Exercise 1 - Chi-Square

Calculate the chi-square value for the contingency table below to answer the question "Are there differences in the way that males and females vote (in the UK)?" The χ^2 distribution table can be found at the end of this document.

	Conservative	**Liberal Democrat**	**Labour**
Male	313	124	391
Female	344	158	388

Source: [US]

Exercise 2 - Pearson's Correlation Coefficient

The table below shows the results in maths and physics for ten students. Find Pearsons's correlation coefficient for the two variables (maths result and physics result) and use the table of critical values in the appendix to determine if the correlation is significant at the 5% level.

Student i	Maths x_i	Physics y_i
1	65	60
2	45	60
3	40	55
4	55	70
5	60	80
6	50	40
7	80	85
8	30	50
9	70	70
10	65	80

Source: [US]

Exercise 3 - Kendall Rank Correlation Coefficient

Find Kendall's τ (Rank Correlation Coefficient) for the two variables shown in the data table below (haemoglobin and red blood cells). Use the table of critical values in the appendix to determine if the correlation is significant at the 1% level.

The following data refer to the amounts of haemoglobin (in g/dl) and the numbers of red blood cells (in hundred million per cl) in samples of blood taken from mothers during labour.

Mother	A	B	C	D	E	F	G	H	I	J
Haemoglobin, x	11.7	14.2	13.7	13.5	14.6	13.8	13.9	11.4	11.6	13.6
Red blood cells, y	349	449	454	441	468	476	473	448	397	496

Source: [US]

Appendix

Percentage points for the χ^2 distribution

If X has a χ^2_v distribution, then a tabulated value, x, is such that $P(X < x) = p\%$.

v	$p(\%)$								
	Lower tail			*Upper tail*					
	0.5	2.5	5	90	95	97.5	99	99.5	99.9
1	$0.0^4 3927$	$0.0^3 9821$	$0.0^2 3932$	2.706	3.841	5.024	6.635	7.879	10.83
2	0.01003	0.05064	0.1026	4.605	5.991	7.378	9.210	10.60	13.82
3	0.07172	0.2158	0.3518	6.251	7.815	9.348	11.34	12.84	16.27
4	0.2070	0.4844	0.7107	7.779	9.488	11.14	13.28	14.86	18.47
5	0.4117	0.8312	1.145	9.236	11.07	12.83	15.09	16.75	20.52
6	0.6757	1.237	1.635	10.64	12.59	14.45	16.81	18.55	22.46
7	0.9893	1.690	2.167	12.02	14.07	16.01	18.48	20.28	24.32
8	1.344	2.180	2.733	13.36	15.51	17.53	20.09	21.95	26.12
9	1.735	2.700	3.325	14.68	16.92	19.02	21.67	23.59	27.88
10	2.156	3.247	3.940	15.99	18.31	20.48	23.21	25.19	29.59
11	2.603	3.816	4.575	17.28	19.68	21.92	24.72	26.76	31.26
12	3.074	4.404	5.226	18.55	21.03	23.34	26.22	28.30	32.91
13	3.565	5.009	5.892	19.81	22.36	24.74	27.69	29.82	34.53
14	4.075	5.629	6.571	21.06	23.68	26.12	29.14	31.32	36.12
15	4.601	6.262	7.261	22.31	25.00	27.49	30.58	32.80	37.70
16	5.142	6.908	7.962	23.54	26.30	28.85	32.00	34.27	39.25
17	5.697	7.564	8.672	24.77	27.59	30.19	33.41	35.72	40.79
18	6.265	8.231	9.390	25.99	28.87	31.53	34.81	37.16	42.31
19	6.844	8.907	10.12	27.20	30.14	32.85	36.19	38.58	43.82
20	7.434	9.591	10.85	28.41	31.41	34.17	37.57	40.00	45.31
21	8.034	10.28	11.59	29.62	32.67	35.48	38.93	41.40	46.80
22	8.643	10.98	12.34	30.81	33.92	36.78	40.29	42.80	48.27
23	9.260	11.69	13.09	32.01	35.17	38.08	41.64	44.18	49.73
24	9.886	12.40	13.85	33.20	36.42	39.36	42.98	45.56	51.18
25	10.52	13.12	14.61	34.38	37.65	40.65	44.31	46.93	52.62
30	13.79	16.79	18.49	40.26	43.77	46.98	50.89	53.67	59.70
40	20.71	24.43	26.51	51.81	55.76	59.34	63.69	66.77	73.40
50	27.99	32.36	34.76	63.17	67.50	71.42	76.15	79.49	86.66
60	35.53	40.48	43.19	74.40	79.08	83.30	88.38	91.95	99.61
70	43.28	48.76	51.74	85.53	90.53	95.02	100.4	104.2	112.3
80	51.17	57.15	60.39	96.58	101.9	106.6	112.3	116.3	124.8
90	59.20	65.65	69.13	107.6	113.1	118.1	124.1	128.3	137.2
100	67.33	74.22	77.93	118.5	124.3	129.6	135.8	140.2	149.4

For values of v greater than 100, use the result that $\sqrt{2X}$ has an approximate normal distribution with mean $\sqrt{2v-1}$ and variance 1.

Pearson's Correlation Coefficient critical values

n	5%	1%	n	5%	1%	n	5%	1%	n	5%	1%
4	.950	.990	7	.754	.874	10	.632	.765	13	.553	.684
5	.878	.959	8	.707	.834	11	.602	.735	14	.532	.661
6	.811	.917	9	.666	.798	12	.576	.708	15	.514	.641

Kendall's Tau (Rank Correlation Coefficient) one-tailed critical values

n	5%	1%	n	5%	1%	n	5%	1%	n	5%	1%
4	1.000	*	7	.619	.810	10	.467	.600	13	.359	.513
5	.800	1.000	8	.571	.714	11	.418	.564	14	.363	.473
6	.733	.867	9	.500	.667	12	.394	.545	15	.333	.467

References

[**MSD**] *Making Sense of Data I: A Practical Guide to Exploratory Data Analysis and Data Mining*, by Glenn J. Myatt and Wayne P. Johnson, John Wiley & Sons, 2014.

[**US**] Understanding Statistics, by Graham Upton and Ian Cook, Oxford University Press, 1996.