

Second Midterm - Spring 2017

Instructions

- The use of a mobile phone, or any other means of communication, is forbidden.
- Give all the results with a **two decimals** precision.
- Write answers on a **separate** sheet of paper. **Underline** your results.

Section are independent and can be treated separately.

1 Exercise I - Means of distribution (4 point)

In a study on the salaries in a firm, the median (M_e), the deciles (D_1, D_2, \dots, D_9) and the quartiles (Q_1, Q_2, Q_3) have been calculated. The salaries ranged between €1,200 and €12,000.

Quantile	D_2	Q_1	M_e	Q_3	D_8	D_9
Salary in €	2,000	3,000	4,000	7,000	9,000	12,000

1. Reconstruct the distribution of employees by *salaries bracket*. (1pt)
2. Compute the mode, the mean and the standard deviation of the distribution. (3pts)

2 Exercise II - Gini and Freddie (6 points)

Freddie Mac, a mortgage firm, has the following wages' distribution :

Wages	Nb of people
10k - 20k	150
30k - 40k	800
50k - 70k	50

1. Determine the following values and explain in a few words what they mean :
 - the median salary (1pt)
 - the standard deviation (1pt)
 - the medial (1pt)
2. Draw the Lorenz Curve (Use a rule !) (2pts)
3. Determine the Gini coefficient (2pts)

3 Exercise III - Mothers and prisoners (4 points)

DataIsFun Inc., a consulting firm specialised in statistics, has gathered data on the number of prisoners in France (in thousands) each year since 1980 and the average age of the mother at child birth. The following table reports their findings:

Variable	Statistics	Value
Age of the mother	mean	28.96
Nb of prisoners	mean	53.45
Age of the mother	standard deviation	1.18
Nb of prisoners	standard deviation	10.89
Covariance		11.29

They want to estimate the following model

$$nb\ of\ prisoners = a * age\ of\ the\ mother + b$$

1. Compute a and b (1.5pt).
2. Compute the correlation coefficient, ρ , and the coefficient of determination R_2 (1.5pt)
3. Interpret your findings and propose a way to improve the model (1pt).

4 Exercise IV - Out of tiny acorns mighty oaks grow (4 points)

Josh has the choice between two investments of 1000\$, each of them for 10 years.

- Investment A: annual interest rate: 5% (**simple** interests)
- Investment B: annual compount interest : 3% (**compound** interests).

1. Compute Josh's profit with investment A and investment B. What is the best investment ? (1pt)
2. What should be the annual interest rate of investment A so that Josh is indifferent between investment A and investment B ? (i.e. find the annual interest rate so that Josh's profit with investment A equals Josh's profit with investment B, all other things being equal) (1pt)
3. How long should be investment A so that Josh's profit with investment A equals its profit with investment B ? (1pt)
4. If inflation is 3% annually and Josh chooses investment A, what will be its *real* profit (in terms of purchasing power) after the 10 years ? (1pt)

5 Exercise V - The Art of the deal (3 points)

1. Eric has made a 1000\$ for one year at a 5% annual interest rate but paid the interests at the beginning (interests are checked-off). What is the effective (or real) interest rate ? (1pt)
2. Chelsea has two credits: (i) 1000\$ to repay in 30 days and (ii) 3000\$ to repay in 90 days. What is the average maturity ? (1pt)

3. A firm has a repayment due in 180 days of 100,000\$ and want to renegotiate the debt contract to expand the maturity to 360 days. The commercial discount rate is 7%. How much will the firm need to repay in 360 days ? (1pt)
