Statistics for International Studies

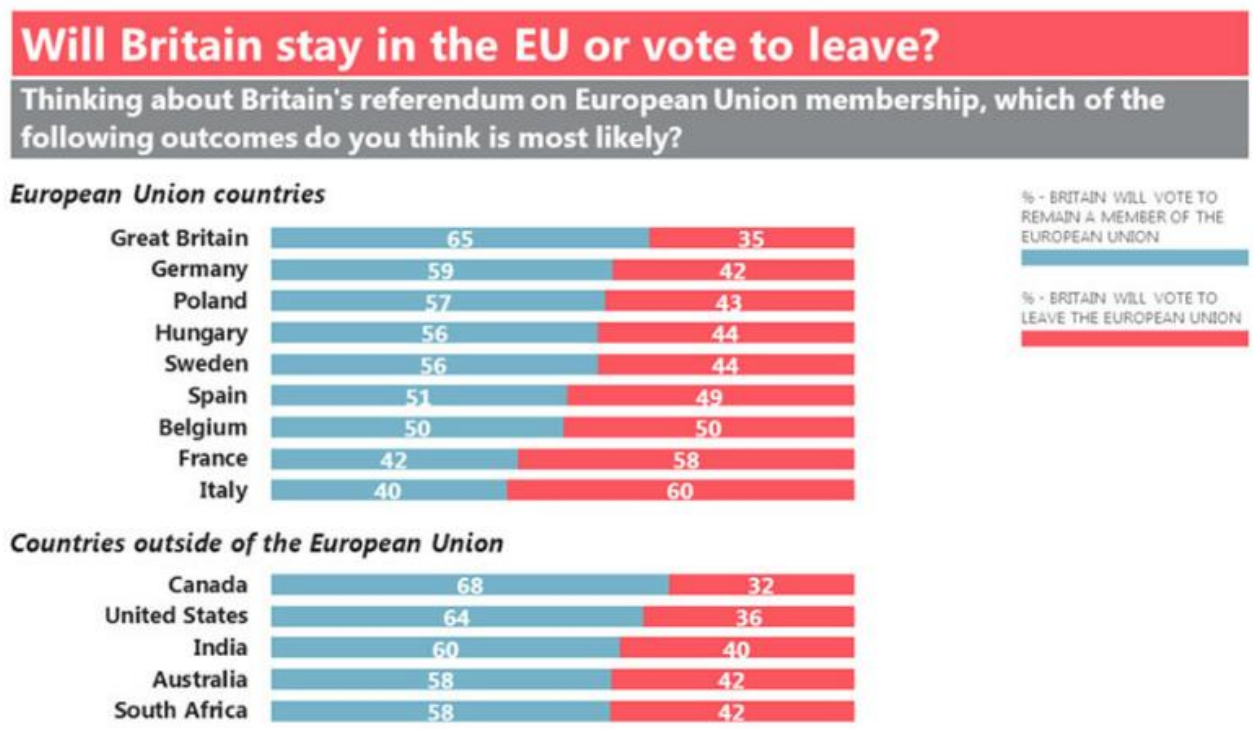
Exam: 19th May 2016

Name: _____

Group: _____ **Date:** _____

PROBLEM 1.

a) The following graph taken from an Ipsos survey carried out in March to April 2016 reflects the opinions of Europeans and non-Europeans about whether the UK will exit the Euro zone or not. The left (right) hand bar sections represent the estimated probabilities of Britain staying in (leaving) the EU.



Supposing that these results are representative, the probability that an Australian a German and a Pole all think that Britain will vote to stay in the EU is:

i. 0.580000.
ii. 1,740000.
iii. 0,195192.
iv. 0,195054.

Solution (1 point)			
i)	**ii)**	**iii)**	**iv)**

b) The following graph relates the 2016 World Freedom Index (WFI) to the 2016 Economic Freedom Index (EFI) for alphabetically chosen countries of the world from A to C.

