1. The owner of a gas-station has obtained a random sample in order to know the number of cars arriving to the station per minute. The sample is based on 42 minutes and these are the results:

Number of cars per minute	Number of times for this event happening
0	4
1	7
2	10
3	9
4	4
5	3
6	2
8	2
10	1

Test the goodness of fit of these data to the Poisson distribution at a 5% significance level. To merge the two first classes and the last four is suggested.

2. Repeat exercise 1 considering now this sample with 50 minutes:

Number of cars per minute	Number of times for this event happening
0	6
1	8
2	5
3	9
4	5
5	4
6	5
7	4
10	4

3. A s.r.s. of 100 people has been obtained aiming at knowing their opinion about the economic situation nowadays. Their answers are collected in the table:

Answers	Number of people
Very bad	50
Bad	28
Fair	15
Good	4
Very good	3

Test the hypothesis consisting of this sample coming from a discrete uniform distribution at a 5% significance level.

4. Now repeat exercise 3 considering the following sample:

Answers	Number of people
Very bad	28
Bad	26
Fair	16
Good	14
Very good	16

5. The number of life insurance policies sold per day by agents of an Insurance Company varies between 0 and 10. A s.r.s. of 38 agents has been selected with the purpose of testing the distribution of the variable as a B(m;p) with m=10. Its results are given in the table at the next page. To pool categories 0, 1 and 2 by one side and 6,7, 8, 9 and 10 by another side is suggested. Find:
    a) Do the hypothesis test at a 1% level of significance
    b) Solve it using the p-value
    c) Change the sample in order to make the opposite decision at that chosen at question a)

Number of policies sold	Number of agents
0	2
1	4
2	5
3	7
4	8
5	5
6	3
7	2
8	1
9	1
10	0

6. What it follows is the distribution of grades in an exam of Statistics coming from 30 students. Run a goodness of fit test of those data to a normal distribution at a 1% significance level. Pool the data in 5 classes with the same probability. Discuss the adequacy of the test.

5,0	6,0	5,5	5,5	6,8	5,8	5,2	4,6	4,3	6,8
3,7	4,4	6,8	3,7	1,9	6,3	5,2	5,4	8,1	2,1
4,8	4,1	8,1	4,9	4,8	6,2	6,9	6,2	4,2	8,9

7. Verify if after realizing other data mergers in the previous exercise (8 or 10 classes, for instance) the decision made holds.

8. The volume of water in hm^3 received by a dam in the last year is given in the table. Test that the water arrived quarterly follows a discrete uniform distribution at $\alpha = 5\%$:

Season	Volume of water in hm^3
Winter	20
Spring	10
Summer	2
Autumn	8

9. Test the normality hypothesis in the variable considered at exercise 6, by means of the Kolmogorov-Smirnov test with the Lilliefors correction.

10. The manager in charge of a line of business in a firm affirms that weekly income, in thousands of euros, follows a U[10-20]. To show that he has obtained a s.r.s. of 20 weeks with the following results:

16,5551	10,1825	15,4442	12,0811	17,3431	13,7300	19,9808
14,2073	19,9487	10,3858	12,3160	13,1230	16,9411	13,6796
13,1581	17,8228	12,9814	19,6908	19,0768	19,1671	

Run the corresponding Kolmogorov-Smirnov test at a 5% significance level.

11. Now redo the previous exercise considering the following data:

15,2469	16,4022	12,8697	16,0905	12,2827	15,2483	14,5376
14,6803	10,0190	14,6219	10,7199	15,0284	14,1517	13,2282
14,4477	15,7295	14,4144	17,9642	15,9837	15,4005	

12. A responsible at the Industry Department in Madrid Regional Government wants to know if the electricity produced in the region by means of renewable energy, in dozens of GWh, follows a U[2-6]. Aimed at that a random sample of 12 days has been obtained with these data:

2,90	2,00	5,57	4,69	2,49	3,62
2,72	5,85	5,43	2,94	2,06	2,62

Answer using the Kolmogorov-Smirnov test at a 1% level of significance.

13. A consumer organization has randomly selected 50 households and collected their average gas consumption in a year with the purpose of testing its fit to a normal distribution. The data in thousands of kWh are:

5,39	5,99	4,21	6,05	4,28	4,77	4,39	4,28	4,45	6,41
5,79	5,10	4,18	8,45	4,04	6,54	7,37	4,70	3,61	4,55
5,98	2,71	4,61	4,92	5,36	6,64	5,42	7,91	6,02	3,98
4,79	6,06	6,08	4,79	3,45	6,30	8,76	1,31	5,40	4,36
6,08	5,09	6,63	3,99	5,63	6,51	2,76	5,09	1,47	6,10

Answer the question using a Kolmogorov-Smirnov test with Lilliefors correction at a 1% significance level.

