Vylučování odlehlých výsledků

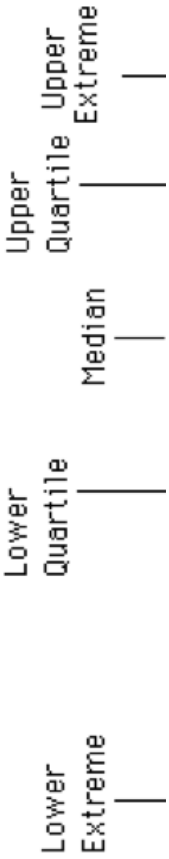
Krabicový graf a jeho dvě užití

seřazeno

37
47
41
30
68
79
98
87
70
17
68
48
65
18
86
83
82
10
84
78
29
18
83
60

funkce =quartil.inc()

v krabici je....



vylučování odlehlých výsledků metoda vnitřních hradeb

- Lower inner fence: Q1 − (1.5 * IQR)
- Upper inner fence: Q3 + (1.5 * IQR)

7
63
110
69
87
99
62
87
89

45

Ou

MVH, Vnitřní hradby, vnější hradby

Která z těchto 55 hodnot je odlehlá?

29 179 180 201 300 301 304 350 399

Q1
Q3
IQR

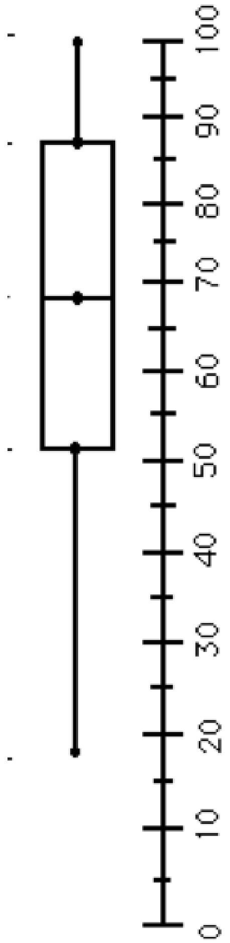
LIF
UIF

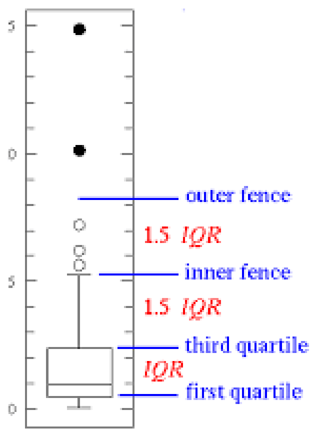
- Lower inner fence: Q1 – (1.5

LOF
UOF

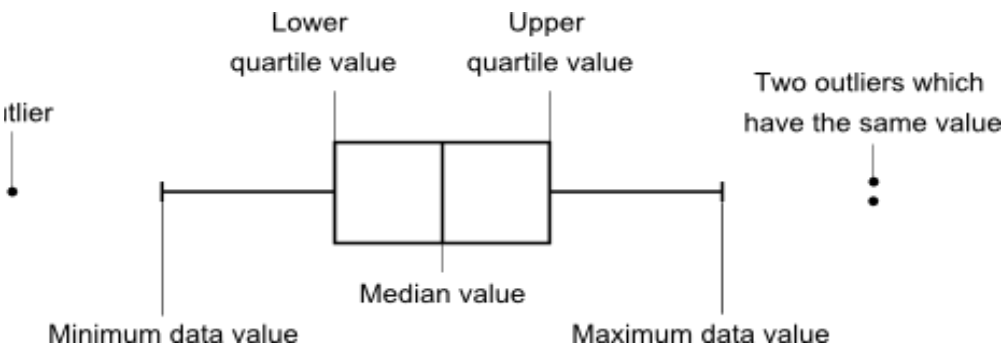
- Upper inner fence: Q3 + (1.5
- Lower outer fence: Q1 − (3 *
- upper outer fence: Q3 + (3 *

více o vylučování odlehlých výsled





- Lower inner fence: Q1 − (1.5 * IQR)
- Upper inner fence: Q3 + (1.5 * IQR)
- Lower outer fence: Q1 − (3 * IQR)
- upper outer fence: Q3 + (3 * IQR)



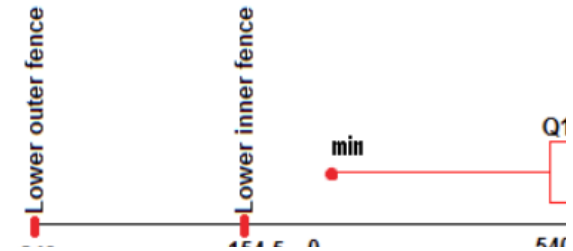
401 455 501 503 540 543 549 560 561

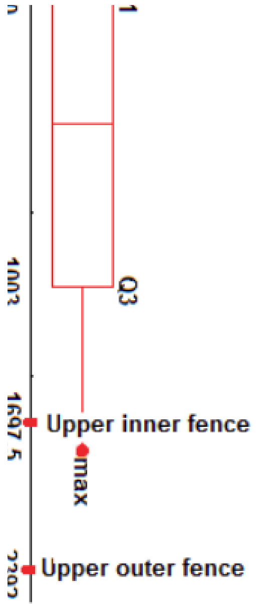
* IQR)

