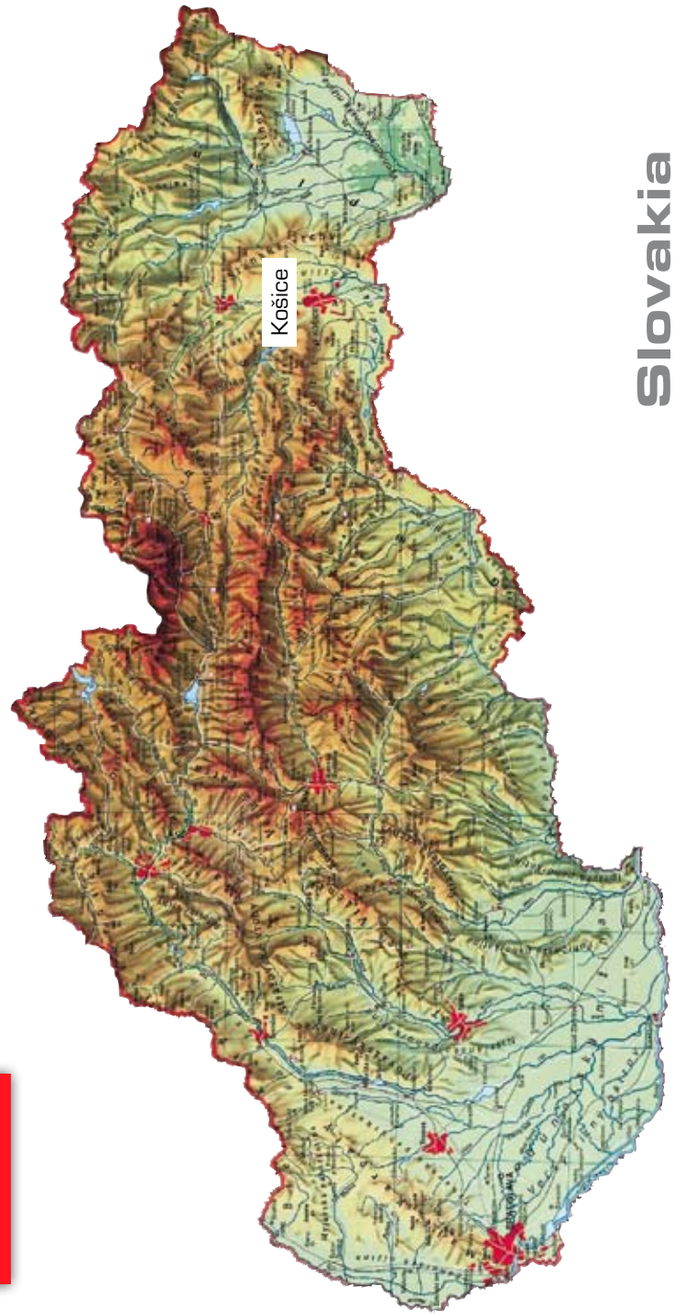
Ministry of Education of the Slovak Republic
P.J. Šafárik University in Košice, Faculty of Science
Comenius University in Bratislava, Faculty of Mathematics, Physics and Informatics, Slovak Society for Computer Science

Central European Olympiad in Informatics

July 12th – 19th 2010, Košice, Slovakia

http://ceoi2010.ics.upjs.sk



17th Central European Olympiad in Informatics

July 12th – July 19th, 2010, Košice, Slovakia

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Contents

Bibiána Obrimčáková

The State Secretary
Ministry of Education of the Slovak Republic

Vážené dámy, vážení páni,
milí žiaci, vzácni hostia,

dovoľte mi touto cestou Vás pri príležitosti konania Medzinárodnej stredoeurópskej olympiády v informatike v mene Ministerstva školstva SR, ako aj v mene mojom, srdečne privítať a pozdraviť. Osobitne by som rada privítala na našom malebnom Slovensku zahraničných hostí. Verím, že sa im u nás bude páčiť a zavítajú k nám aj v čase mimo pracovných alebo školských povinností.

Informatika hýbe svetom, dnes už ovplyvňuje takmer všetky súčasti života moderného človeka. Za posledné roky je pre naše školstvo charakteristická práve jeho silná informatizácia. Preto som rada, že máme tú česť byť organizátormi tak významnej a aktuálnej medzinárodnej súťaže, akou táto olympiáda je. Predmetové olympiády sú integrálnou súčasťou výchovno–vzdelávacieho procesu na našich základných a stredných školách. Mnohí žiaci, ktorí sa zapojili do týchto olympiád, sa neskôr v reálnom živote stali významnými vedcami a odborníkmi vo svojom odbore aj na medzinárodnom poli. Ich úspechy sú aj odrazom kvality a nastavenia školského systému na Slovensku. Nebolo by ich možné však dosiahnuť bez toho, ak by za týmito úspechmi mladých ľudí nestáli obetaví učitelia, pedagógovia, ale aj rodičia, ktorí dokázali rozpoznať zárodky talentu a podporovať ich v rozvoji. Za to im patrí moja úprimná vďaka a uznanie.

Medzinárodné predmetové olympiády sú súťaže, na ktorých sa stretávajú žiaci z rôznych krajín a merajú si svoje znalosti a zručnosti v rôznych disciplínach. Tu si môžu otestovať svoje vedomosti a zručnosti v predmete, o ktorý majú vyhranený záujem, porovnať si svoje schopnosti s najlepšími kolegami zo zahraničia a získať tak nové skúsenosti a poznatky vo svojom odbore.

