

# MME 2023

Mathematical Methods in Economics

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41st International Conference on Mathematical Methods  
in Economics

September 13<sup>th</sup> – 15<sup>th</sup>, 2023, Prague, Czech Republic

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Conference is held under auspices of

- [Prague University of Economics and Business](#)
- [Czech Society for Operations Research](#)
- [Slovak Society for Operations Research](#)
- [Czech Econometric Society](#)



# Programme

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1. Information for participants [here](#)
2. General schedule [here](#)

## Wednesday, September 13<sup>th</sup>, 2023:

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- 08:30 – 10:00 Registration of participants
- 10:00 – 12:00 Opening ceremony, plenary session (NB D)
- 12:00 – 13:00 Lunch
- 13:00 – 14:30 Parallel sessions A
- 14:30 – 15:00 Coffee break
- 15:00 – 16:30 Parallel sessions B
- 16:30 – 17:00 Coffee break
- 17:00 – 18:00 Meeting of the Czech Society for Operations Research (NB 473)
- 18:30 – 21:30 Welcome evening at Academic Club restaurant

## Thursday, September 14<sup>th</sup>, 2023:

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- 08:30 – 10:00 Parallel sessions C, including PhD students competition (and also registration of participants)
- 10:00 – 10:30 Coffee break
- 10:30 – 12:00 Parallel sessions D, including PhD students competition
- 12:00 – 13:00 Lunch
- 13:00 – 19:00 Conference trip / Social programme
- 20:00 – 23:00 Conference dinner at Červený Jelen restaurant, including the ceremony announcing the results of the PhD students competition

## Friday, September 15<sup>th</sup>, 2023:

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- 09:00 – 09:30 Morning coffee
- 09:30 – 11:00 Parallel sessions E
- 11:30 – 12:30 Lunch

# Schedule of plenary and parallel sessions

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All lectures take place in the **New Building (NB)** of the Prague University of Economics and Business.  
**Plenary session** is taking place in lecture room D (Posluchárna D) on the ground floor of the New Building.  
**Parallel sessions** are taking place on the 4th floor of the New Building.  
**Coffee breaks** will be served in meeting rooms NB468 on the 4th floor of the New Building.

## Wednesday, September 13, 2023 - Plenary session

10:00 - 12:00 NB D

Session: **Plenary session**

Chair: [Josef Jablonský](#)

Paper ID

Dimitris Despotis	Network data envelopment analysis: The prevalent methodological approaches and some recent developments	3
Miloš Kopa	Decision making in finance via stochastic dominance	116

## Wednesday, September 13, 2023 - Parallel sessions A

13:00 - 14:30 NB 469

Session: **Predictions**

Chair: **Jana Hančlová**

Paper ID

Mark Van Lokeren	General bounds for functionals of the lifetime, compatible with life tables	101
Petr Vejmelka	Clustering methods usable in loss reserving in non-life insurance and their comparison	71
Tereza Singerová and Lukáš Fryd	Nowcasting macroeconomic variables: Forecasting unemployment in the Czech Republic	61
Jakub Neugebauer	Parameter optimization of trend detection algorithm presented on selected stock prices	85

13:00 - 14:30 NB 470

Session: **Transportation problems 1**

Chair: **František Zapletal**

Paper ID

Jiří Homan, Ladislav Beránek and Radim Remes	A user recommendation system based on graph neural network and contextual behavior	73
Jaromír Zahrádka	The exact solution of vehicle routing problem by mixed integer linear programming in Matlab	7
Tatána Funioková, Petr Kozel and František Zapletal	Economic perspective of smart system for waste collection	97
Ľudmila Jánošíková and Peter Jankovič	Optimizing the fleet of transport ambulances	23
Jan Fábry and Ondřej Kopčan	Traffic flow control using Tecnomatix Plant Simulation	65

13:00 - 14:30 NB 471

Session: **Applications of econometric techniques**

Chair: **Michal Černý**

Paper ID

Veronika Mitkova and Sona Kralova	Income effects of a liberal migration policy	41
Petr Krautwurm and Michal Černý	Econometric aspects of elasticity of substitution	57
Petr Krautwurm and Michal Černý	Towards an alternative generalization of CES function	58
Michal Černý and Lucie Dvořáčková	Will this manuscript turn into an influential paper?	54