* IQR)
IQR)
IQR)

ků - viz dále

Step 3: Plot the upper and lower fences on a box plot. I
spot:





Not necessarily statistically, but it makes outliers easier to

562	563	569	570	599	601	603	650	701

703 704 709 713 733 745 801 900 982

983 985 999 1001 1002 1003 1009 1100 1101

1102 1103 1109 1201 1301 1399 1400 1501 1599

1699

Která z těchto 55 hodnot je odlehlá?

= v předchozím příkladu jsme použili MVH a vyloučili nejv
nyní použijeme Grubbsův test

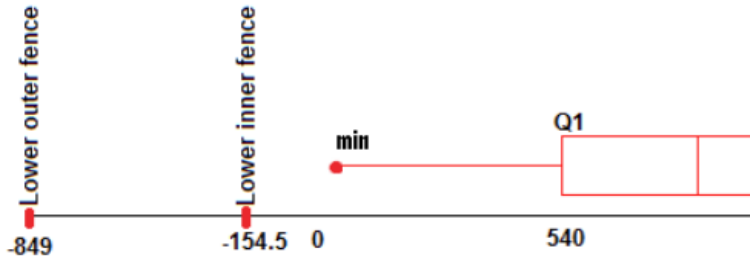
29 179 180 201 300 301 304 350 399

29
179
180
201
300
301
304
350
399
401
455
501
503
540
543
549
560
561
562
563
569
570
599
601
603
650
701
703
704
709
713
733
745
801
900
982
983
985
999
1001
1002
1003
1009

$$T = \frac{|x_{(i)} - \bar{x}|}{S}$$

T

Step 3: Plot the upper and lower fences on a box plot. Not necessarily s
spot:



1100
1101
1102
1103
1109
1201
1301
1399
1400
1501
1599
1699

T

závěr: V daném výběrovém souboru ....

Grubbsův test

zkontrolovat normalitu

průměr
směrodatná odchylka

T

$$T = \frac{|x_{(i)} - \bar{x}|}{S}$$

7
63
110
69
87
99
62
87
89
45

ryby

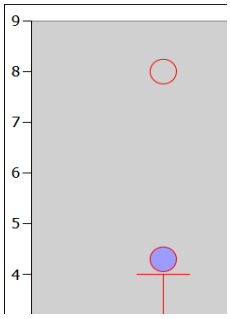
Rybáři vylovili malý rybník v městském parku.
Byl to první výlov po 10ti letech, byly v něm ryby různých velikostí, celkem 30 kusů. Jejich váhy jsou tyto
Zjistěte, zda-li je některá hodnota odlehlá.

	m (kg)	*seřazeno*
1	0.30	
2	1.90	
3	2.10	
4	0.48	
5	2.10	
6	3.10	
7	0.80	
8	2.30	
9	3.20	

