

**Statistics I Final Exam, 26th May 2016.**  
**Degrees in ADE, DER-ADE, ADE-INF, FICO, ECO, ECO-DER, TUR.**

**EXAM RULES:** 1) Use separate booklets for each problem. 2) Perform the calculations with at least two significant decimal places. 3) You may not leave the exam during the first 30 minutes. 4) You are not allowed to leave the classroom without handing in the exam.

1. The following tables contain information about 10 companies of the IBEX 35. In particular, three variables are shown:  $X_1$  = “average remuneration of the governing board”,  $X_2$  = “average remuneration of senior management” and  $X_3$  = “average expenditure per employee” (in millions of euros). Source: El País, 8th May 2016.

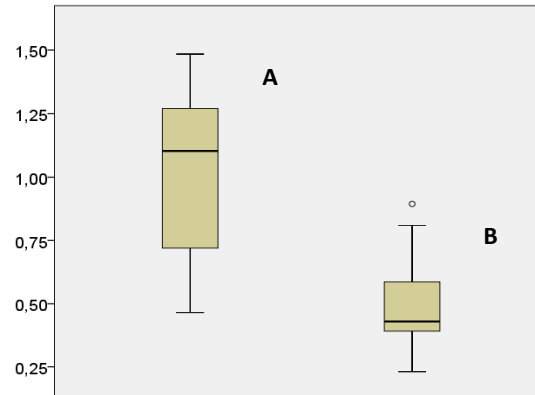
**Tabla 1 / Table 1**

Empresa / Company	X1	X2	X3
BBVA	0,985	1,144	0,455
ACS	0,667	0,540	0,401
FCC	0,720	0,650	0,323
Inditex	1,270	1,730	0,231
Acciona	0,463	0,590	0,390
Santander	1,484	2,580	0,586
IAG	1,220	2,440	0,809
Iberdrola	0,920	1,979	0,894
Ferrovial	1,330	1,800	0,391
Telefónica	1,240	1,869	0,491

**Tabla 2 / Table 2**

	X1	X2	X3
Media / Mean	1,030		0,497
Mediana / Median		1,765	0,428
Desv. típica / Standard dev.	0,333	0,756	0,210
Varianza / Variance		0,572	0,044
Q1	0,770	0,774	0,390
Q3	1,263	1,952	

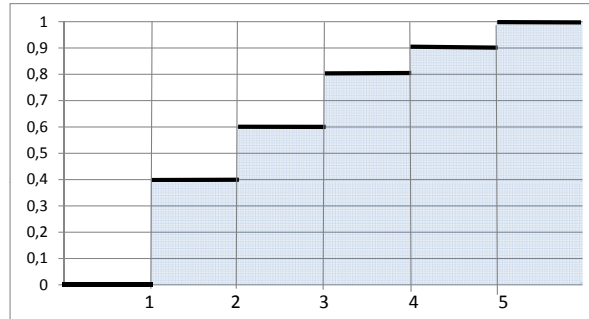
**Figura 1 / Figure 1**



Answer to the following questions:

- (0.4 points) Fill in the gaps in Table 2.
- (0.4 points) Determine the shape of the distribution of  $X_2$ . Justify your answer.
- (0.4 points) Which of the three variables is more disperse? Justify your answer.
- (0.4 points) Are there any outliers in  $X_3$ ? Justify your answer.
- (0.4 points) Match the box-plots A and B of Figure 1 with the corresponding variables ( $X_1, X_2, X_3$ ). Justify your answer.
- (0.5 points) It is known that the correlation between  $X_1$  and  $X_3$  is 0.175 and, on the other hand, that the covariance between  $X_2$  and  $X_3$  is 0.093. Is it true that the linear relationship between  $X_3$  and  $X_1$  is stronger than between  $X_3$  and  $X_2$ ? Justify your answer.

2. A given company offers a maximum of 5 extra vacation days if employees meet the targets. Let  $X$  be the r.v. that measures the “number of extra vacation days”, with the following cumulative distribution function:



- (a) (0.75 points) Write the probability function.
- (b) (0.75 points) Calculate the expectation of  $X$  and its standard deviation.
- (c) (0.5 points) Considering that the company assumes a cost of 100 euros for each extra vacation day, calculate the average cost and the variance.
- (d) (0.5 points) The company forecasts that only 300 employees can meet the target. In particular, 4 extra vacation days can be reached by  $1/3$  of them and only 1 extra vacation day can be reached by the others. Calculate the global cost assumed by the company (consider that the cost of 1 extra vacation day is 100 euros).
3. The AROPE indicator is computed using several social vulnerability factors and measures the risk that a given household is under risk of poverty exclusion. During 2014, an NGO attended 1.200.000 households and 156.000 were not under AROPE. Regarding the households that did not suffer AROPE, 84% of them were not over-indebted. On the other hand, considering the households that were under AROPE, 40% of them also suffer over-indebtedness.
- (a) (0.5 points) Calculate the number of households attended by the NGO that suffer over-indebtedness.
- (b) (0.75 points) Given that a household is not over-indebted, compute the probability that it is under AROPE.
- (c) (0.5 points) A social worker can visit 20 households per day. Compute the probability that, in a given day, 5 out of 20 households are not under AROPE.
- (d) (0.75 points) Considering that 420 households can be visited per month, compute the probability that at least 150 households suffer both AROPE and over-indebtedness.
4. The average annual remuneration of the highest paid executives of Spanish companies in the stock exchange market is 2.3 million euros, with a standard deviation of 0.7. Answer to the following questions:
- (a) (0.75 points) Calculate the probability that the average annual remuneration of 100 of these executives is between 2.15 and 2.45 million euros.
- (b) (0.5 points) If instead of 100 executives we consider only 50, without doing any additional computation, decide whether the probability computed in (a) will increase or not. Justify your answer.
- (c) (0.5 points) Calculate the probability that the total amount of the remunerations of 100 of these executives is greater than 250 million euros.
- (d) (0.75 points) Considering that in a sample of 30 Spanish companies, the average annual remuneration of the highest paid executives is 2 million euros with a standard deviation of 1.4, calculate the 90% confidence interval of the mean remuneration assuming normality. How confident are you that the true mean is in fact 1.5 million euros?