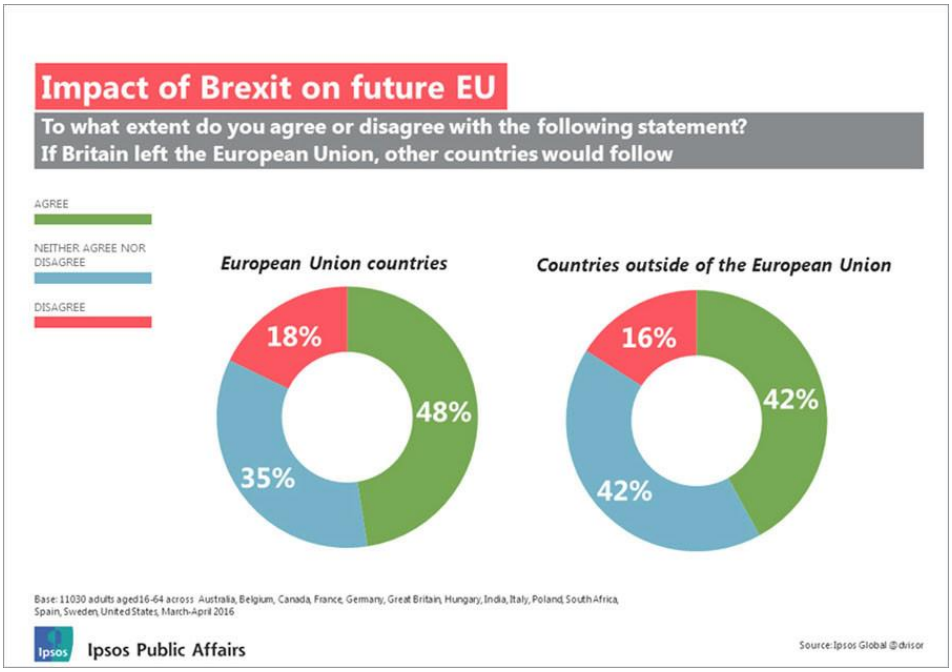
The Ivory Coast (Côte d'Ivoire) was included in A-C of the EFI with value 60 but not in the WFI (where it was classified as beginning with I). Use the regression line to estimate its WFI value. Do you think the estimate is reasonable? Why? **(1.25 points)**.

c) The most recent table of UNOCD murder rates estimates that in Macedonia, there are, on average 2 intentional homicides per year. Assuming that homicides occur according to a Poisson distribution, the probability that there is at least one homicide in Macedonia in the next six months is:

i. 0.3679.
ii. 0.6321.
iii. 0.7358.
iv. 0.2462.

Solution (1 point)			
i)	**ii)**	**iii)**	**iv)**

d) The following question was also asked in the IPSOS survey referred to previously.



In this case, the variable in the question is:

i. Quantitative and continuous.
ii. Qualitative and ordinal.
iii. Qualitative and discrete.
iv. None of the above.

Solution (1 point)			
i)	**ii)**	**iii)**	**iv)**

e) The following table, (taken from Transparency International), shows the values of the 2016 Economic Freedom Index of the first eight countries for which values are available.

Country	Albania	Algeria	Angola	Argentina	Armenia	Australia	Austria	Azerbaijan
EFI	65.9	50.1	48.9	43.8	67.0	80.3	71.7	60.2

For these data:

i. The median is 63.5000 and the range is [43.8000, 71.7000].
ii. The mean is 63.5000 and the first quartile is 49.2000.
iii. The mean is 60.9875 and the third quartile is 70.5250.
iv. The median is 60.9875 and the interquartile range is 21.3250.

Solution (1 point)			
i)	**ii)**	**iii)**	**iv)**

PROBLEM 2. The following table comes from a survey of 1140 American voters (508 Republicans, 462 Democrats and the remainder Independents) carried out by Quinnipiac University in December 2015. (Note that each row in the table sums to 100%).

"Do you support or oppose accepting Syrian refugees into the U.S.?"