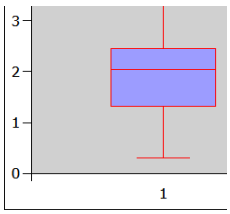
metoda vnitřních/vnějších hradeb

=Q1

=Q3
=R31
=1.5*R31
=3*R31



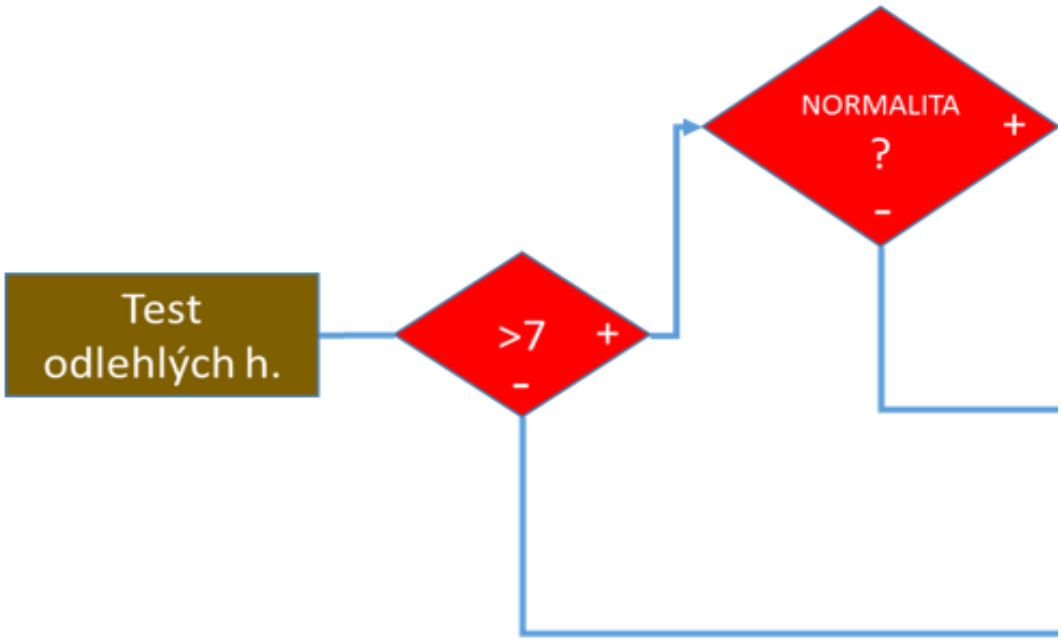
10	1.00		inner
11	1.60		
12	2.20		outer
13	2.50		
14	1.40		
15	2.20		
16	4.00		
17	1.10		
18	2.00		
19	3.10		
20	1.95		
21	2.00		
22	1.50		
23	2.56		
24	8.00		
25	1.01		
26	2.15		
27	4.30		
28	0.90		
29	2.20		
30	1.30		



Dean-Dixon Q-test

R=
Q1,2=
Q29,30=
Qcrit(0.05)

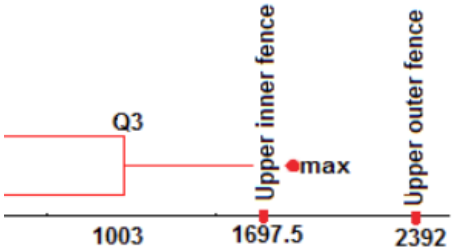
Grubbsův x Q-test



ětší hodnotu 1699

401 455 501 503 540 543 549 560 561

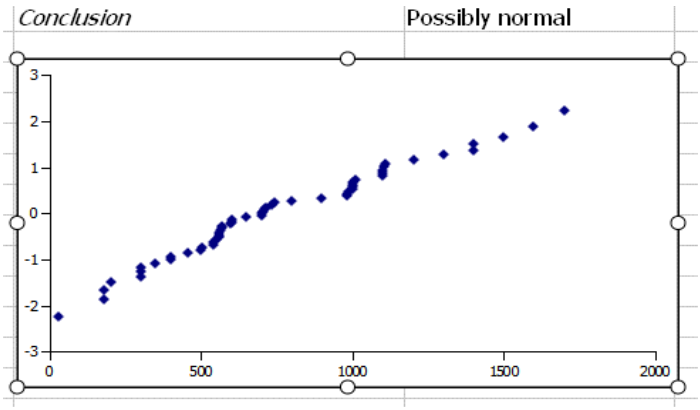
statistically, but it makes outliers easier to



$$T = \frac{|x_{(i)} - \bar{x}|}{}$$

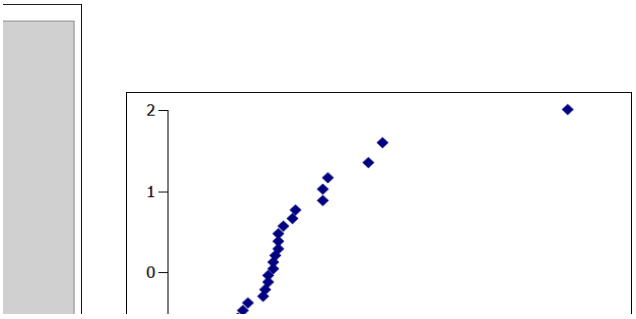
Lilliefors (Kolmogorov-Smirnov) Test	*Column 1*
Alpha	0.05
p-Value	0.058561562512873415
Statistic	0.11693480557274441
N	55

