EMS_2019
HOMEWORK 1

1. Three instruments each make 10 repeated measurements of a flow rate known to be 1.500 m^3/s with the results given in the next Table.

Trial	Instrument A	Instrument B	Instrument C
1	1.5	1.73	1.552
2	1.3	1.73	1.531
3	1.4	1.73	1.497
4	1.6	1.73	1.491
5	1.3	1.73	1.500
6	1.7	1.73	1.550
7	1.5	1.73	1.456
8	1.7	1.73	1.469
9	1.6	1.73	1.503
10	1.5	1.73	1.493

a. Which instrument is most precise? Least precise? Explain.
b. Which instrument has the best accuracy? Worst accuracy? Explain.
c. Which instrument has the best resolution? Worst resolution? Explain.

2. Draw the ***normalized histograms*** (the bin width is 1) and calculate the ***mean*** and the ***standard deviation*** values for the next data sets:

Boys									
Shoe size	38	39	40	41	42	43	44	45	46
How many	1	2	3	8	25	16	12	9	5

3. Considering the Standard Normal Distribution (z) and using the tables, find:

P (z < 1.47)
P (z > -0.25)
P (-2 < z < -1)
P (-1.96 < z < 1.96)

4. Considering a population of capacitors having a nominal value of 10μF and a manufacturing tolerance of 15%. Statistical analysis of the capacitors values suggests that their distribution is normal, having a mean of μ=10.02μF.
a. Find the relative error [%] (bias) of the mean value relative to the nominal value (reference value)
b. Find the standard deviation knowing that the tolerance is given as ±3σ.
c. How many capacitors (from 1000) have values in the interval μ±3σ?
d. How many capacitors (from 1000) have values in an interval of ±5%?
e. How many capacitors (from 1000) have values in an interval of [0%,5%]?
f. How many capacitors (from 1000) have values in an interval of [-2%,4%]?
g. Find the symmetrical interval (x_1, x_2) where 70% of the population is situated.
Hint: The areas from μ ±1σ; μ ± 2σ; μ ± 3σ are known (see the slides from the course lectures).

5. A population of resistances values has the standard deviation of 0.156 ohms. A sample of 60 resistors has the average resistance of 0.55 ohms.
(a) Based on these data, what is the confidence interval at a 95.45% confidence level for the population mean resistance.