	Support	Oppose	Unsure/ No answer
	%	%	%
12/16-20/15	43	51	5
Republicans	13	82	5
Democrats	74	22	4
Independents	42	51	6

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

(0,75 points)

b) Are the two events "be a Republican" and "support accepting Syrian refugees into the US" independent? Justify your response.

(0.75 points)

c) If two of the Republicans in the survey are chosen at random, what is the probability that one supports the entry of refugees into the US and the other opposes it?

(0.75 points)

PROBLEM 3. The following headline and article appeared in the Sunday Mirror Newspaper on 14th May 2016.

EU Referendum voters split down the middle between Brexit and Remain

Roughly a third of people polled said they are unsure which way they'll vote, with the Remain and Leave voters also split down the middle

There's everything to play for in the great EU decider – with the nation divided almost equally on whether we are better off in or out.

Today's Sunday Mirror ComRes poll shows 29 per cent of voters think they will be better off if Britain leaves. But that is balanced by 33 per cent who believe they will be better off if Britain votes to stay in the EU on June 23. Yet nearly four out of 10 voters do not know one way or the other.

Our poll shows that David Cameron's so-called Project Fear is not getting through. Last week he predicted a Britain more likely to be attacked by terrorists and a Europe at greater risk of war if we decide to leave. But 42 per cent of voters think Britain would be better able to protect herself outside the EU – a rise of seven points since we last asked this question in March. That compares to 38 per cent who say we are more secure inside, a drop of four points. Britons are more than twice as likely to believe Brexit leader Boris Johnson as PM Mr Cameron.

Only one in five believes the PM while 45 per cent think Boris is being honest with them. And 57 per cent reckon we will be able to better protect our borders and control immigration if we pull out of the EU.

ComRes interviewed 2,043 UK adults online between May 11-12.

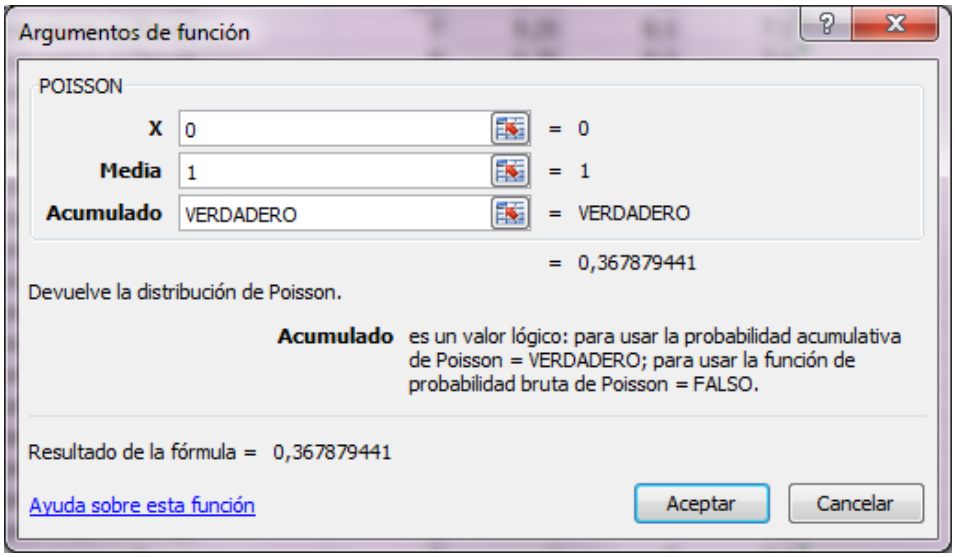
a) Calculate a 99% confidence interval for the true proportion of UK adults who think that Britain would be better off outside the EU. Is there any evidence (at a 1% significance level) that this is different to 1/3? Comment on the results with respect to the headline.