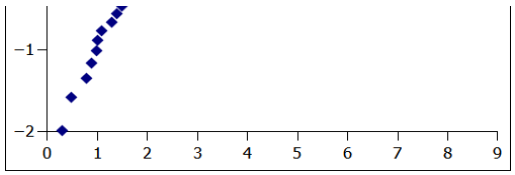
S



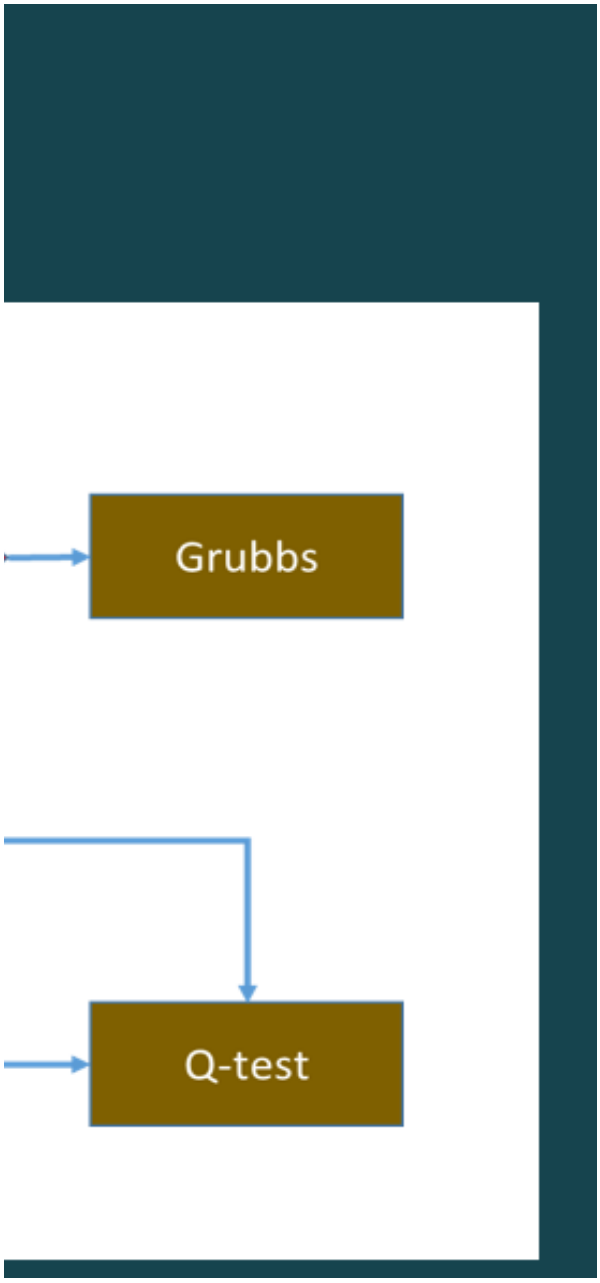
3	1.154
4	1.481
5	1.715
6	1.887
7	2.020
8	2.127
9	2.215
10	2.290
11	2.355
12	2.412
13	2.462
14	2.507
15	2.548
16	2.586
17	2.620
18	2.652
19	2.681
20	2.708
30	2.908
55	3.166

ɔ:





N^b	95% ($\alpha = 0.05$)
3	**0.970**
4	**0.829**
5	**0.710**
6	**0.625**
7	**0.568**
8	**0.526**
9	**0.493**
10	**0.466**
11	**0.444**
12	**0.426**
13	**0.410**
14	**0.396**
15	**0.384**
16	**0.374**
17	**0.365**
18	**0.356**
19	**0.349**
20	**0.342**
21	**0.337**
22	**0.331**
23	**0.326**
24	**0.321**
25	**0.317**
29	**0.312**
27	**0.308**
28	**0.305**
29	**0.301**
30	**0.298**


Grubbs
Q-test

562 563 569 570 599 601 603 650 701

703 704 709 713 733 745 801 900 982

983 985 999 1001 1002 1003 1009 1100 1101

1102 1103 1109 1201 1301 1399 1400 1501 1599

1699

Najdi odlehlé hodnoty pomocí Grubbsova testu
vyjádři interval spolehlivosti se správným počtem desetinných míst
zaokrouhlujeme na 2 platné číslice směrodatné odchylky

číslo měření	koncentrace Pb [ng/ml]
1	37.9
2	22.8
3	13.4
4	31.6
5	50.8
6	20.2
7	9.5
8	26.7
9	78.1
10	22.0

T

$$T = \frac{|x_{(i)} - \bar{x}|}{S}$$

kritické ho

N\α
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20

$$\left\langle x - t_{(\alpha,n-1)} * \frac{s}{\sqrt{n}} \; ; \; x + t_{(\alpha,n-1)} * \frac{s}{\sqrt{n}} \right\rangle$$

sm.odchylka
s.e.m.
dolní IS
horní IS

normsinv

Q-Q graf

dnoty Grubbsova testu (dvoustranný test)

0.05
1.155
1.481
1.715
1.887
2.020
2.126
2.215
2.290
2.355
2.412
2.462
2.507
2.549
2.585
2.620
2.651
2.681
2.709

INTERVAL SPOLEHLIVOSTI - CONFIDENCE INTERVAL

Co je to interval spolehlivosti průměru? "Confidence interval" je oblast, kde 95% opakovaných měření n
při všech možných kombinacích výběrů z dané populace.

