Probability & Statistics

Problem set №14. Week starting on June, 1st

$\Phi(\cdot)$ means from now – until revocation – cdf of $N(0,1)$ distribution. Additionally: exercises 1–8 are classes exercises (1 point each), while exercises 9–16 are of **(E0.5)** each.

1. Rejection area is defined by $\Phi > 2$. Significance level α equals: a) 0.2280 b) 0.0228 c) 0.0500 d) 0.1000
2. Significance level α which corresponds rejection area $|\Phi| > 1.55$ equals: a) 0.5500 b) 0.0606 c) 0.1211 d) 0.1234
3. Level of significance $\alpha = 0.075$. Rejection area of the left-tailed hypothesis is given by: a) $\Phi < -1.34$ b) $\Phi < -1.38$ c) $\Phi < -1.40$ d) $\Phi < -1.44$.
4. Find p-value when $\Phi = 2.34$ and $H_a : \mu \neq \mu_0$: a) 0.0096 b) 0.0101 c) 0.0193 d) 0.0202
5. Find p-value when $\Phi = -3.05$, $H_a : \mu < \mu_0$: a) 0.0011 b) 0.0111 c) 0.0038 d) 0.0001
6. Give p-value when $\Phi = 1.89, H_a : \mu > \mu_0$: a) 0.0588 b) 0.1234 c) 0.0249 d) 0.0669
7. Tested hypothesis $H_0 : \mu = 10$, alternative hypothesis $H_a : \mu \neq 10$, significance level $\alpha = 0.01$. For which of the following 99% confidence interval μ initial hypothesis is rejected? a) (12.1, 15.3) b) (8.8 12.5) c) (5.5, 15.5) d) (9.9 10.5)
8. Hypothesis about expected value is tested, based on a large sample.

```
Test of mu = 6 vs < 6
The assumed standard deviation = 0.476
                                                95%
                                                Upper
Variable N    Mean      StDev   SEMean   Bound      Z      P
Z        500  5.51912  0.47608  0.02129  5.55413 -22.59 0.000
```

Which of the following are true? a) Hypothesis H_0 is one-tailed. b) Value of the test statistics equals -22.59. c) Sample size is $n = 500$. d) Tested value of μ_0 equals 5.51912.

---

9. During the experiment, the response time to the neurological stimulus was measured.

```
One-Sample T: time
Test of mu = 1.5 vs not = 1.5
Variable N Mean    StDev    SEMean      95%CI         T     P
time    15 1.97087 0.55233 0.14261 (1.66500,2.27674) 3.30 0.005
```

Which of the following are true? a) Tested hypothesis is two-tailed. b) Complement to 1 of $t(14)$ cdf in point $t = 3.30$ is equal 0.005. c) We have no reason to reject H_0 hypothesis, with significance level $\alpha = 0.05$, because 1.5 does not fit with 95% confidence interval (1.665, 2.277). d) 15 is the size of the sample.

10. Below are results of YES-NO question.

```
                Test of p = 0.4 vs p not = 0.4

Sample  X  N    Sample p  95%CI             Z-Value  P-Value
   1   180 400 0.450000 (0.401247,0.498753) 2.04     0.041
```

Which of the following are true? a) 400 persons were surveyed, 180 answers is YES. b) Tested hypothesis was one-sided. c) Significance level is $\alpha = 0.05$. d) cdf in point 2.04, has the value 0.041.

	A	B	C
1	0.25	Procent odpowiedzi TAK	=125/500
2	0.0194	błąd standardowy wskaźnika struktury	=PIERWIASTEK(C1*(1-C1)/500)
3	1.96	kwantyl rozkładu normalnego	=ROZKŁAD.NORMALNY.ODW(0.975;0;1)
4			
5	0.212	lewy kraniec 95% przedziału ufności	=C1-C2*C3
6	0.288	prawy kraniec 95% przedziału ufności	=C1+C2*C3
7			
8	2.7951	wartość statystyki testowej	=(C1-0.2)/PIERWIASTEK(0.2*0.8/500)
9	0.0052	p-value	=2*(1-ROZKŁAD.NORMALNY(C8;0;1;PRAWDA))

11. 500 people were questioned, the question was of YES-NO type.
Which of the following are true? a) Tested parameters has the value $p_0 = 0.20$ b) 0.0052 is one-sidedp-value. c) Tested p_0 does not fit in 95% confidence interval. d) Because n is large, $np_0 \geqslant 5, nq_0 \geqslant 5$, we can approximate binomial distribution by normal distribution.

12. We hypothesize that the standard deviation of the variable is less than 5.

	A	B	C	D	E	F	G
1	70	3.437758	Odchylenie standardowe =ODCH.STANDARDOWE(A1:A12)				
2	73	5.2	Wartość statystyki testowej =11*B1^2/25				
3	70						
4	72	0.078905	p-value =1-ROZKŁAD.CHI(B2;11)				
5	74						
6	70	p-value > 0.05, nie odrzucamy hipotezy zerowej					
7	74						
8	76						
9	75						
10	80						
11	74						
12	80						

Which of the following are true? a) Sample S^2 has the value 3.43776. b) If significance level is $\alpha = 0.05$ we accept hypothesis H_0. c) Area under density of $\chi^2(11)$ distribution is 0.078905. d) Test is right-tailed.

13. The speed of 100 cars was measured. The 95% confidence interval for standard deviation is determined below.

10	75	75	50	60	80	60	50	75
11								
12	10.64818	Odchylenie standardowe =ODCH.STANDARDOWE(A1:J10)						
13	113.3838	Wariancja =A12^2						
14								
15	73.3611	Chi-kwadrat, 0.975 na prawo od tego punktu =ROZKŁAD.CHI.ODW(0.975;99)						
16	128.4219	Chi-kwadrat, 0.025 na prawo od tego punktu =ROZKŁAD.CHI.ODW(0.025;99)						
17								
18	87.40719	Lewy kraniec 95% CI dla wariancji =99*A13/A16						
19	153.0102	Prawy kraniec 95% CI dla wariancji =99*A13/A15						
20								
21	9.349181	Lewy kraniec dla odchylenia standardowego =PIERWIASTEK(A18)						
22	12.36973	Prawy kraniec dla odchylenia standardowego =PIERWIASTEK(A19)						

Which of the following are true? a) $S^2 = 10.64818$ b) Confidence interval of σ^2 is $(87.40710, 153.0102)$ c) Confidence interval of σ is equal $(9.349181, 12.36973)$ d) Area under the density function of $\chi^2(99)$ distribution on the interval $(73.3611, 128.4219)$ equals 0.99.

14. Significance level of tested hypothesis $\alpha = 0.05$. Which p-value results in rejecting initial hypothesis: a) p-value= 0.05 b) p-value= 0.14 c) p-value= 0.024 d) p-value= 0.34.
15. The goal of testing hypotheses is a) describing samples, b) describing the population, c) inferring about the population based on samples, d) inferring about samples based on the population.
16. We perform t-test about two means. With this, we assume that: a) samples are independent b) samples come from population of normal distribution c) samples come from $t(n_1 + n_2 - 2)$ distribution d) samples are of the same distribution.

Hereby – I revoke the assumption that $\Phi(\cdot)$ means cdf of $\mathrm{N}(0, 1)$ distribution.

Witold Karczewski