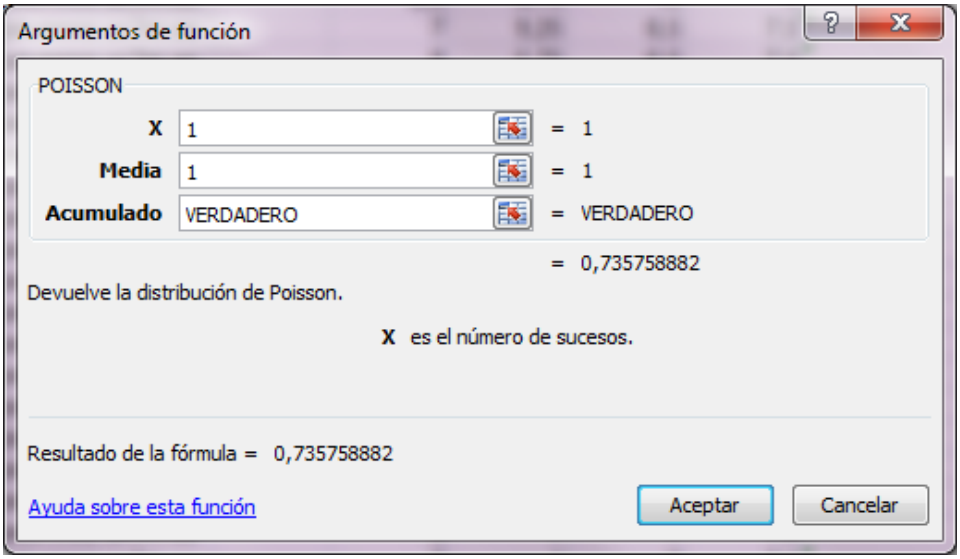
(1,5 points)

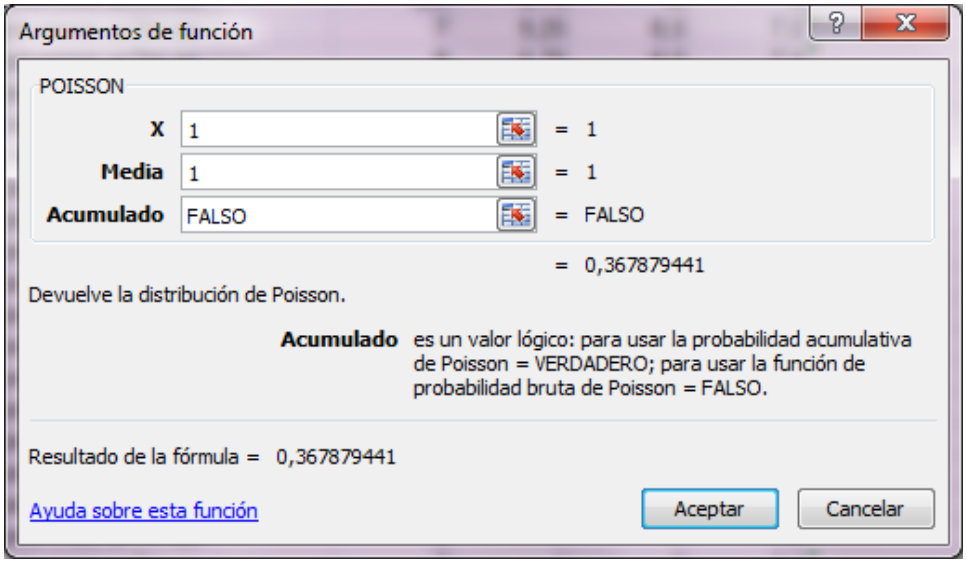
b) Is there any evidence (at a 5% significance level) that more than half of UK adults think that the UK will be better able to protect its borders and control immigration if it exits the EU.