pro opakované spojité hodnoty normálně rozdělené
se hodnota počítá kolem arit. průměru ("mean")

příklad

44
47
61
64
84
85

$$S_{\bar{x}} = \frac{S}{\sqrt{n}}$$

$$\left\langle \bar{x} - t_{(\alpha, n-1)} * \frac{s}{\sqrt{n}}; \bar{x} + \right.$$

průměr
SEM
CI =L1
=L2

=T.INV.2T(0.05;N-1)

pro ne-normálně rozdělené spojité hodnoty se uvádí CI kolem mediánu;
hledají se indexy

Stanovte 95% interval spolehlivosti mediánu populace pro oba dva výběrové soubory A a B.

species A	species B
16	34
32	36
37	38
39	45
40	50
41	54
42	56
50	59
82	69
	91

(A) j=
(A) k=
p=

(B) j=
(B) k=
p=

n=

pro poměr (počty výskytů)

Lékař vybral náhodný vzorek 215 žen ze svého registru.
Z nich 39 trpělo astmatem. Jaký je výskyt astmatu v populaci?

celkem	n=	
problém s astmatem=		
	p=	
	s.e.=	
		1.96
	1/2 I.S.=	
	L1	
	L2	

$$se(p) = \sqrt{p(1-p)/n}$$

$$\langle p - 1{,}96 * se; p + 1{,}96 * se$$

ıalezne skutečnou průměrnou hodnotu

$$= = SEM$$
$$n$$

$$\_t_{(\alpha n\_1)} * \frac{s}{\sqrt{n}}; x + t_{(\alpha n\_1)} * \frac{s}{\sqrt{n}}\rangle$$

http://perfeval.epfl.ch

n	j	k	p
$n \leq 5$: no confidence interval possible.			
6	1	6	0.969
7	1	7	0.984
8	1	7	0.961
9	2	8	0.961
10	2	9	0.979
11	2	10	0.988
12	3	10	0.961
13	3	11	0.978
14	3	11	0.965
15	4	12	0.965
16	4	12	0.951
17	5	13	0.951
18	5	14	0.969
19	5	15	0.981
20	6	15	0.959

⟩

příklady výpočtů intervalu spolehlivosti

V průmyslové odpadní vodě objemu 1000 ml byl polarograficky zjištěn zinek v množství: 150 µg, 142 µg, 148 µg,
Vypočtěte směrodatnou odchylku s a interval spolehlivosti s pravděpodobností 95% (α = 0,05).

150 142 148 134 144 140 144 139 146

data seřazeno T

normálně rozděleno?
IS dle Studenta
n=
prumer=
s(n-1)=
t(0.05;st.v.)
s.e.m=
L1=
L2=

kritické hodnoty Grubbsova testu (dvoustranný test)

N\α	0.05
3	1.155
4	1.481
5	1.715
6	1.887
7	2.020
8	2.126
9	2.215
10	2.290
11	2.355
12	2.412
13	2.462
14	2.507
15	2.549
16	2.585
17	2.620
18	2.651
19	2.681
20	2.709

nenormálně?: indexy

1
2
3
4
5
6
7
8
9
10
11
12

L1
L2

n	j	k	
$n \leq 5$: no confidence interval possible.			
6	1	6	(
7	1	7	(
8	1	7	(
9	2	8	(
10	2	9	(
11	2	10	(
12	3	10	(
13	3	11	(
14	3	11	(
15	4	12	(
16	4	12	(
17	5	13	(
18	5	14	(
19	5	15	(
20	6	15	(

134 µg, 144 µg, 140 µg, 144 µg, 139 µg, 146 µg, 139 µg, 138 µg, 146 µg.

139 138 146

p
0.969
0.984
0.961
0.961
0.979
0.988
0.961
0.978
0.965
0.965
0.951
0.951
0.969
0.981
0.959

116.5031	116.5	normálně rozdělená populace			0
103.8956	103.9	*např. hladina léčiva v krvi (umol/L)*			0
100.3677	100.4				1
113.4851	113.5				1
102.8219	102.8				0
108.4581	108.5				0
122.1449	122.1				0
108.0664	108.1				1
114.1174	114.1				1
101.068	101.1				0
92.28658	92.3				0
94.85572	94.9				0
119.3758	119.4				0
112.6158	112.6				0
106.7351	106.7				0
101.5325	101.5				0
108.6679	108.7				0
89.72939	89.7				0
129.4451	129.4	50 náhodných čísel řádků			0
113.869	113.9				0
120.4151	120.4			hodnoty z B	0
93.68613	93.7	*z gen.* *zaokr.celé*			0
105.7071	105.7			#REF!	0
108.0104	108.0				0
106.737	106.7				1
98.38772	98.4				1
110.2021	110.2				0
90.50481	90.5				0
89.27956	89.3				1
83.95415	84.0				0
96.38185	96.4				0
94.01332	94.0				0
104.5438	104.5				0
103.0488	103.0				0
85.52985	85.5				1
90.44339	90.4				0
82.791	82.8				0
109.9204	109.9				1
77.95185	78.0				0
110.845	110.8				0
100.4228	100.4				0
100.8114	100.8				1
95.01226	95.0				0
104.9825	105.0				0
96.58692	96.6				0
100.1633	100.2				0
91.39324	91.4				0
99.45468	99.5				0
84.71085	84.7				0
84.61662	84.6				0

