- We can leave all other options as the default
- Click OK!



Now onto SPSS…

Observed *N* shows the number of cases we observed for each type of coke

Expected *N* shows the number of cases we would expect if students had no specific preference

We obtained a Chi-Square statistic of 60.240

TypeOfCoke

	Observed N	Expected N	Residual
Normal	24	25.0	-1.0
Diet	10	25.0	-15.0
Zero	57	25.0	32.0
Vanilla	9	25.0	-16.0
Total	100		

Test Statistics

	TypeOfCoke
Chi-Square	60.240[a]
df	3
Asymp. Sig.	.000

a. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 25.0.

df is calculated as *n* - 1 (number of coke options minus 1) = 3

With alpha value set at .05, we obtained a *p* value of less than .001. This means that there is a significant difference in the types of coke student preferred

Writing up the results…

An example write-up can be found on page 263 in

Allen, P., Bennett, K., & Heritage, B. (2019). *SPSS Statistics: A Practical Guide* (4th ed.). Cengage Learning.

02

Test of Independence Example

To build on the earlier example, the JCU cafeteria team now thinks that the choices students made could be related to their weight.

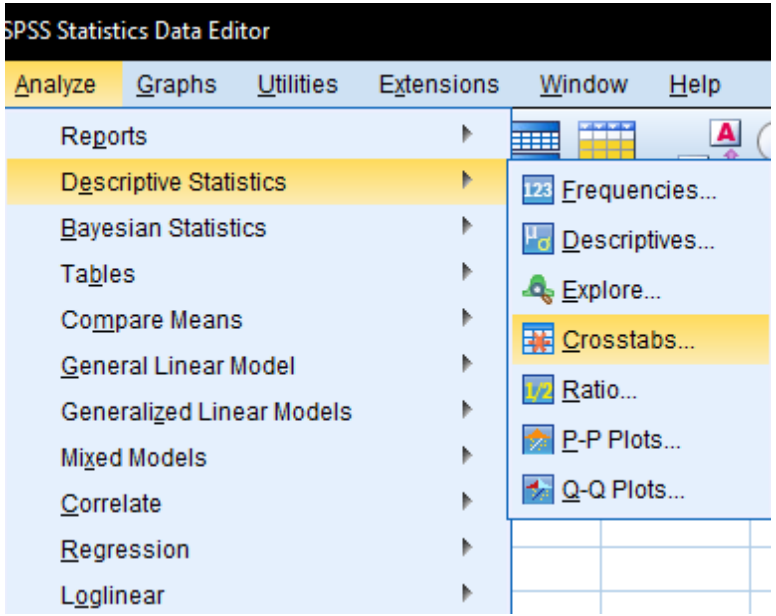
To test this, another 200 students were asked to choose between the 4 types of coke, and also indicate if they were underweight, overweight, or of averaged weight

Were the students' weight and their choice of coke related?

Now onto SPSS…

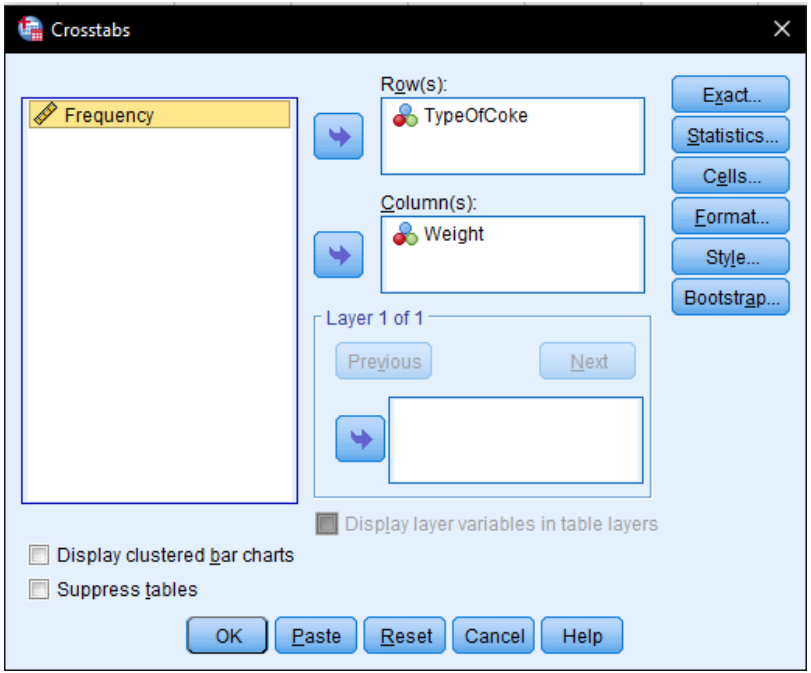
To conduct a test of independence:

