



# Statistics for International Studies

Exam: 26th May 2015

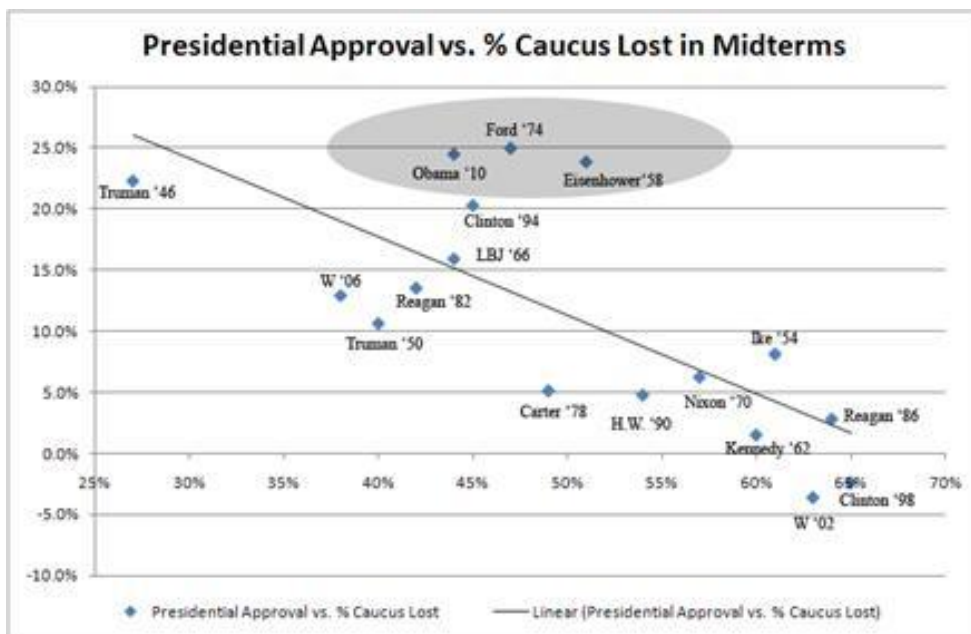
Name: \_\_\_\_\_

Group: \_\_\_\_\_

Date: \_\_\_\_\_

## PROBLEM 1.

- a) The following graph relates Presidential approval with the percentage of caucus lost in the Midterm elections in the USA.