88.47145	88.5			1
94.76644	94.8			0
101.541	101.5			0
94.11186	94.1			0
100.8843	100.9			0
95.4231	95.4			0
98.24573	98.2			0
106.3981	106.4			0
94.56891	94.6			0
102.2546	102.3			1
88.42225	88.4			1
110.6231	110.6			1
96.28203	96.3			1
90.07082	90.1			0
90.06454	90.1			0
98.53326	98.5			0
104.3403	104.3			0
100.9319	100.9			1
100.2077	100.2			0
105.0007	105.0			1
110.4261	110.4			0
106.5709	106.6			0
115.7614	115.8			0
92.61715	92.6			0
104.7303	104.7			0
69.294	69.3			1
104.2472	104.2			0
96.92959	96.9			0
113.7657	113.8			0
96.80103	96.8			0
117.8225	117.8			0
94.805	94.8			0
99.5397	99.5			0
95.55438	95.6			0
91.39766	91.4			1
90.7634	90.8	*prům*		0
101.8756	101.9	*sm.odch*		1
101.724	101.7	n=		1
111.4796	111.5	sem=		0
85.50365	85.5	Studentův koeficient	=t.inv.2T	0
104.6347	104.6		L1	0
86.87456	86.9		L2	0
89.25371	89.3			0
103.9204	103.9	$\left\langle \bar{x} - t_{(\alpha, n-1)} * \frac{s}{\sqrt{n}}; \bar{x} + t_{(\alpha, n-1)} * \frac{s}{\sqrt{n}} \right\rangle$		0
84.11017	84.1			0
110.9614	111.0			0
97.4161	97.4			0
97.2075	97.2			0
106.0748	106.1	malý soubor	seřazeno	0
118.5284	118.5	*1*		0

97.33454	97.3	*2*			0
98.65378	98.7	*3*			1
99.55502	99.6	*4*			0
106.5121	106.5	*5*			0
101.0519	101.1	*6*			0
110.5387	110.5	*7*			1
115.1383	115.1	*8*			0
105.1391	105.1	*9*			0
106.1661	106.2	*10*			1
90.63843	90.6	*11*			0
91.00562	91.0				0
104.8049	104.8		n=		0
98.76717	98.8		j=		1
94.30906	94.3		k=		1
85.93621	85.9				0
92.31436	92.3	95% IS	L1		0
99.25536	99.3		L2		0
98.56882	98.6				1
103.6958	103.7				0
95.89137	95.9				0
111.7119	111.7				0
94.72341	94.7				0
104.5421	104.5				0
113.7578	113.8				0
107.1271	107.1				0
125.1322	125.1				0
84.58911	84.6				0
109.7197	109.7				0
94.38803	94.4				1
79.1813	79.2				0
110.0793	110.1				0
116.2573	116.3				0
99.89482	99.9				0
119.559	119.6				0
101.1358	101.1				1
91.16496	91.2				1
101.6433	101.6				0
112.9998	113.0				0
109.1654	109.2				0
107.3899	107.4				0
109.8035	109.8				0
95.67649	95.7				0
114.64	114.6				0
111.4752	111.5				0
96.94321	96.9				0
105.3992	105.4				1
86.29323	86.3				0
106.1254	106.1				0
97.04966	97.0				0
95.7327	95.7				0

91.9896	92.0	1
99.7242	99.7	0
89.54354	89.5	0
101.3709	101.4	0
87.93455	87.9	0
108.8068	108.8	0
117.3245	117.3	0
91.99592	92.0	0
103.2651	103.3	0
101.3833	101.4	1
103.3985	103.4	1
90.17546	90.2	0
106.975	107.0	0
99.84432	99.8	0
76.87555	76.9	1
114.6066	114.6	0
95.74945	95.7	0
98.66304	98.7	0
90.42284	90.4	0
89.97771	90.0	1
93.14159	93.1	1
106.6451	106.6	0
104.0255	104.0	0
85.65511	85.7	0
106.2013	106.2	1
98.52475	98.5	0
100.1909	100.2	0
100.998	101.0	0
109.1723	109.2	0
89.07203	89.1	0
95.83304	95.8	0
112.545	112.5	0
97.46353	97.5	0
112.4664	112.5	0
94.46934	94.5	0
93.61969	93.6	0
120.7655	120.8	0
85.28583	85.3	0
87.7195	87.7	0
97.93722	97.9	0
104.3252	104.3	0
100.955	101.0	0
89.47458	89.5	0
115.4841	115.5	0
96.70588	96.7	0
89.78756	89.8	0
101.1157	101.1	1
106.3991	106.4	0
108.5703	108.6	0
113.6134	113.6	0