- Click on Analyze -> Descriptive Statistics -> Crosstabs



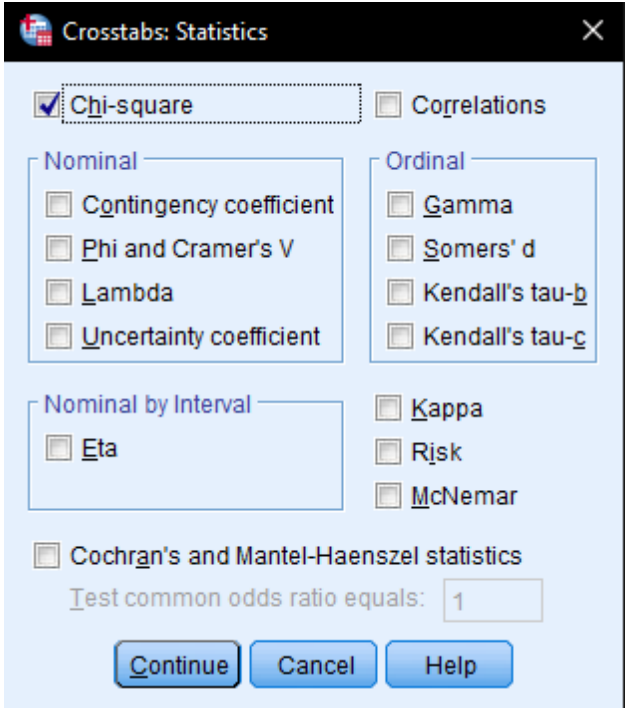
Now onto SPSS…

- Shift ‘TypeofCoke’ over to under Row(s), and ‘Weight’ to under Column(s)
- Click on Statistics to tweak some settings…



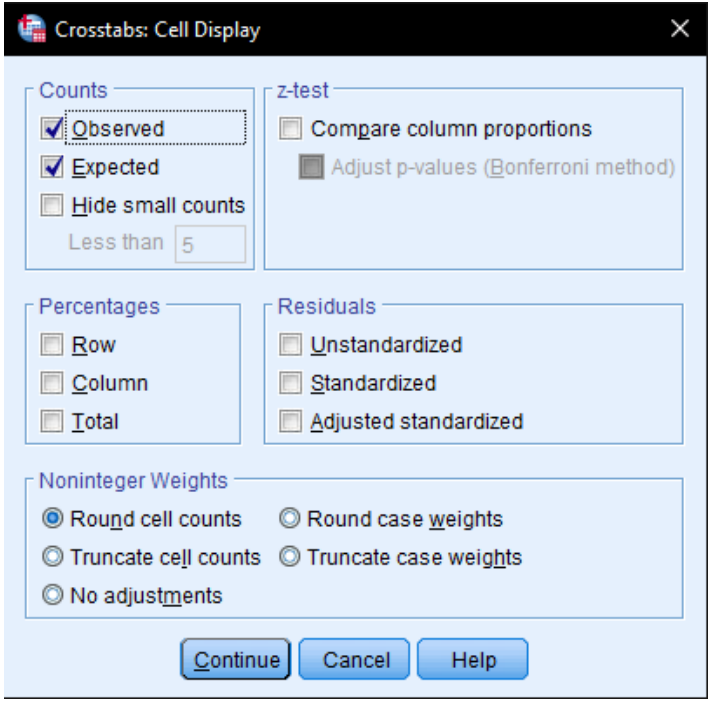
Now onto SPSS…

- Select *Chi-square*
- You can also select *Phi and Cramer's V* to obtain effect size
- Click Continue



Now onto SPSS…

- Next, click on Cells
- Select ‘Observed’ and ‘Expected’
- This will provide us with descriptive statistics that we can use in our write-up
- Click Continue, and OK!



Now onto SPSS…

This table shows the breakdown of observed and expected counts across all levels of our 2 variables

TypeOfCoke * Weight Crosstabulation

			Weight			
			Underweight	Acceptable	Overweight	Total
TypeOfCoke	Normal	Count	20	21	11	52
		Expected Count	13.8	18.5	19.8	52.0
	Diet	Count	8	15	20	43
		Expected Count	11.4	15.3	16.3	43.0
	Zero	Count	19	25	32	76
		Expected Count	20.1	27.0	28.9	76.0
	Vanilla	Count	6	10	13	29
		Expected Count	7.7	10.3	11.0	29.0
Total		Count	53	71	76	200
		Expected Count	53.0	71.0	76.0	200.0

Pearson's Chi-Square value = 10.157, with a *df* of 6

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	10.157[a]	6	.118
Likelihood Ratio	10.613	6	.101
Linear-by-Linear Association	5.285	1	.022
N of Valid Cases	200		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 7.69.

This is the *p* value; it is larger than the alpha value of .05. We can conclude that students' weight and their preferred types of coke were not related

Writing up the results…

An example write-up can be found on:

JCUS Learning Centre website -> Statistics and Mathematics Support

JAMES COOK UNIVERSITY SINGAPORE

Any questions?

learningcentre-singapore@jcu.edu.au

JAMES COOK UNIVERSITY AUSTRALIA

Cairns
Singapore
Townsville

www.jcu.edu.sg