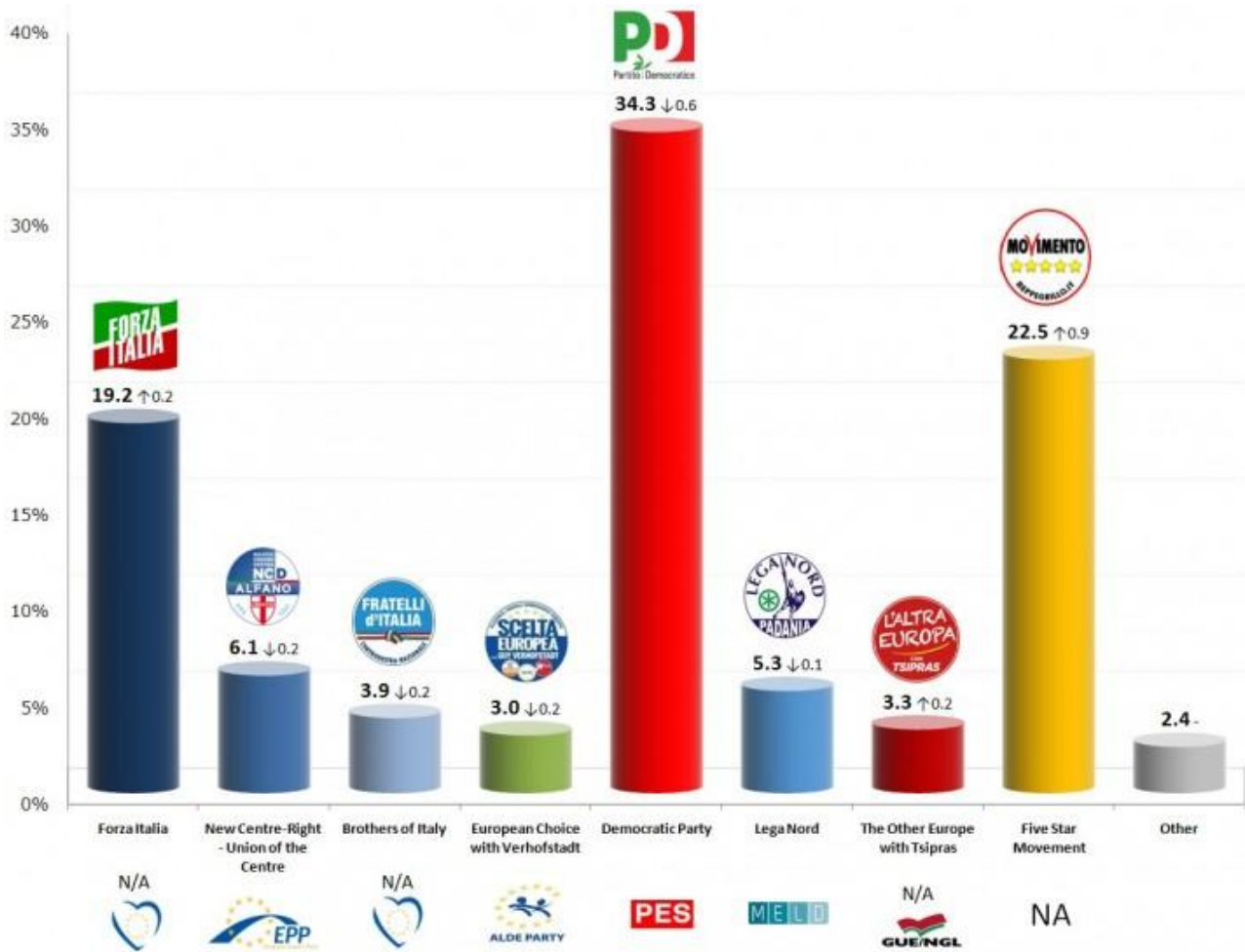


In this case:

- The correlation between *Presidential Approval* and *%Caucus lost* is positive
- The variances of *Presidential Approval* and *%Caucus Lost* are negative.
- The covariance between *Presidential Approval* and *%Caucus lost* is equal to zero.
- None of the above.

Solution			
i)	ii)	iii)	iv)

b) The following graph (taken from <http://www.politico.eu> in May 2014) reflects the support for the different political parties in Italy.



Supposing that these results are representative of Italians, the probability that out of two (independent) Italians, one supports Forza Italia and the other supports the Democratic Party is (to 3 decimal places):

- i. 0,535
- ii. 0,066
- iii. 0,132
- iv. None of the above.

Solution			
i)	ii)	iii)	iv)

- c) The following question comes from the model of the INE labour force survey of 2005 in Spain.

What is your nationality?	Spanish 1
	Spanish and other 2
	Foreign 3

In this case, the variable "Nationality" is:

- i. Quantitative and discrete
- ii. Qualitative and ordinal
- iii. Qualitative and discrete
- iv. Quantitative and nominal

Solution			
i)	ii)	iii)	iv)

- d) In a recent YouGov poll in Wales (April 2015), respondents were asked to rate the political leaders between 0 to 10. The mean evaluation for David Cameron was 3.8. Assuming ratings for David Cameron are normally distributed with this mean and standard deviation 1, the probability that a Welsh person rates Cameron at exactly 3.8 is:

- i. 0
- ii. 0.5
- iii. 1
- iv. None of the above.

Solution			
i)	ii)	iii)	iv)

- e) The following table, (taken from Transparency International), shows the values of the (normalized) anual index of the perception of corruption in Spain since 2006.

Año	2014	2013	2012	2011	2010	2009	2008	2007	2006
Índice	60	59	65	62	61	61	65	67	68

For these data:

- i. The mode is 65 and the median is 62.
- ii. The median is 61 and the range is 9.
- iii. The first quartile is 60.5 and the range is 9.
- iv. None of the above.

Solution			
i)	ii)	iii)	iv)

**PROBLEM 2.** The following tables are taken from a report on the results of a survey (Public Policy Polling) of opinions about the death penalty in Pennsylvania carried out in March 2015.



**March 20-22, 2015**  
**Survey of 632 Pennsylvania voters**

Q7 If you are a Democrat, press 1. If a Republican, press 2. If an independent, press 3.