97.88405	97.9	1
104.6962	104.7	0
94.11186	94.1	0
104.75	104.8	0
93.96291	94.0	1
97.64167	97.6	1
109.8122	109.8	0
113.6599	113.7	1
99.95755	100.0	0
83.02824	83.0	1
107.2012	107.2	1
93.46799	93.5	1
89.30805	89.3	0
116.2316	116.2	1
122.8143	122.8	0
99.15022	99.2	0
109.2237	109.2	0
88.3908	88.4	0
97.97393	98.0	1
100.4167	100.4	0
69.98376	70.0	0
100.187	100.2	0
106.6929	106.7	1
95.53833	95.5	0
98.6059	98.6	0
106.5956	106.6	0
106.4678	106.5	0
75.26174	75.3	1
87.72437	87.7	0
103.0993	103.1	0
101.4961	101.5	0
78.25453	78.3	0
94.03801	94.0	0
108.9201	108.9	0
89.01349	89.0	0
90.24094	90.2	0
90.65622	90.7	0
87.75033	87.8	1
89.11226	89.1	1
110.4578	110.5	0
114.226	114.2	1
107.0307	107.0	0
101.2976	101.3	0
98.32802	98.3	1
77.18569	77.2	1
87.01803	87.0	0
97.8222	97.8	1
89.58835	89.6	0
90.26063	90.3	1
88.32752	88.3	0

106.0932	106.1	1
100.0394	100.0	0
109.3438	109.3	0
89.81586	89.8	0
86.94304	86.9	0
99.98968	100.0	0
83.69663	83.7	0
93.56239	93.6	0
86.00988	86.0	0
104.2263	104.2	0
88.4863	88.5	0
101.8079	101.8	0
111.0286	111.0	0
91.9283	91.9	0
103.1153	103.1	0
90.91469	90.9	0
91.49692	91.5	0
95.07195	95.1	0
93.47935	93.5	1
106.8072	106.8	0
91.20446	91.2	1
110.2318	110.2	0
93.48029	93.5	0
100.044	100.0	0
119.4008	119.4	0
101.1011	101.1	0
101.665	101.7	0
106.1116	106.1	0
107.2967	107.3	0
113.7795	113.8	1
103.8058	103.8	1
100.5706	100.6	0
96.51628	96.5	0
113.3814	113.4	0
90.78445	90.8	1
108.9658	109.0	0
102.3002	102.3	1
104.1319	104.1	0
97.39157	97.4	1
98.57731	98.6	0
107.0572	107.1	0
93.7653	93.8	0
97.82299	97.8	0
96.56502	96.6	0
103.6067	103.6	0
122.448	122.4	1
92.87393	92.9	0
104.9644	105.0	0
126.7348	126.7	0
107.4483	107.4	0

109.1723	109.2	0
104.6407	104.6	0
91.59098	91.6	0
100.5131	100.5	0
112.0197	112.0	0
96.78653	96.8	0
120.1986	120.2	0
125.7336	125.7	0
109.7234	109.7	0
77.37759	77.4	0
108.3168	108.3	1
107.4624	107.5	1
100.1503	100.2	0
111.3841	111.4	0
115.2279	115.2	0
89.88117	89.9	1
84.92399	84.9	1
106.0453	106.0	0
107.4221	107.4	0
98.68464	98.7	0
109.0599	109.1	0
100.9373	100.9	0
94.85221	94.9	0
99.70199	99.7	0
91.85391	91.9	0
101.5403	101.5	1
99.08572	99.1	0
111.2189	111.2	0
108.7978	108.8	0
100.6449	100.6	1
92.33285	92.3	0
106.0582	106.1	0
101.8196	101.8	0
79.17466	79.2	1
81.95603	82.0	0
100.6649	100.7	0
86.96096	87.0	0
106.9906	107.0	1
104.3689	104.4	1
105.9977	106.0	1
93.26974	93.3	0
112.4216	112.4	0
113.305	113.3	1
106.8797	106.9	0
111.7073	111.7	0
129.3301	129.3	1
92.059	92.1	0
91.10378	91.1	1
112.6857	112.7	1
113.3964	113.4	0

