Version A

1. Four experts (A, B, C and D) assessed the new building in 10-points system. Six properties were evaluated on this building. The results were as follows

Property	Expert A	Expert B	Expert C	Expert D
1	8	9	7	8
2	6	5	9	7
3	10	7	7	8
4	9	6	8	6
5	9	10	10	7
6	9	8	6	8

Can You reject the hypothesis that experts assessed the building equally. Significance level is 0.05.

2. Let us have sample which elements X_i have binomial distribution $B(10, Y)$. Let prior distribution of Y be beta distribution with parameters $\alpha = 1.5$ and $\beta = 1.5$. Let us have a pair of hypotheses

$$\begin{cases} H_0 : y > 0.5 \\ H_1 : y \leq 0.5. \end{cases}$$

If likelihood ratio $LR > 5$ then we prove H_1. In the other case we have to stay on H_0. Which decision you make if sample realization

$$\mathbf{x} = (4, 6, 3, 2, 7, 1, 8).$$

Version B

1. Let us have following data table

Y(g)	X_1(m)	X_2(cm)	X_3(m^2)	X_4(cm)
51.4	0.2	17.8	24.6	18.9
72	1.9	29.4	20.7	8
53.2	0.2	17	18.5	22.6
83.2	10.7	30.2	10.6	7.1
57.2	6.8	15.3	8.9	27.3
66.5	10.6	17.6	11.1	20.8
98.3	9.6	35.6	10.6	5.6
74.8	6.3	28.2	8.8	13.1
92.2	10.8	34.7	11.9	5.9
97.1	9.6	35.8	10.8	5.5
88.1	10.5	29.6	11.7	7.8
94.8	20.3	26.6	6.7	10.1

a) Compose model $Y = \beta_0 + \sum_{j=1}^{4} \beta_j X_j$.

b) Test significance of the model with in significance level $\alpha = 0.05$.

c) For which parameters β_j can reject hypothesis $H_0 : \beta_j = 0,\ j = 0, 1, ..., 4$? Let significance level be 0.05.

d) How much of variable Y variation is described by the model?

e) Make some conclusions from a)–d).

2. Let us have Markov Chain $X_t = 1, 2, 3,\ t = 0, 1, ..., n, ...$ with transition matrix

$$\mathbf{P} = \begin{pmatrix} 0.5 & 0.4 & 0.1 \\ 0.3 & 0.4 & 0.3 \\ 0.1 & 0.2 & 0.7 \end{pmatrix}$$

where first row is for state 1, second for 2 and third for 3.

a) Find probability to get with 3 time steps from state 2 to state 3,

b) Find stationary distribution of states 1,2 and 3.

Version C

1. Athlete A and Athlete B had the following discus throw results for season seven

Athlete A	68.24	66.15	64.13	63.98	62.12	61.98	61.22
Athlete B	65.66	65.12	64.02	63.28	63.12	63.04	62.55

Compose the Statistical Test rejecting the statement of equal stability both athletes. Let us assume that discus throw results follow normal distribution during the season.

2. Let us have sample which elements X_i have Poisson distribution with Λ. Let prior distribution of Λ be exponential distribution with parameter 1. Let us have a pair of hypotheses

$$\begin{cases} H_0 : \lambda > 1 \\ H_1 : \lambda \leq 1. \end{cases}$$

If likelihood ratio $LR > 6$ then we prove H_1. In the other case we have to stay on H_0. Which decision you make if sample realization

$$\mathbf{x} = (1, 0, 1, 0, 0, 1, 2, 0)^{\intercal}.$$

Version D

1. Let us have following data table

Y(g)	X_1(m)	X_2(cm)	X_3(m^2)	X_4(cm)
51.4	0.2	17.8	24.6	18.9
72	1.9	29.4	20.7	8
53.2	0.2	17	18.5	22.6
83.2	10.7	30.2	10.6	7.1
57.2	6.8	15.3	8.9	27.3
66.5	10.6	17.6	11.1	20.8
98.3	9.6	35.6	10.6	5.6
74.8	6.3	28.2	8.8	13.1
92.2	10.8	34.7	11.9	5.9
97.1	9.6	35.8	10.8	5.5
88.1	10.5	29.6	11.7	7.8
94.8	20.3	26.6	6.7	10.1

a) Compose model $Y = \beta_0 + \sum_{j=1}^{4} \beta_j X_j$.

b) Test significance of the model with in significance level $\alpha = 0.05$.

c) For which parameters β_j can reject hypothesis $H_0 : \beta_j = 0,\ j = 0, 1, ..., 4$? Let significance level be 0.05.

d) How much of variable Y variation is described by the model?

e) Make some conclusions from a)–d).

2. Let us have sample which elements X_i have binomial distribution $B(10, Y)$. Let prior distribution of Y be uniform distribution in the set $(0; 1)$. Let us have a pair of hypotheses

$$\begin{cases} H_0 : y > 0.5 \\ H_1 : y \leq 0.5. \end{cases}$$

If likelihood ratio $LR > 5$ then we prove H_1. In the other case we have to stay on H_0. Which decision you make if sample realization

$$\mathbf{x} = (4, 6, 3, 2, 7, 1, 8).$$