Democrat..... 45%  
 Republican..... 41%  
 Independent..... 14%

	Base	Party		
		Democrat	Republican	Independent
<b>Punishment Preference</b>				
Life in prison with no possibility of parole	32%	38%	24%	36%
Life in prison with a chance of parole after at least 40 years	13%	16%	12%	5%
Life in prison with a chance of parole after at least 20 years	9%	13%	4%	8%
Death penalty	42%	30%	56%	41%
Not sure	4%	2%	4%	10%

Note that the columns in the above table sum to 100%.

**a)** If one of the people in the survey is chosen at random, what is the probability that they are a Democrat?

(0,75 points)

**b)** Calculate the probability that the selected person is a Democrat and selects the Death penalty as their punishment preference.

(1 point)

**c)** Are the two events “be a Democrat” and “support the Death penalty as a punishment preference” independent? Justify your response.

(0.75 points)

**PROBLEM 3.** The following news story appeared in the Gibraltar Chronicle of 12<sup>th</sup> December 2014.

## Majority in favour of attending 'ad hoc' talks – GBC poll

An overwhelming majority of Gibraltarians believe that Gibraltar should take part in 'ad hoc' talks with Spain and the UK and there is strong support for allowing commercial fishing in British Gibraltar territorial Water so long as this is under a properly regulated licensing system. Those are the views reflected by the results in a poll carried out for GBC.

However, relations with Spain and incursions are not the most important issues for potential voters.

The results were revealed yesterday evening in Viewpoint and follow their earlier release of the finding that whilst the governing GSLP/Liberal alliance is in the lead most Gibraltarians are currently undecided about how they will cast their vote at a general election. The result on an election poll was 53% undecided, 33.5% Gslp/Liberals and 13.5% GSD.

And, in an apparent coincidence the very day that the Government has announced a £77m power station contract, the GBC poll finds that a new power station ranks as the first priority amongst those polled.

In order, the issues that would be most important at the next election are: new power station 25%; employment 19%; public finances and commerce/frontier fluidity both 12.5%; housing 12%; traffic/parking 10%; relations with Spain/incursions 8% and; football stadium location 1%. However, asked specifically about the football stadium location 42% were against it being at Europa Point, 36% in favour and 22% uncertain.

On taking part in 'ad hoc' talks 67% said yes, 13% no and 20% did not know. Favouring controlled commercial fishing in BGTW were 47.0% with 27.5% against and 255 did not know.

The poll was carried out for GBC by Colourworks and 650 views were sampled.

a) Calculate a 95% de confidence interval for the true proportion of Gibraltarians who favour controlled commercial fishing in British Gibraltar Territorial Waters (BGTW). Is there any evidence (at a 5% significance level) that this proportion is different from 50%? Why?

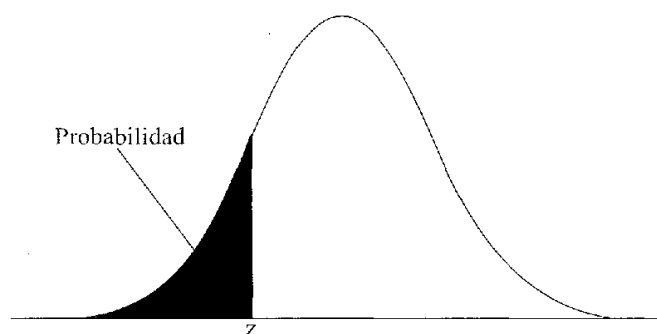
(1,5 points)

b) Is there any evidence (at a 5% significance level) that a majority of Gibraltarians think that the country should take part in 'ad hoc' talks with Spain? Comment with respect to the headline of the article.

(1 point)

