Ex. 4. Estimation with confidence intervals

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Task. 1. The researchers estimate yields of 4 cereals (in 1 ha) in individual farms in 2003 near Warsaw. They randomly selected 100 individual farms. The average yield in 2003 was 43 q/ha and the standard deviation 5q/ha. Form a 95% confidence interval which covers the value of the average yields of all individual farms near Warsaw in 2003.

Task.2. The researchers estimate the living area of flats in Poznań in 2003. They randomly selected 70 flats. The results are shown in the table. Form a 95% confidence interval which covers the value of the average living area in Poznań in 2003.

Living area [m^2]	Number of flats	$\dot{x}_i$	$\dot{x}_i n_i$	$(\dot{x}_i - \bar{x})^2$	$(\dot{x}_i - \bar{x})^2 n_i$
35-45	5	40	200	576	2880
45-55	10	50	500	196	1960
55-65	25	60	1500	16	400
65-75	15	70	1050	36	540
75-85	10	80	800	256	2560
85-95	5	90	450	676	3380
-	70		4500	-	11720

Task 3. The researchers examine the plasterers working in the company "Omega" in 2005 in Poznań. They randomly selected 20 workers and recorded their work productivity. The results are shown in the table. Form a 99% confidence interval which covers the average work productivity of the entire brigade.

Work productivity (m^2) x_i	Number of plasterers n_i	$x_i n_i$	$(x_i - \bar{x})$	$(x_i - \bar{x})^2$	$(x_i - \bar{x})^2 n_i$
13	1	13	-3	9	9
14	2	28	-2	4	8
15	4	60	-1	1	4
16	6	96	0	0	0
17	4	68	1	1	4
18	2	36	2	4	8
19	1	19	3	9	9
-	20	320	-	-	42

Task 4. The researchers examine 100 randomly selected 'Fiat Punto' cars. The conducted analysis concerns the use of gasoline per 100 km. The standard deviation in the chosen sample of cars is 1 liter per 100 km. The use of gasoline has a normal distribution. Form a 99% confidence interval which covers the standard deviation of the use of gasoline for all 'Fiat Punto' cars

Task 5. The researchers selected randomly 25 trees in Gdynia. The results are : $\bar{x} = 40$, S = 4 cm. Specify the diversification of the tree diameters in the forest in Gdynia. Form a 90% confidence interval which covers the standard deviation of the all tree diameters in the forest in Gdynia.

Task 6. The students' test results in Statistics at Poznań University of Economics in 2004 are shown in the table. Form a 99% confidence interval which covers the fraction of students who get the grade dst +.

Grade	Number of students
ndst	30
dst	36
dst +	24
db	15
db+	10
bdb	4
cel	1
-	120