13:00 - 14:30 NB 472

Session: **Environment**

Chair: **David Bartl**

Paper ID

Raminta Vaitiekuniene and Kristina Sutiene	Does performance of the largest European corporates concur with green deal targets?	110
Petra Králová and Jana Krajčová	Analysis of the demand for local food in the Czech Republic applying the theory of planned behavior	105
Kristina Sutiene, Daniele Bielskyte, Lina Dagiliene and Raminta Vaitiekuniene	Relationship between ESG disclosure and financial ratios	109
Miroslava Jánošová	Using game theory to address climate change	64
Tuğçe Dabanli Kurt and Derya Eren Akyol	Sustainable partner selection and order allocation: An application in Turkish textile industry	52

## Wednesday, September 13, 2023 - Parallel sessions B

15:00 - 16:30 NB 469

Session: **Dynamic models**

Chair: **Miroslav Žižka**

Paper ID

Petra Tomanová and Marcial Lagos	Impact of political structural breaks on the volatility of Latin America exchange rates	93
Vladimír Holý	Introducing the gasmodel package for score-driven models	49
Zuzana Prášková	Testing structural breaks in large dynamic model	86
Diana Bílková	Three-parameter lognormal curves combined with the quantile method of parameter estimation as models of salary distribution	22
Eva Štichhauerová and Miroslav Žižka	Performance comparison of industry clusters: Canonical correlation analysis vs. data envelopment analysis	46

15:00 - 16:30 NB 470

Session: **Analytic hierarchy (network) process**

Chair: **Helena Brožová**

Paper ID

Josef Jablonský	Best-worse method: Comparison with traditional approaches	74
Matej Brnka, Jan Rydval and Petra Pavlíčková	ANP model for suggestions on whether to lead a project agile or waterfall	17
Petra Bláhová, Jan Rydval and Helena Brožová	Strategic management DSS preferences evaluation method using ANP – application of behavioral economics	62
David Bartl and Jaroslav Ramík	A consensual coherent priority vector of pairwise comparison matrices in group decision-making	39
Jaroslav Ramík	Calculating desirable properties in MCDM	9

15:00 - 16:30 NB 471

Session: **Numeric methods and max-min algebra**

Chair: **Miloš Kopa**

Paper ID

Ján Plavka	Strong generalized eigenvector of fuzzy EA-interval matrices	15
Monika Molnárová	Strong robustness of convex and concave Monge matrices in max-min algebra	31
Helena Myšková	On the von Neumann regularity of max-min matrices	36
Dana Čemá	Wavelet method for valuation of options on investment project expansion	21
Emília Draženská	The crossing numbers of Cartesian product of paths and cycles with several 8-vertex graphs	114

15:00 - 16:30 NB 472

Session: **Game theory**

Chair: **Jana Klicnarová**

Paper ID

Petr Fiala	Model of network interconnections	53
Marek Kvet and Jaroslav Janáček	Self-learning metaheuristics for Pareto front approximation	27
Jana Klicnarová and Kateřina Walterová	Sportka - "Better" strategies based on analyses of specific combinations of numbers?	51
Jiří Hozman and Tomáš Tichý	Numerical valuation of investment opportunities under two-factor uncertainty	16

## Thursday, September 14, 2023 - Parallel sessions C

8:30 - 10:00 NB 469

Session: **Economic dependency**

Chair: Jiří Neubauer

Paper ID

Jakub Odehnal, Lenka Brizgalová, Jiří Neubauer and Lucie Svobodová	Models of military expenditure	50
Alžběta Heroschová, Marek Sedláček, Kamila Hasilová and Jakub Odehnal	Statistical analysis of determinants of military recruitment	76
Tomas Domonkos and Stefan Domonkos	Economic dependency in Slovakia	112
Andrea Čížků	Statistical analysis of brand marketing	37

8:30 - 10:00 NB 470

Session: **Data envelopment analysis 1**

Chair: Lucie Chytilová

Paper ID

Petra Zýkova and Diddl Zýka	Two-stage or one-stage DEA model?	89
Lucie Chytilová and Hana Štverková	Application of the two-stage DEA model in SMEs bussiness	95
Ondřej Sokol and Lukáš Frýd	Two-stage efficiency analysis pitfalls	59
Petra Tisová and Martin Flégl	Underwriting and investment efficiency in the Czech life insurance sector: A two-stage DEA window analysis approach	28
Lucie Chytilová and Jana Hančlová	Measuring and analyzing the technical efficiency of hockey players	91