109.5289	109.5	0
100.7792	100.8	0
101.3871	101.4	0
84.80375	84.8	0
97.29806	97.3	0
100.8267	100.8	1
89.33915	89.3	0
99.93995	99.9	1
101.6572	101.7	0
97.62358	97.6	1
115.0356	115.0	0
89.90666	89.9	0
105.8209	105.8	0
112.3115	112.3	0
103.2086	103.2	0
104.7141	104.7	0
92.19147	92.2	0
101.2521	101.3	1
86.29519	86.3	1
95.22083	95.2	1
94.91587	94.9	0
91.79513	91.8	0
103.9601	104.0	0
87.31264	87.3	0
90.11206	90.1	0
114.7323	114.7	0
108.9589	109.0	1
76.23054	76.2	0
88.26684	88.3	0
99.5106	99.5	1
99.76475	99.8	1
90.16554	90.2	0
102.9687	103.0	0
102.814	102.8	1
107.0229	107.0	0
109.4736	109.5	0
111.1859	111.2	1
89.04002	89.0	0
93.68052	93.7	1
94.61671	94.6	1
109.7998	109.8	1
90.92277	90.9	0
87.61145	87.6	1
95.64371	95.6	1
99.81831	99.8	0
100.1182	100.1	0
100.031	100.0	1
96.34261	96.3	1
114.3086	114.3	0
94.94023	94.9	0

116.9043	116.9	0
125.3927	125.4	1
94.88887	94.9	0
98.41716	98.4	0
94.50496	94.5	0
89.6761	89.7	0
93.97485	94.0	1
97.39553	97.4	0
93.76344	93.8	0
94.57423	94.6	0
106.3316	106.3	1
83.12114	83.1	0
85.04913	85.0	0
85.0304	85.0	0
103.5399	103.5	0
97.94582	97.9	0
99.57798	99.6	0
113.6853	113.7	0
105.8954	105.9	0
101.6572	101.7	0
79.16129	79.2	0
110.6056	110.6	0
109.1805	109.2	0
108.8294	108.8	0
106.4103	106.4	0
86.05854	86.1	0
105.2187	105.2	0
95.98276	96.0	0
88.46549	88.5	0
100.4641	100.5	0
122.8143	122.8	0
101.098	101.1	0
105.5896	105.6	0
78.97667	79.0	0
92.89068	92.9	1
116.5994	116.6	0
108.9726	109.0	1
95.63446	95.6	1
102.9951	103.0	0
94.38446	94.4	0
86.8091	86.8	0
100.6112	100.6	0
94.73307	94.7	1
98.05585	98.1	0
93.48786	93.5	1
121.9621	122.0	0
84.1747	84.2	0
105.754	105.8	0
104.9479	104.9	1
104.9367	104.9	0

87.51032	87.5	0
103.0231	103.0	0
93.67865	93.7	1
110.8753	110.9	0
105.8273	105.8	0
115.5324	115.5	0
89.2387	89.2	0
105.7829	105.8	0
103.9477	103.9	1
105.664	105.7	0
109.4461	109.4	1
97.93408	97.9	0
112.9784	113.0	0
82.51196	82.5	0
93.92523	93.9	0
112.4547	112.5	0
109.7862	109.8	0
108.8883	108.9	0
94.30097	94.3	0
105.7261	105.7	0
92.40654	92.4	0
107.0926	107.1	0
84.62413	84.6	0
103.9369	103.9	0
91.60841	91.6	1
104.7757	104.8	0
86.94843	86.9	0
84.67133	84.7	0
104.9782	105.0	0
94.79974	94.8	0
93.11349	93.1	0
108.4319	108.4	0
95.49265	95.5	0
103.1837	103.2	1
93.58965	93.6	0
107.6333	107.6	1
97.25519	97.3	0
93.07756	93.1	1
100.7991	100.8	0
109.7418	109.7	1
109.4186	109.4	0
98.82805	98.8	0
96.12664	96.1	0
86.63548	86.6	0
108.8826	108.9	0
102.6805	102.7	1
98.86115	98.9	0
97.72183	97.7	1
121.0443	121.0	0
102.9583	103.0	0

binomicky rozdělená populace
např. pacient lékaře s obezitou = 1
pacient lékaře bez obezity = 0

50 náhodných čísel řádků

hodnoty z I

z gen. *zaokr.celé*

#REF!

počet 1
p=
n=
se(p)=

L1
L2

$$se(p) = \sqrt{p(1-p)/n}$$

$$\langle p - 1{,}96 * se; p + 1{,}96$$

n	j	k	p
$n \leq 5$: no confidence interval possible.			
6	1	6	0.969
7	1	7	0.984
8	1	7	0.961
9	2	8	0.961
10	2	9	0.979
11	2	10	0.988
12	3	10	0.961
13	3	11	0.978
14	3	11	0.965
15	4	12	0.965
16	4	12	0.951
17	5	13	0.951
18	5	14	0.969
19	5	15	0.981
20	6	15	0.959

$\rangle * se\rangle$