(1 point)

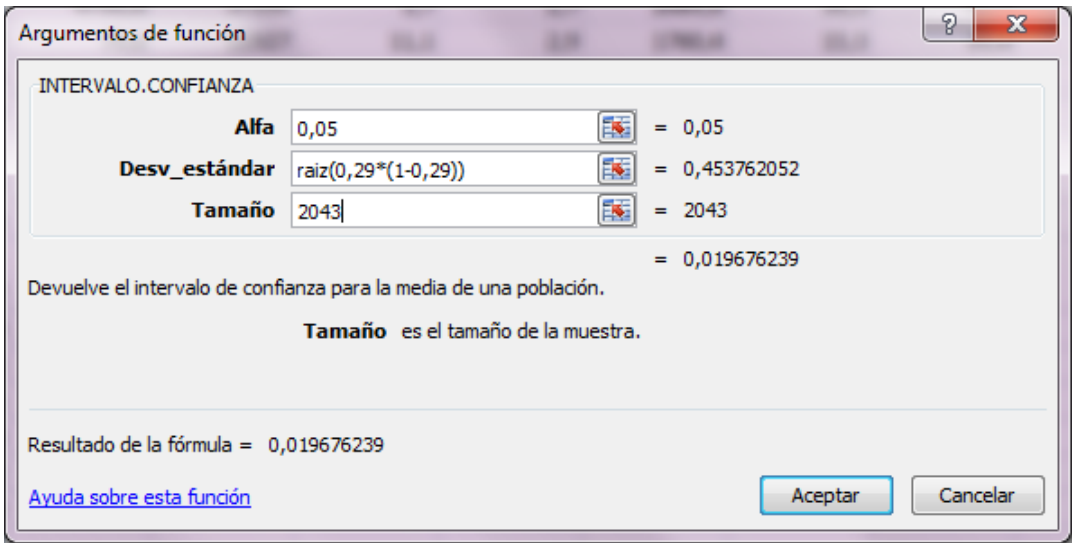
ANNEX: EXCEL OUTPUTS

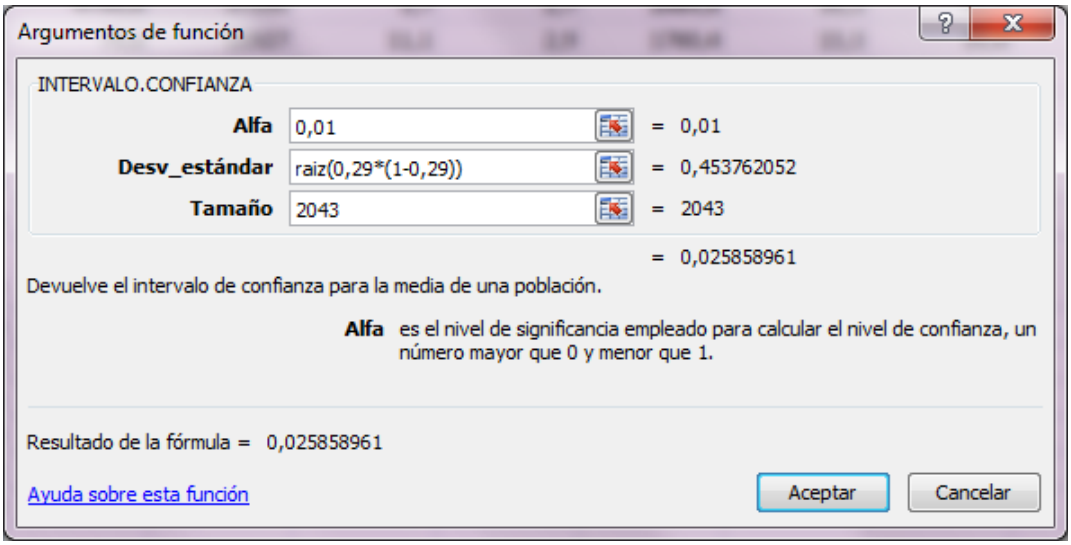


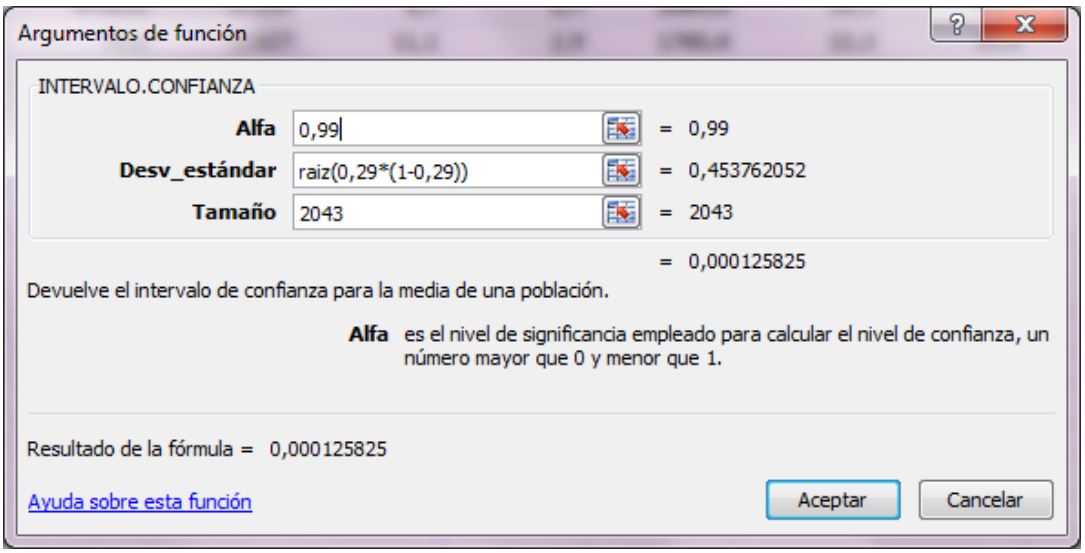





Argumentos de función
DISTR.NORM.ESTAND.INV
Probabilidad 0,95 = 0,95
= 1,644853627
Devuelve el inverso de la distribución normal estándar acumulativa. Tiene una media de cero y una desviación estándar de uno.
Probabilidad es una probabilidad asociada a la distribución normal, un número entre 0 y 1 inclusive.
Resultado de la fórmula = 1,644853627
Ayuda sobre esta función
Aceptar
Cancelar
Argumentos de función
DISTR.NORM.ESTAND.INV
Probabilidad 0,975 = 0,975
= 1,959963985
Devuelve el inverso de la distribución normal estándar acumulativa. Tiene una media de cero y una desviación estándar de uno.
Probabilidad es una probabilidad asociada a la distribución normal, un número entre 0 y 1 inclusive.
Resultado de la fórmula = 1,959963985
Ayuda sobre esta función
Aceptar
Cancelar
Argumentos de función
DISTR.NORM.ESTAND.INV
Probabilidad 0,99 = 0,99
= 2,326347874
Devuelve el inverso de la distribución normal estándar acumulativa. Tiene una media de cero y una desviación estándar de uno.
Probabilidad es una probabilidad asociada a la distribución normal, un número entre 0 y 1 inclusive.
Resultado de la fórmula = 2,326347874
Ayuda sobre esta función
Aceptar
Cancelar
Argumentos de función
DISTR.NORM.ESTAND.INV
Probabilidad 0,995 = 0,995
= 2,575829304
Devuelve el inverso de la distribución normal estándar acumulativa. Tiene una media de cero y una desviación estándar de uno.
Probabilidad es una probabilidad asociada a la distribución normal, un número entre 0 y 1 inclusive.
Resultado de la fórmula = 2,575829304
Ayuda sobre esta función
Aceptar
Cancelar


Argumentos de función
INTERVALO.CONFIANZA
Alfa 0,05 = 0,05
Desv_estándar raiz(0,29*(1-0,29)) = 0,453762052
Tamaño 2043 = 2043
= 0,019676239
Devuelve el intervalo de confianza para la media de una población.
Tamaño es el tamaño de la muestra.
Resultado de la fórmula = 0,019676239
Ayuda sobre esta función
Aceptar
Cancelar