8:30 - 10:00 NB 471

Session: **Portfolio selection**

Chair: Marian Reiff

Paper ID

Adam Borovička	Portfolio selection under unstable dynamics using the fuzzy concept operating with a triplet of moving characteristics	8
Petra Vašaničová and Marta Miškuřová	Portfolio cash flow on P2P lending platform: The quantile regression approach	55
David Neděla	Effect of factor numbers in the approximation of returns on portfolio performance	4
Juraj Pekár, Ivan Brezina and Marian Reiff	Investment portfolio selection from shares of environmental companies	40

8:30 - 10:00 NB 472

Session: **PhD students competition**

Chair: Martin Dlouhý

Paper ID

Jana Junová	Estimation of the general measure of stochastic non-dominance	35
Monika Kařatová	Bilevel models in portfolio selection problems	43
Martin Konopásek	Estimation procedure for complex model with spatial and temporal features	100
Monika Matoušková	Distributionally robust fixed interval scheduling with heterogeneous machines under uncertain finishing times	70
Jan Rejthar	Unveiling the myth: Investigating the existence of hot hands in gaming	11

## Thursday, September 14, 2023 - Parallel sessions D

10:30 - 12:00 NB 469

Session: **Location and scheduling**

Chair: **František Koblasa**

Paper ID

Dušan Hrabec, Karel Šohaj, Vlastimír Nevrlý and Kateřina Vichová	Optimal location for bike-sharing stations	117
Josef Košťálek and Pavla Koťátková Stránská	Determining the optimal location of the logistics center in the presence of limiting conditions	99
Martin Branda	Maintenance scheduling for production units with machine failures	77
Majid Yazdani	Optimizing time/cost trade-off problem with net present value maximization: The exact solution procedures	113
František Koblasa and Miroslav Vavroušek	Facility layout problem with heterogeneous material handling system constraints	47

10:30 - 12:00 NB 470

Session: **Data envelopment analysis 2**

Chair: **Martina Kuncová**

Paper ID

Natalie Pelloneová and Vladimíra Hovorková Valentová	Application of CCR and SBM models in measuring the efficiency of IT clusters in the Czech Republic and Slovakia	66
Martina Kuncová, Simona Činčalová and Petr Musil	Efficiency analysis of building material producers in the Czech Republic	104
Nino Gochitidze	DEA methodology as a tool for determining the efficiency of public transport in South Moravian Region	24
Jakub Hanousek	Testing the stability of the result of composite indicator obtained by the model benefit of the doubt	92
Jana Sekničková and Martina Kuncová	The impact of the COVID-19 pandemic in the brewing industry with regard to profitability and production efficiency	82

10:30 - 12:00 NB 471

Session: **Transportation problems 2**

Chair: **Dušan Teichmann**

Paper ID

Martin Jašek and Ivana Olivková	Queueing model for reducing of waiting time at airports	115
Jakub Čileček, Dušan Teichmann, Polina Yuryevna Koriukina and Cong Thanh Luu	Mathematical modeling of ground handling process for cargo aircraft	120
Andrea Hrnčíková, Karel Ječmen, Dušan Teichmann and Denisa Mocková	Cost optimization model for synchronous storage and dispatch in production warehouse	102
Karel Ječmen, Daniel Pilát, Dušan Teichmann, Denisa Mocková and Olga Mertlová	Optimizing the selection of a portfolio of transport infrastructure investment projects including elements of uncertainty modeled using fuzzy logic	79
Rostislav Stryk, Abate Getaw Sewagegn, Petr Jalůvka and Michal Dorda	Priority single-server queueing system with optional second server activated upon request – simulation study	30

