

Mathematical Statistics 2021/2022 Problem Set 0

Index Numbers

1. The dynamics of minimum gross hourly wages in Poland in 2017-2022 may be summarized by the following series of chained simple indices:

Year	2018	2019	2020	2021	2022
previous year =100	105.4	107.3	115.6	107.6	107.1

Find the change between 2017 and 2022 (a simple index number with a base of 2017). Knowing that the minimum gross hourly wage in 2022 is equal to 19.6 PLN, find the value of the minimum gross hourly wage in 2017. Find the average yearly rate of change between 2017 and 2022. Assuming further that the same average rate of change will apply to subsequent years, approximate the value of the minimum gross hourly wage in 2024.

2. The dynamics of the number of emigrants from Poland (stock) in the years 2004-2020 may be summarized by the following chain of simple index numbers, with 2004 as the base year:

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
index	1.45	1.95	2.27	2.21	2.1	2.0	2.06	2.13	2.2	2.32	2.4	2.52	2.54	2.46	2.42	2.24

Calculate the average rate of change of the emigrant stock for the years 2004-2020. Calculate the chain index numbers. In which year was the stock of migrants the lowest, and in which year the highest? In which year was the annual rate of growth the lowest, and in which year the highest? Knowing that the stock of emigrants in 2020 was estimated at 2.239 million, assess the number of emigrants in 2021 (extrapolating the average rate of change for 2004-2020).

3. The monthly figures of the unemployment rate in Poland in 2021 are presented in the table below:

Month	January	February	March	April	May	June	July	August	September	October	November	December
Unemployment rate	6.5	6.6	6.4	6.3	6.1	6	5.9	5.8	5.6	5.5	5.4	5.4

Construct the chained simple indices for unemployment in 2021 as well as simple indices for unemployment with a base of December 2020, knowing that the value of the unemployment rate in December 2020 amounted to 6.3. Which month saw the sharpest increase and which month saw the sharpest decrease of the unemployment rate in 2021?

4. The following table provides monthly price chain index numbers for February, March and April, as well as the value of sales for February and April for two articles:

Article	Sales value		Price chain index		
	II	IV	II	III	IV
A	100	150	1.2	0.9	0.9
B	200	220	1.0	1.1	1.2

Calculate the aggregate index numbers (using the Lasperes, Paasche and Fisher formulas) for the prices and quantities, as well as an index number for the values to compare the sales in February and April. Interpret the results. What had a greater impact on the sales value between February and April: price or quantity changes? What was the impact of price changes on the aggregate sales value between January and February?