14. Repeat the previous exercise running a Pearson's Chi square test.

15. Test the goodness of fit of the following data to a normal distribution using the Shapiro-Wilks technique ($\alpha = 5\%$):

-0,98	-1,36	0,79	-0,13	-0,84	-0,84	0,01	1,54	-0,33	-1,25

16. Now redo the previous exercise substituting the first observation (-0.98) by this one: 7

17. The manager at charge of a gas-station wants to know if the demand of petrol per hour, measured in thousands of liters, fits to a normal population. With that purpose she has randomly selected a day and obtained a sample with 24 hours. Data in ascending order are:

6,58	10,26	11,06	11,94	12,08	13,73	13,80	14,10
14,34	14,36	14,48	15,12	15,30	15,65	16,73	17,00
18,12	18,17	18,33	18,69	19,61	20,07	21,46	21,56

Run a Shapiro-Wilks test to make a decision ($\alpha = 1\%$).

18. Redo the previous exercise but now substituting the last data in the sample (21,56) by this one: 30.

19. Elaborate the Wald-Wolfowitz runs test on the following samples regarding sex at a 5% significance level:

X_0:		M	M	H	M	H	H	H	M	M	M
X_1:		M	M	M	M	M	H	H	H	H	H
X_2:		M	H	M	H	M	H	M	H	M	H
X_3:	M	M	M	M	M	H	H	H	M	M	M	M
	H	H	H	H	H	M	M	M	M	M	M
	H	H	H	H	M	M	M	M	M	M	M

20. Build the Wald-Wolfowitz runs test on these samples ($\alpha = 5\%$):

X_0:	1	2	5	3	9	64	15	18	5	7	
X_1:	5	16	1	24	3	47	6	9	61	4	9
	8	14	28	34	78	49	8	6	5	2	1
X_2:	3	3	4	4	2	8	5	3	6	15	5
	2	1	3	4	7	20	17	12	15	4	7
	5	12	15	13	13	14	10	12	20	22	3
	5	7	7	6	5	7	7	8	5	6	1

21. This table shows the distribution by sex of the board members at five firms.

	A	B	C	D	E
Mujeres	2	4	1	2	0
Hombres	10	6	9	6	6

Test if the distribution by sex of the board members does not depend on the firm at a 1% significance level.

22. The results obtained by students belonging to different degrees in an exam of Maths are included in the following table:

	A	B	C	D	E
Pass	80	40	30	75	2
Fail	10	60	74	40	38

Test the null hypothesis consisting of the students passing Maths not depending on the degree studied at $\alpha = 1\%$.

23. A teacher has realized the same exam in Statistics to two different groups of students, one of them studying Economics and the other one Business. She wants to know if there are significant differences between both degrees in grades obtained. Consequently she has selected two independent random samples of 10 and 12 students, respectively. Here are the data:

Economics: 7 6 8,5 4 3 5 6,5 7 2 5,5

Business: 6,5 7 3,2 4 5 6,5 8 9 7,5 4 4,5 5

Run the Mann-Whitney U test implementing a two sided test at a 1% significance level and answer the question.

24. An independent agency has assessed the duration, in hours, of the battery incorporated at two mobile phones, X and Y, by means of two independent samples of customers: 12 from X and 10 from Y. These are the data:

X: 8 12 18 7,5 20 6 7,5 9 10 8 12 6

Y: 18 15 15 10 12 20 24 22 20 21

Explain by means of a Mann-Whitney U test if there are significant differences between both mobiles regarding their duration (α=5%).

25. The owner of a restaurant has changed the chef wishing to check if there are significant differences in its customers' opinion. Aimed at that she has obtained a s.r.s. of 12 clients who tried the same tasting menu before and after the change, giving a grade between 1 and 10. These are the data coming from both matched samples:

Before: 3 2 8 6 4 5 3 4 5 6 2 6

After: 7 6 7 8 7 5 7 4 8 4 6 9

Test the homogeneity of both samples by running the Wilcoxon sign ranked test for paired samples at 5% significance level (consider a two sided test).

26. We wish to know if the devaluation of a currency in a country has had an impact on the exports of its industrial sector. With that purpose a s.r.s. of 25 firms has been obtained computing the sales in both, the year before the devaluation and the year after (sales measured in thousand of euros). In this way two paired samples were obtained, the respective matched differences being calculated and ordered by ranks. Then the lowest sum of ranks corresponded to that coming from the exports in the year before the devaluation by an amount of 46.5. Can be accepted that there have not been significant differences in the exports before and after the devaluation? Explain your answer using a two tailed Wilcoxon sign ranked test for paired samples at 5% significance level.