10:30 - 12:00 NB 472

Session: **PhD students competition**

Chair: **Petr Fiala**

Paper ID

Dominik Kavřík	Filtering methods for output gap estimation and the empirical Taylor curve: A comparative study	44
Jindřich Lacko	Socioeconomic determinants of electric vehicle adoption in Czechia	72
Michaela Matoušková	Analysis of commercial property prices on the Czech market	90
Mira Mauleshova	System dynamics modelling scenarios for economic-ecological system of the Aral Sea	12
Lukáš Veverka	The influence of influencers: Assessing the impact of influencer marketing on brand awareness	25
Patrik Šváb	Czech Republic in the Euro area: A two-country DSGE model	6

## Friday, September 15, 2023 - Parallel sessions E

9:30 - 11:00 NB 471

Session: **Stochastic optimization**

Chair: Jiří Witzany

Paper ID

Miroslav Rada	Computational experiments with a special case of quadratic maximization over an interval box	119
Karel Sladký	Average reward optimality in Semi-Markov decision processes with interventions	33
Vlasta Kaňková	Ambiguity in stochastic optimization problems with nonlinear dependence on a probability measure via Wasserstein metric	34
Jiří Witzany and Milan Fičura	Estimating stochastic volatility models - a comparison of Bayesian MCMC and machine learning approaches	103
Milan Fičura and Jiří Witzany	Historical calibration of SVJD models with deep learning	107

9:30 - 11:00 NB 472

Session: **Uncertainty**

Chair: Robert Hlavatý

Paper ID

Martin Dlouhý	Computational aspects of data envelopment analysis	32
Sandra González-Gallardo, Maria Isabel Sánchez-Rodríguez, Ana B. Ruiz and Mariano Luque	Assessing the scientific perception of several professions through quantitative methods	69
Roman Horváth and Svatopluk Kapouněk	Heterogeneous effects of financial uncertainty: Evidence from global financial crisis	108
Robert Hlavatý and Helena Brožová	Designing an efficient transportation system under a constrained budget and cost uncertainty	20
Milan Hladík	A generalized approach to measure sensitivity in linear programming	38



# Organizational guidelines

The conference MME 2023 will take place at the **Prague University of Economics and Business**, Winston Churchill Square 1938/4, Prague 3 – Žižkov, Czech Republic.



The university is close to **Hlavní nádraží metro station** (metro line C; 7 minutes by walk) and **Viktoria Žižkov tram stop** (tram lines 5, 9, 15 and 26; 5 minutes by walk).

## Registration

Registration takes place in the New Building (NB, Nová budova) of the Prague University of Economics and Business – entrance from W. Churchill Square on the left side of the building (between the gatehouse and the barrier). Directions are also marked with arrows with the conference logo.



When you enter the building, there are cloakrooms to the left where the registration desk will be located.

You can register here on **Wednesday, September 13 from 8:30 to 13:00**. Additional registrations are available in the same building on the 4th floor in room NB 473 on

- Wednesday, September 13, 13:00 - 17:00,
- Thursday, September 14, 8:30 - 12:00, and
- Friday, September 15, 8:30 - 11:00.



## Opening ceremony, plenary session

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The opening ceremony and plenary session will take place on Wednesday, September 13 at 10:00 in the lecture room NB D (Posluchárna D), which is immediately next to the registration desk on the ground floor of the New Building (NB, Nová budova).



## Parallel sessions

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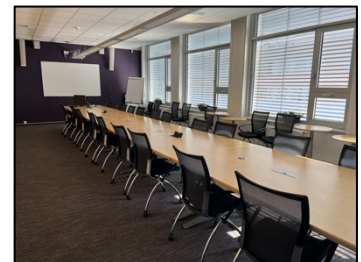
All parallel sessions will take place on the 4<sup>th</sup> floor of the New Building. It is expected that every paper included in the program will be presented. A computer with standard software and a data projector are available. Presentations should take 10-12 minutes, followed by space for 3-5 minutes of discussion. The same conditions will apply for the PhD students competition. The committee for this competition is composed of the selected members of the Czech Society for Operations Research.



## Meeting of the Czech Society for Operations Research

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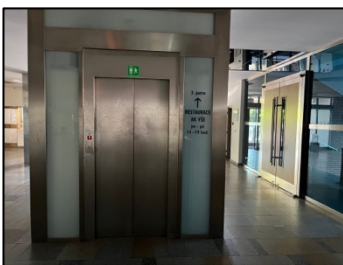
The meeting of the Czech Society for Operations Research is a closed meeting open only to members of the Society and invited guests. The meeting is chaired by Miloš Kopa and takes place from 17:00 in room NB 473 on the 4<sup>th</sup> floor of the New Building.



