You collected survey data aiming to prove a connection between self-reported patriotism and political support for Andrej Danko in Slovakia. Responses are summarized in following frequency table:

Patriotic? \ Danko?	Yes	No
Yes	53	42
Don't know	28	41
No	10	40

Test ($\alpha = 0,05$) whether responses associated with being patriotic are independent on the support for Andrej Danko

f_i $\quad C = 2$

X_i	Yes	No	
Yes	53	42	95
Dn	28	41	69
No	10	40	50
	91	123	214

$R = 3$

$\hat{f}_i$

E_i	Y	N	
Y	40.4	54.6	95
D	29.3	39.7	69
N	21.3	28.7	50
	91	123	214

	3.93	2.9	6.83
	0.06	0.04	0.1
	6	4.45	10.45
	9.99	7.39	17.38 = t

$$\frac{(f_i - \hat{f}_i)^2}{\hat{f}_i}$$

$$\overline{W}_{0.95} = \langle 0; \chi^2((R-1)\cdot(C-1))\rangle$$
$$= \langle 0; \chi^2(2\cdot 1)\rangle = \langle 0; 5.9914\rangle$$
$$t \notin \overline{W}_\alpha \Rightarrow \text{zamítáme } H_0$$
(nezávislost)

For low sample sizes (expected frequencies < 5) and 2x2 table (so no further aggregation is possible) you can use Hypergeometric probabilities and Fisher's exact test. Suppose you want to find out whether some TV show will be polarizing to different age groups of audiences and you have just observations out of representative "test audience" (in following Frequency table)

Age \ Liked show	Yes	No
12-18	5	3
30-45	2	7

Derive some form of Fisher's exact test and test whether age and liking a show are independent (at $\alpha \leq 0,1$)

	Y	N	
12-18	$\boxed{5}$	3	8
30-45	2	7	9
	7	10	17

	Y	N	
			8
			9
	7	10	17

$X \sim H(17, 8, 7)$

$x = 0$ 0 8 / 7 2

$x=1$ 1 7 / 6 3

$p(x=0) = p(0) = \frac{\binom{8}{0}\binom{9}{7}}{\binom{17}{7}} = 0.002$ $\quad p(x=1) = p(1) = \frac{\binom{8}{1}\binom{9}{6}}{\binom{17}{7}} = 0.035$

$p(2) = 0.181$
$p(3) = 0.363$
$p(4) = 0.302$
$p(5) = 0.104$
$p(6) = 0.013$
$p(7) = 0.0004$

$\alpha \leq 0{,}1$

podle rostoucí p.

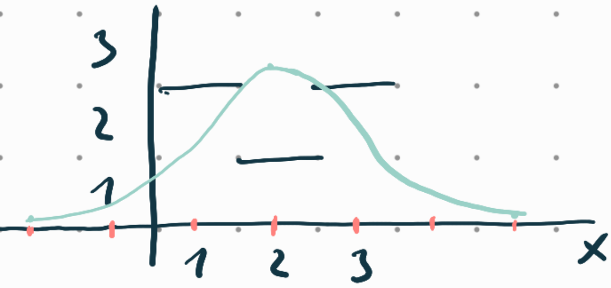
$\{7, 0, 6, 1\} = W_{0.1}$

0.04977 ... skutečné α

$\overline{W}_{0.1} = \{2, 3, 4, 5\}$

$5 \in \overline{W}_{0.1} \Rightarrow$ nezamítám H_0

Using IID observations $1; 2; 3; 1; 3$ of some random variable X test, whether $X \sim N(\mu, \sigma^2)$. Use Lilliefors test with significance level $\alpha = 0,05$



$\bar{x} = 2$

$s(x)^2 = \frac{1}{4}(1+1+1+1) = 1$

$x \to u$

$1 \to \frac{1-\bar{x}}{s^2} = -1$

$2 \to 0$

$3 \to 1$

u_i u_{i+1}	$\hat{F}(u)$	$\Phi(u_i)$	$\Phi(u_{i+1})$	D_i^-	D_i^+
$(-\infty; 1)$	$\frac{0}{5} = 0$	0	0.1587	0	0.1587
$\langle 1; 2)$	$\frac{2}{5} = 0.4$	0.1587	0.5	0.2413	0.1
$\langle 2; 3)$	$\frac{3}{5} = 0.6$	0.5	0.8413	0.1	0.2413
$\langle 3; \infty)$	$\frac{5}{5} = 1$	0.8413	1	0.1587	0

$\max\{D_i^-; D_i^+\} = 0.2413 = t$

$\bar{W}_\alpha = \langle 0; 0.3427)$ $\quad t \in \bar{W} \Rightarrow$ nezamítáme H_0

(že výběr pochází z N rozd.)

$H_0: x_{0.5} = 75 = C$ počet $+ = 3$ $n = 10$

$d_i = x_i - C$ $\quad$ $\mathrm{sign}(d_i)$ $\quad$ $B:(10; 0.5)$

$\vdots$ $\quad$ $+$ $\quad$ $X(0) = 0.00097 = \binom{10}{0} 0.5^0 0.5^{10}$

$-$ $\quad$ $1 \quad 0.0097$ $\quad$ $\vdots$

$\vdots$ $\quad$ $2 \quad 0.0439$

$\vdots \quad \vdots$

$8 \quad 0.0439$

$9 \quad 0.0097$

$10 \quad 0.00097$

You obtained final results (points) of some exam at BUT: ~~98,7~~; ~~63,7~~; ~~81,3~~; ~~63,0~~; 68,3; ~~62,0~~; ~~83,9~~; ~~63,0~~; ~~74,3~~; 64,1. Test whether the median of an underlying random variable is equal to 75 at $\alpha \leq 0,05$.

$W_{0.05} = \{0, 10, 1, 9\}$

$t = 3$ $\quad$ $t \in \overline{W_{0.05}} \Rightarrow H_0$ nezamítám

You want to compare median exam scores of groups with different lecturers of the same course. For this purpose you obtained 20 exam scores for each lecturer (sorted values are in the table bellow)

X	**Lecturer 1**									
	60,2	60,6	61,1	62,4	63,3	63,5	63,7	64,5	65,0	66,4
	66,5	67,3	68,2	69,2	73,1	73,4	73,5	76,8	80,7	83,1
	Lecturer 2									
Y	52,1	52,2	52,7	54,3	55,1	55,6	56,0	56,3	58,1	58,1
	60,7	66,3	67,2	68,0	76,0	79,2	85,1	86,9	98,0	100,0

Use Mood's median test to test $H_0 : X_{0,5} = Y_{0,5}$ at $\alpha = 0,05$

$X_{0.5} = 66.45$

$Y_{0.5} = 59.4$

$z_{0.5}$ medián z obou souborů

$z_{0.5} = 65.65$

spočítaná

	1	2	
pod	9	11	20
nad	11	9	20
	20	20	40

f_j

očekávaná

10	10	20
10	10	20
20	20	40

$\hat{f}_j$

$$\sum \frac{(f_j - \hat{f}_j)^2}{f_j} = \frac{4}{10} = t$$

$$\overline{W}_{0.05} = \langle 0; \chi_{0.95}(1)) = \langle 0; 3.841\rangle$$

$t \in \overline{W}_\alpha \Rightarrow$ <u>H_0 nezamítáme</u>