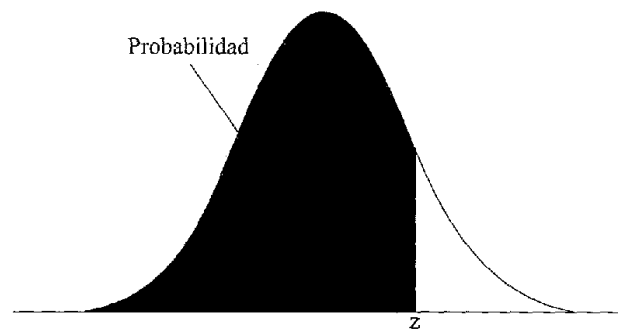


## Normal distribution tables



**Tabla 3.** Probabilidad de que una variable normal de media cero y desviación típica uno tome un valor menor que  $z$

$z$	0,00	0,01	0,02	0,03	0,04	0,05	0,06	0,07	0,08	0,09
-3,4	0,0003	0,0003	0,0003	0,0003	0,0003	0,0003	0,0003	0,0003	0,0003	0,0002
-3,3	0,0005	0,0005	0,0005	0,0004	0,0004	0,0004	0,0004	0,0004	0,0004	0,0003
-3,2	0,0007	0,0006	0,0006	0,0006	0,0006	0,0006	0,0006	0,0005	0,0005	0,0005
-3,1	0,0010	0,0009	0,0009	0,0009	0,0008	0,0008	0,0008	0,0008	0,0007	0,0007
-3,0	0,0013	0,0013	0,0013	0,0012	0,0012	0,0011	0,0011	0,0011	0,0010	0,0010
-2,9	0,0019	0,0018	0,0018	0,0017	0,0016	0,0016	0,0015	0,0015	0,0014	0,0014
-2,8	0,0026	0,0025	0,0024	0,0023	0,0023	0,0022	0,0021	0,0021	0,0020	0,0019
-2,7	0,0035	0,0034	0,0033	0,0032	0,0031	0,0030	0,0029	0,0028	0,0027	0,0026
-2,6	0,0047	0,0045	0,0044	0,0043	0,0041	0,0040	0,0039	0,0038	0,0037	0,0036
-2,5	0,0062	0,0060	0,0059	0,0057	0,0055	0,0054	0,0052	0,0051	0,0049	0,0048
-2,4	0,0082	0,0080	0,0078	0,0075	0,0073	0,0071	0,0069	0,0068	0,0066	0,0064
-2,3	0,0107	0,0104	0,0102	0,0099	0,0096	0,0094	0,0091	0,0089	0,0087	0,0084
-2,2	0,0139	0,0136	0,0132	0,0129	0,0125	0,0122	0,0119	0,0116	0,0113	0,0110
-2,1	0,0179	0,0174	0,0170	0,0166	0,016	0,0158	0,0154	0,0150	0,0146	0,0143
-2,0	0,0228	0,0222	0,0217	0,0212	0,0207	0,0202	0,0197	0,0192	0,0188	0,0183
-1,9	0,0287	0,0281	0,0274	0,0268	0,0262	0,0256	0,0250	0,0244	0,0239	0,0233
-1,8	0,0359	0,0351	0,0344	0,0336	0,0329	0,0322	0,0314	0,0307	0,0301	0,0294
-1,7	0,0446	0,0436	0,0427	0,0418	0,0409	0,0401	0,0392	0,0384	0,0375	0,0367
-1,6	0,0548	0,0537	0,0526	0,0516	0,0505	0,0495	0,0485	0,0475	0,0465	0,0455
-1,5	0,0668	0,0655	0,0643	0,0630	0,0618	0,0606	0,0594	0,0582	0,0571	0,0559
-1,4	0,0808	0,0793	0,0778	0,0764	0,0749	0,0735	0,0721	0,0708	0,0694	0,0681
-1,3	0,0968	0,0951	0,0934	0,0918	0,0901	0,0885	0,0869	0,0853	0,0838	0,0823
-1,2	0,1151	0,1131	0,1112	0,1093	0,1075	0,1056	0,1038	0,1020	0,1003	0,0985
-1,1	0,1357	0,1335	0,1314	0,1292	0,1271	0,1251	0,1230	0,1210	0,1190	0,1170
-1,0	0,1587	0,1562	0,1539	0,1515	0,1492	0,1469	0,1446	0,1423	0,1401	0,1379
-0,9	0,1841	0,1814	0,1788	0,1762	0,1736	0,1711	0,1685	0,1660	0,1635	0,1611
-0,8	0,2119	0,2090	0,2061	0,2033	0,2005	0,1977	0,1949	0,1922	0,1894	0,1867
-0,7	0,2420	0,2389	0,2358	0,2327	0,2296	0,2266	0,2236	0,2206	0,2177	0,2148
-0,6	0,2743	0,2709	0,2676	0,2643	0,2611	0,2578	0,2546	0,2514	0,2483	0,2451
-0,5	0,3085	0,3050	0,3015	0,2981	0,2946	0,2912	0,2877	0,2843	0,2810	0,2776
-0,4	0,3446	0,3409	0,3372	0,3336	0,3300	0,3264	0,3228	0,3192	0,3156	0,3121
-0,3	0,3821	0,3783	0,3745	0,3707	0,3669	0,3632	0,3594	0,3557	0,3520	0,3483
-0,2	0,4207	0,4168	0,4129	0,4090	0,4052	0,4013	0,3974	0,3936	0,3897	0,3859
-0,1	0,4602	0,4562	0,4522	0,4483	0,4443	0,4404	0,4364	0,4325	0,4286	0,4247
-0,0	0,5000	0,4960	0,4920	0,4880	0,4840	0,4801	0,4761	0,4721	0,4681	0,4641