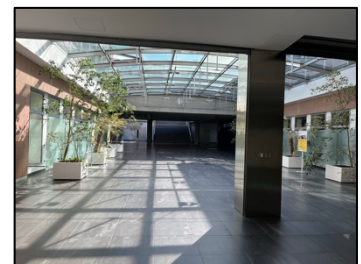
## Lunch

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Lunches are served in the Academic Club Restaurant (AK, Akademický klub) in the Paradise Building (Rajská budova) of the Prague University of Economics and Business. The entrance to the building is on the ground floor and is marked with signs with arrows and the conference logo. The restaurant is on the 3<sup>rd</sup> floor – you can use the elevator (if in use) or the marked staircase. The toilets are next to the restaurant.



One serving of soup (outside the entrance), one dessert (on the serving table) and one drink (soft drink or small beer, at the bar) is for everyone to take. The main dish is exchanged for a lunch-ticket and served by the restaurant staff. Participants form one queue (FIFO check-in).



### Wednesday menu:

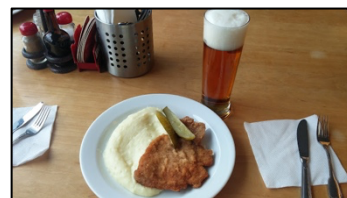
<b>Soup:</b>	Potato soup
<b>Main dish:</b>	Beef Stroganoff, Rice Baked Chicken Breast with Ham and Cheese, Mashed Potatoes Spinach Lasagna
<b>Drink:</b>	Spilled soft drink or small beer
<b>Dessert:</b>	Apple strudel
<b>Coffee:</b>	Coffee or tea

### Thursday menu:

<b>Soup:</b>	Minestrone soup
<b>Main dish:</b>	Beef Goulash, Bread Dumplings Chicken Thigh with Mushroom Sauce, Rice Vegetable Risotto with Cheese
<b>Drink:</b>	Spilled soft drink or small beer
<b>Dessert:</b>	Apricot pie
<b>Coffee:</b>	Coffee or tea

### Friday menu:

<b>Soup:</b>	Broccoli cream
<b>Main dish:</b>	Chicken Wok, Rice Fried Pork Schnitzel, Mashed Potatoes Black Beluga Lentil Curry, Rice
<b>Drink:</b>	Spilled soft drink or small beer
<b>Dessert:</b>	Cottage cheese strudel
<b>Coffee:</b>	Coffee or tea



## Coffee breaks

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Coffee breaks are served in the room NB 468. This is also where containers or bags for sorted waste and mixed waste are located. Cups and other dishes are recyclable. Please dispose of them in the appropriate bags. Also, please be careful not to soil the carpet with food and drink.

## Welcome evening

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The Welcome evening will be held at 18:30 at the Academic Club Restaurant (AK, Akademický klub) in the Paradise Building (Rajská budova) of the Prague University of Economics and Business (the same place where lunches are served). The entrance to the building is on the ground floor and is marked with signs with arrows and the conference logo. The restaurant is on the 3<sup>rd</sup> floor – you can use the elevator (if in use) or the marked staircase. The toilets are next to the restaurant.



All food served and drinks served are free, including wine and beer. Other drinks can be purchased at the bar.





You must leave the restaurant no later than 21:30 and leave the university. At 22:00, the school's security alarm will be activated and neither conference participants nor restaurant staff may be in the building at that time.

## Conference trip / Social programme

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### Trip to Konopiště castle

Meeting point: at 13:00 on W. Churchill Square, in front of the entrance to the university building.

Departure: **by a larger bus at 13:10** (the bus cannot wait, it blocks the route of the public transport bus).

We will drive approximately one hour to the parking area at Konopiště. It takes approximately 30 minutes to walk to the castle. We recommend suitable footwear or hiking poles. From 15:00 and 15:15 a tour is booked. The rooms in the southern wing of the castle were furnished in a Baroque style; this route includes the hunting corridor, beautiful chambers and a historical bathroom. Due to the large number of participants, we will divide into two groups.

After the tour, there will be free time – time to walk around the gardens or enjoy a coffee or beer. Those interested can pay for another tour. Depending on your walking speed, we will walk back to the car parking area.