Argumentos de función
INTERVALO.CONFIANZA
Alfa 0,01 = 0,01
Desv_estándar raiz(0,29*(1-0,29)) = 0,453762052
Tamaño 2043 = 2043
= 0,025858961
Devuelve el intervalo de confianza para la media de una población.
Alfa es el nivel de significancia empleado para calcular el nivel de confianza, un número mayor que 0 y menor que 1.
Resultado de la fórmula = 0,025858961
Ayuda sobre esta función
Aceptar
Cancelar


Argumentos de función
INTERVALO.CONFIANZA
Alfa 0,99 = 0,99
Desv_estándar raiz(0,29*(1-0,29)) = 0,453762052
Tamaño 2043 = 2043
= 0,000125825
Devuelve el intervalo de confianza para la media de una población.
Alfa es el nivel de significancia empleado para calcular el nivel de confianza, un número mayor que 0 y menor que 1.
Resultado de la fórmula = 0,000125825
Ayuda sobre esta función
Aceptar
Cancelar

Normal distribution tables

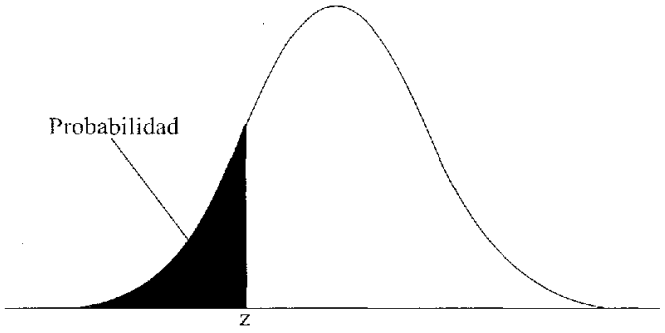


Tabla 3. *Probabilidad de que una variable normal de media cero y desviación típica uno tome un valor menor que z*

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	0,0855	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	0,721	0,4681	0,4641

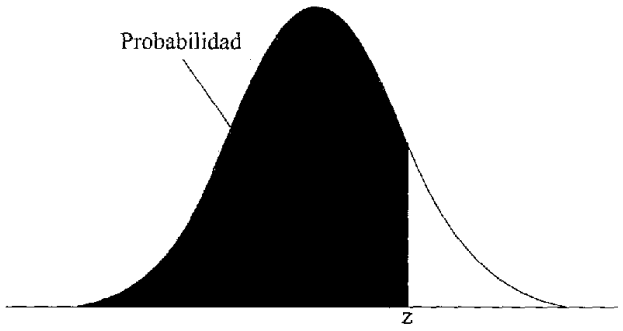


Tabla 3. (*continuación*) *Probabilidad de que una variable normal de media cero y desviación típica uno tome un valor menor que z*

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	09981,	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

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

$$\overline{X} = \frac{\sum_{i=1}^{n} x_i}{n} \qquad S_x^2 = \left[\frac{\sum_{i=1}^{n} x_i^2}{n}\right] - (\overline{x})^2 \qquad Cov(X,Y) = \left[\frac{\sum_{i=1}^{n} x_i y_i}{n}\right] - (\overline{x} * \overline{y})$$

$$r(X,Y) = \frac{Cov(X,Y)}{S_x * S_y}$$

ii) Regression

The least squares line is y = a + bx where

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

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 α.

Z_α 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
$\mu = \mu_0$	$\mu < \mu_0$	$\frac{\bar{x} - \mu_0}{\sigma/\sqrt{N}} < -Z_\alpha$
$\mu = \mu_0$	$\mu > \mu_0$	$\frac{\bar{x} - \mu_0}{\sigma/\sqrt{N}} > Z_\alpha$
$\mu = \mu_0$	$\mu \neq \mu_0$	$\frac{\lvert\bar{x} - \mu_0\rvert}{\sigma/\sqrt{N}} > Z_{\alpha/2}$

b) For a proportion

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

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