**Tabla 3.** (continuación) Probabilidad de que una variable normal de media cero y desviación típica uno tome un valor menor que  $z$

$z$	0,00	0,01	0,02	0,03	0,04	0,05	0,06	0,07	0,08	0,09
0,0	0,5000	0,5040	0,5080	0,5120	0,5160	0,5199	0,5239	0,5279	0,5319	0,5359
0,1	0,5398	0,5438	0,5478	0,5517	0,5557	0,5596	0,5636	0,5675	0,5714	0,5753
0,2	0,5793	0,5832	0,5871	0,5910	0,5948	0,5987	0,6026	0,6064	0,6103	0,6141
0,3	0,6179	0,6217	0,6255	0,6293	0,6331	0,6368	0,6406	0,6443	0,6480	0,6517
0,4	0,6554	0,6591	0,6628	0,6664	0,6700	0,6736	0,6772	0,6808	0,6844	0,6879
0,5	0,6915	0,6950	0,6985	0,7019	0,7054	0,7088	0,7123	0,7157	0,7190	0,7224
0,6	0,7257	0,7291	0,7324	0,7357	0,7389	0,7422	0,7454	0,7486	0,7517	0,7549
0,7	0,7580	0,7611	0,7642	0,7673	0,7704	0,7734	0,7764	0,7794	0,7823	0,7852
0,8	0,7881	0,7910	0,7939	0,7967	0,7995	0,8023	0,8051	0,8078	0,8106	0,8133
0,9	0,8159	0,8186	0,8212	0,8238	0,8264	0,8289	0,8315	0,8340	0,8365	0,8389
1,0	0,8413	0,8438	0,8461	0,8485	0,8508	0,8531	0,8554	0,8577	0,8599	0,8621
1,1	0,8643	0,8665	0,8686	0,8708	0,8729	0,8749	0,8770	0,8790	0,8810	0,8830
1,2	0,8849	0,8869	0,8888	0,8907	0,8925	0,8944	0,8962	0,8980	0,8997	0,9015
1,3	0,9032	0,9049	0,9066	0,9082	0,9099	0,9115	0,9131	0,9147	0,9162	0,9177
1,4	0,9192	0,9207	0,9222	0,9236	0,9251	0,9265	0,9279	0,9292	0,9306	0,9319
1,5	0,9332	0,9345	0,9357	0,9370	0,9382	0,9394	0,9406	0,9418	0,9429	0,9441
1,6	0,9452	0,9463	0,9474	0,9484	0,9495	0,9505	0,9515	0,9525	0,9535	0,9545
1,7	0,9554	0,9564	0,9573	0,9582	0,9591	0,9599	0,9608	0,9616	0,9625	0,9633
1,8	0,9641	0,9649	0,9656	0,9664	0,9671	0,9678	0,9686	0,9693	0,9699	0,9706
1,9	0,9713	0,9719	0,9726	0,9732	0,9738	0,9744	0,9750	0,9756	0,9761	0,9767
2,0	0,9772	0,9778	0,9783	0,9788	0,9793	0,9798	0,9803	0,9808	0,9812	0,9817
2,1	0,9821	0,9826	0,9830	0,9834	0,9838	0,9842	0,9846	0,9850	0,9854	0,9857
2,2	0,9861	0,9864	0,9868	0,9871	0,9875	0,9878	0,9881	0,9884	0,9887	0,9890
2,3	0,9893	0,9896	0,9898	0,9901	0,9904	0,9906	0,9909	0,9911	0,9913	0,9916
2,4	0,9918	0,9920	0,9922	0,9925	0,9927	0,9929	0,9931	0,9932	0,9934	0,9936
2,5	0,9938	0,9940	0,9941	0,9943	0,9945	0,9946	0,9948	0,9949	0,9951	0,9952
2,6	0,9953	0,9955	0,9956	0,9957	0,9959	0,9960	0,9961	0,9962	0,9963	0,9964
2,7	0,9965	0,9966	0,9967	0,9968	0,9969	0,9970	0,9971	0,9972	0,9973	0,9974
2,8	0,9974	0,9975	0,9976	0,9977	0,9977	0,9978	0,9979	0,9979	0,9980	0,9981
2,9	0,9981	0,9982	0,9982	0,9983	0,9984	0,9984	0,9985	0,9985	0,9986	0,9986
3,0	0,9987	0,9987	0,9987	0,9988	0,9988	0,9989	0,9989	0,9989	0,9990	0,9990
3,1	0,9990	0,9991	0,9991	0,9991	0,9992	0,9992	0,9992	0,9992	0,9993	0,9993
3,2	0,9993	0,9993	0,9994	0,9994	0,9994	0,9994	0,9994	0,9995	0,9995	0,9995
3,3	0,9995	0,9995	0,9995	0,9996	0,9996	0,9996	0,9996	0,9996	0,9996	0,9997
3,4	0,9997	0,9997	0,9997	0,9997	0,9997	0,9997	0,9997	0,9997	0,9997	0,9998