Departure: at 17:00 from the car parking.

Return: around 18:00 in front of the university building.



### Hiking excursion to Tetín

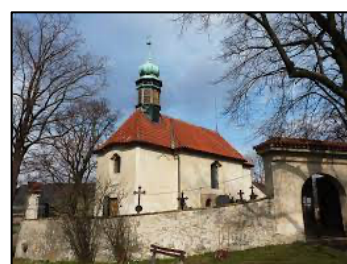
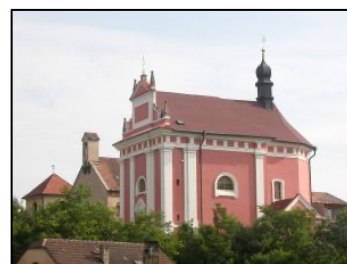
Meeting point: at 13:00 on W. Churchill Square, in front of the entrance to the university building.

Departure: **by a smaller bus at 13:15** (the bus cannot wait, it blocks the route of the public transport bus).

We will drive approximately one hour directly to Tetín. Here a visit to all three churches (which are not normally open to the public) is arranged with approximately one hour of commentary.

We will see:

- The Church of St. Ludmila
- The Church of St. Catherine
- The Church of St. John of Nepomuk.



In the case of nice weather, a walk to the viewpoint and a visit to the rest of the Slavic fortress will follow. If you wish, you can then visit the Jewish district.

Depending on speed and interest, those interested can take the approximately 5 km walk along the Berounka River to Srbsko, where the bus will leave at 17:00. Participants who don't feel like walking or don't want to go can take the bus to Srbsko.



Departure: at 17:00 from Tetín or from Srbsko (depending on agreement and weather).

Return: around 18:00 in front of the school building.

## Puzzle hunt in Prague

Meeting point: at 13:30 at the statue of W. Churchill, in front of the university building.

The puzzle hunt will take the form of a relatively easy walk in the broader center of Prague. Participants will be divided into groups that will move independently along the route. Groups can be formed anytime in advance, at the welcome party, or at the start of the game itself. The ideal group size is 3 or 4 members, although differently sized groups are also possible. Once you form a group, please email us about it to know how many groups are formed.

There will be an unspecified number of stations along the route. At each station, the team will receive an encrypted message, and upon deciphering it, they will learn the location of the next station. Clues will be provided for solving the ciphers, so teams won't get stuck during the game.

The expected length of the main route is 7 km. Public transportation will be used once during the game (we recommend a public transport ticket for 30 minutes, price 30 CZK).

Main route destination is somewhere in Letenské sady. The team should complete the main route by 18:30. Additional content for solving puzzles will be available at the finish line for early arrivals and other interested participants.



Required or recommended equipment are writing materials (colored and/or erasable pens are very desirable), a ruler, a writing pad and mobile device with internet connection (one per group). Preinstalled app "mapy.cz" is recommended. Comfortable clothing is advantageous.

## Conference dinner

The conference dinner will take place at 20:00 in the restaurant Červený Jelen, Hybernská 1034/5, Prague 1.

There are two parallel events in the restaurant in a separate area, so you need to enter through the reserved entrance to the ŠPORK trezor (next to the main entrance, see photo). The entrance will be marked with the logo of the MME 2023 conference. Follow the signs and walk past the reception to the first floor, which is entirely reserved for our event. There are also toilets.

The event will end at 23:00, and participants must leave the restaurant after that as it will be closing.

All food served and drinks served are free, including wine, beer, homemade lemonades, coffee and tea. Other drinks can be purchased at the bar.



## Wifi connection

Two networks can be used for wireless internet access in the university buildings during the MME 2023 conference.

If you know your Eduroam login and password, you can use this network as standard.

The second option is to connect to the secure network guest.vse.cz. For this you need a login and password, which you will receive during registration with your name badge. If not, you can contact the organizers (students with green badges) at any time during the conference.

Instructions:

- Connect to guest.vse.cz network.
- Open a web browser and enter any existing page, e.g. mme2023.vse.cz.
- You will be automatically redirected to the page with your login details.
- Enter the required login and password (you receive it together with your name badge).

If you have any troubles with the connection, please contact the organizers.

