Semester work 2024 (1. year NMSP PS, KS)

Assignment:

1. Write a m-file (function), where the input parameter will be a vector of values X and and the function will return the values of basic statistical characteristics of location (arithmetic average, lower and upper quartile, median, mode, maximum, minimum), dispersion (variance, standard deviation, coefficient of variation, range, interquartile range), shape characteristics (skewness, kurtosis) and others (number of data, sum) and will be stored in a structure array (`Structure Array`). Output can be seen here

   The function further plots graphs of exploratory data analysis (density histogram + theoretical probability density function $N(\overline{x}, s)$, boxplot, empirical distribution function + theoretical distribution function $N(\overline{x}, s)$, histogram + kernel density estimate, normal probability plot, Q-Q graph with theoretical quantiles of normal distribution), which will be in one graphical window. Output can be seen here

   Test the function on any data.

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2. The function is given by a table

x_i	0.1	0.28	0.71	0.91	1.2	1.4
y_i	5.2	1.72	2.33	0.15	-0.48	-0.7

Using the least squares method, estimate the polynomials $P_n(x) = \sum_{j=0}^{n} \beta_j x^j$, for $n = 1, 3, 5$. Write a m-file (script) in MatLab to estimate the coefficients by the method of least squares. Use the `for` loop. Calculate the coefficient estimates, the coefficient of determination, draw a graph for the above polynomials, and plot the points from the table on the graph.

Output can be seen here

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3. Create the m-file (function), which calculates the diameter of a synthetic fiber (circular cross section) in micrometers when the input parameters are fiber fineness t $[dtex]$ and density ρ $[kg/m^3]$. If the fiber diameter is higher than 10 μm, the text 'fiber diameter is higher than 10 microns' shall be displayed, otherwise the text 'fiber diameter is lower than 10 microns'. Test the function for PP fiber ($t = 2.2$ $dtex$, $\rho = 991$ kg/m^3) and stainless steel fiber ($t = 3.85$ $dtex$, $\rho = 8000$ kg/m^3).

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4. The shielding efficiency (SE) of the fabric was evaluated depending on the content of the conductive component in the material. x - independent variable, content of the conductive component P [%]; y - dependent variable, shielding efficiency SE [dB]. Assume that the data comes from a normal distribution.

P [%]	1	3	5	10	15	20	40	60	75
	13,50	20,30	23,70	29,50	31,90	36,50	40,70	46,20	52,10
	13,60	21,10	23,80	28,60	32,50	33,70	41,50	45,00	49,90
	12,40	19,70	24,90	29,90	32,40	34,60	39,70	45,80	51,60
	12,90	20,50	23,10	29,20	31,90	34,20	42,20	45,20	48,70
SE	12,70	21,20	24,70	27,80	32,90	34,40	42,00	43,60	49,80
[dB]	13,20	19,90	24,00	28,50	32,00	34,50	42,50	45,10	49,10
	12,80	20,30	24,00	29,60	31,10	35,80	42,60	44,90	50,40
	12,50	20,30	23,40	28,90	32,80	33,10	43,60	44,00	50,00
	13,10	21,10	23,80	28,40	33,30	35,30	40,90	43,30	50,10
	13,30	19,50	22,50	28,40	34,20	35,30	40,20	44,10	50,80

Create a m-file (script) that will:

- draw a scatter plot of the average values of the shielding efficiency SE on the content of the conductive component + draw 95% confidence intervals for means
- draw the function $SE = 14 \times P^{0.3}$ in the same graph
- insert a legend describing the meaning of points and solid lines

Output can be seen here

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Commands (functions) can be found in exercises as well as in MatLab help, specifically in Statistics and Machine Learning Toolbox.

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To obtain the credit, prepare

- a written technical report (title page, assignment, solution, results and figures, discussion, conclusion, references). The file will have a name in the form `surname.pdf`.
- functional m-files. m-files will have names in the form `surname_numberofexmple.m`, for example (`tunak_1.m` - `tunak_4.m`).

Send the prepared technical reports together with functional m-files (in the archive) to my e-mail address maros.tunak@tul.cz till 7th June 2024 (12:00).

Evaluation of graded credit (practical demonstration of acquired skills) will take place during the exam period (I will list 2-3 dates per week for max. 10 students /term) in the computer room (there will be 1-2 examples to solve).

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Field ▲	Value
average	25.5413
lower_quartile	21.1637
median	25.4082
upper_quartile	28.6874
mode	10.2786
variance	31.9199
stand_deviation	5.6498
coeff_variation	22.1201
skewness	0.3756
kurtosis	3.5004
maximum	42.8920
minimum	10.2786
sum	2.5541e+03
number	100
range	32.6134
intequartile_range	7.5237

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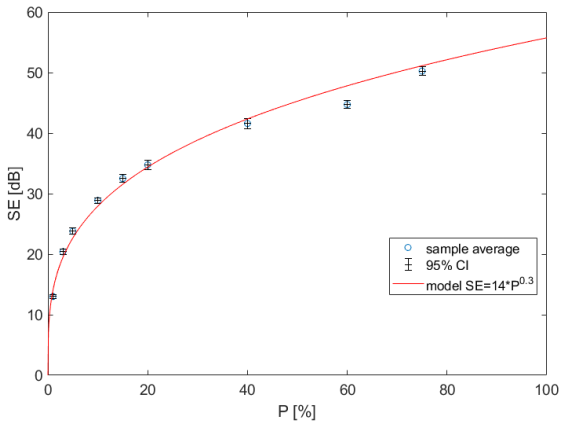# Semester work 2024 (1. year NMSP PS, KS)
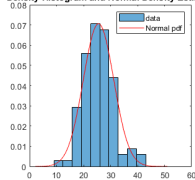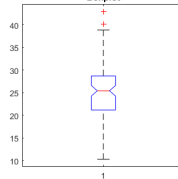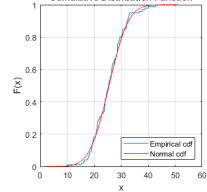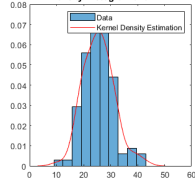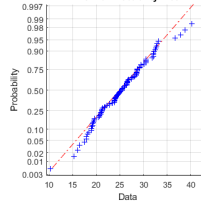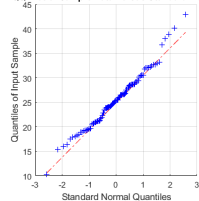
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