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i) Basic results (based on a sample of size n)

$$\bar{X} = \frac{\sum_{i=1}^n X_i}{n} \quad S_x^2 = \left[ \frac{\sum_{i=1}^n X_i^2}{n} \right] - (\bar{X})^2 \quad \text{Cov}(X, Y) = \left[ \frac{\sum_{i=1}^n X_i Y_i}{n} \right] - (\bar{X} * \bar{Y})$$
$$r(X, Y) = \frac{\text{Cov}(X, Y)}{S_x * S_y}$$

ii) Regression

The least squares line is  $y = a + bx$  where

$$b = \frac{\text{Cov}(X, Y)}{S_x^2} = r(X, Y) * \frac{S_y}{S_x} \quad a = \bar{y} - (b * \bar{x})$$

iii) 95% confidence intervals (based on a sample of size N) for

a) The mean of a normal population (known variance)

$$(\bar{x} - 1.96\sigma/\sqrt{N}, \bar{x} + 1.96\sigma/\sqrt{N})$$

b) A proportion

$$\left( \hat{p} - 1.96\sqrt{\frac{\hat{p}(1-\hat{p})}{N}}, \hat{p} + 1.96\sqrt{\frac{\hat{p}(1-\hat{p})}{N}} \right)$$

iv) Hypothesis tests at significance level  $\alpha$ .

$Z_\alpha$  represents the point such that  $P(Z < Z_\alpha) = 1 - \alpha$  where  $Z$  has a standard normal distribution.

a) For the mean of a normal population (known variance)

$H_0$	$H_1$	Rejection region
$\mu = \mu_0$	$\mu < \mu_0$	$\frac{\bar{x} - \mu_0}{\sigma/\sqrt{N}} < -Z_\alpha$
$\mu = \mu_0$	$\mu > \mu_0$	$\frac{\bar{x} - \mu_0}{\sigma/\sqrt{N}} > Z_\alpha$
$\mu = \mu_0$	$\mu \neq \mu_0$	$\frac{ \bar{x} - \mu_0 }{\sigma/\sqrt{N}} > Z_{\alpha/2}$

b) For a proportion

$H_0$	$H_1$	Rejection region
$p = p_0$	$p < p_0$	$\frac{\hat{p} - p_0}{\sqrt{\frac{p_0(1-p_0)}{N}}} < -Z_\alpha$
$p = p_0$	$p > p_0$	$\frac{\hat{p} - p_0}{\sqrt{\frac{p_0(1-p_0)}{N}}} > Z_\alpha$
$p = p_0$	$p \neq p_0$	$\frac{ \hat{p} - p_0 }{\sqrt{\frac{p_0(1-p_0)}{N}}} > Z_{\alpha/2}$

v) Critical points of the standard normal distribution

$$P(Z \leq 1,64) = 0,95$$

$$P(Z \leq 1,96) = 0,975.$$

**Space reserved for your calculations**