Záverom by som rada poďakovala organizačnému výboru a všetkým zainteresovaným za vzornú prípravu organizácie súťaže.

Vám, mladí priatelia,
želám nielen v samotnej súťaži, ale aj vo vašom ďalšom živote ešte veľa radosti z dosiahnutých úspechov.

Ladies and gentlemen,
dear students,
esteemed guests,

may I, on behalf of the Ministry of Education, as well as on my behalf, warmly welcome and greet you on the occasion of the International Central-European Olympiad in Information Science. In particular, I would like to welcome our international visitors to our beautiful Slovakia. I hope you will like your trip to this country and visit us again at the time off work or school obligations.

Information science moves the world, today it affects almost all parts of the life of modern man. In recent years, our system of education is indeed characterized by its strong computerization. I am therefore delighted that we have the honour of being the organizers of this important and topical international competition like this Olympiad is. Subject Olympiads are an integral part of the educational process for our primary and secondary schools. Many students who participated in these Olympiads, become important scientists and experts in their field in the international arena later in real life. Their success also reflects the quality and setting of the school system in Slovakia. However, these successes of young people could not be achieved without the backing by self-sacrificing teachers, educators and parents who were able to recognize the seeds of talent and encourage them in their development. They deserve my sincere thanks and appreciation for all that.
International Subject Olympiads are competitions in which students from different countries meet and compare their knowledge and skills in various disciplines. Here they may test their knowledge and skills in the subject, in which they display a strong interest, compare their skills with their best colleagues abroad and gain in this way new experiences and knowledge in their respective fields.

Finally, I would like to thank the Organising Committee and all the stakeholders for perfect preparation of the organization of this competition.

Dear young friends,
May you experience much joy from the achievements not only in this competition, but also in your future life.

Pavol Sovák

Dean of Faculty of Science
Pavol Jozef Šafárik University in Košice

Dear participants of CEOI 2010,

it is my pleasure and privilege to welcome you at our University, at Faculty of Science . We will make every effort to make your stay pleasant and to ensure good conditions for both competition and leisure.

Let me very briefly introduce our Faculty. It belongs to the oldest institutions providing higher education in the natural science, mathematics and informatics in Slovakia. It was founded in 1963 and since that time it has educated more than 5 thousand graduates of both, single (scientific) and joint (teacher training) degree programme studied in all branches (Biology, Chemistry, Geography Ecology, Informatics, Mathematics and Physics). As a respected research institution Faulty offers not only Bachelor and Master study but also PhD study in sixteen accredited fields of science for graduates from all aver the world. The education is provided by experienced teachers who carry out research and closely co-operate with Slovak and foreign universities. The research shows multidisciplinary character and due to this it covers a wide range of topics from molecular biology up to computer and material sciences. Our research in Informatics was oriented on fuzzy technique, neural networks, logical programming and preparation of web-university.

Dear young friends,

We consider CEOI as a one of the most important events organized in this academic year at our University. I am very happy that so many countries are participating. I am sure that it will be great opportunity for all of you to compare your skills in the international frame and to discuss about current topics in Computer Science. Competitions like this will prepare you to be successful on the international job market.

I would like to express my thanks to organizers for preparing both, scientific and interesting social programme which will help you to recognize our beautiful city and country.

Please, let me wish you once more success and pleasant stay in Košice.

Branislav Rovan

President of Slovak Society for Computer Science

Informatics – The Landscape

It is a rare and pleasant occasion to address on behalf of the Slovak Society for Computer Science a group of young people whose perception of the notion of informatics exceeds the common misconception. Much too often the ability to use some word-processing software, to send e-mails and to browse the web makes people believe they are informatics experts. You can appreciate the complexity of problems and the difficulty of finding efficient algorithms. All of you have proved to belong to the top few within your countries. Still, I hope, you do realize you have a long way to go to really understand informatics and to become true experts.

Informatics is most frequently defined to be the science about storing, organizing, manipulating and communicating information. What are the main ingredients of the information processing task?

First, one has to "create" information. This involves representing, encoding, ..., real world objects into some machine readable form, into a form that can be stored and manipulated in a computer. The importance of this step is not always appreciated. And it can make a difference. A frequent example cited is the representation of natural numbers. We could choose roman numerals or the decimal notation. It is clear which choice will let us multiply numbers easier.

Second, find efficient ways to manipulate information. This involves design of algorithms, data structures, ..., but also ways to present (visualize) information.

Third, make sure that what was done is what was intended to be done. One has to specify what a (software) system should do and prove it does, best in conjunction with the second step. Many formal and semiformal specification languages were designed and associated logics and proof systems studied.

Fourth, one has to really make it work. This means implementation and involves many of the engineering aspects of computer science. It involves writing up programs (transferring the above obtained design into machine executable code) and of course it needs hardware, machinery that executes programs.

Most of you have some understanding of efficiency in information processing. To fully understand the challenges in this an the other three areas you will of course need further study at the university. Rest assured there are enough hard problems to be solved to keep you busy for the rest of your life. And this is still not the whole story. One can clearly see shifting of the focus in informatics. In the early years it was the dominance of hardware and IBM was the IT company of the world. We are passing through the period of software dominance with Microsoft dominating the markets. We are clearly moving to a period where information is becoming dominant and you can witness growing importance of "information providers" like Google. Informatics is not well prepared for this period. The classical notion of information introduced by Shannon does not capture all aspects of information that are becoming relevant. Measuring the amount of information was useful when efficient transmission and storage of information was the main concern. Redefining the notion of information to capture its usefulness, relevance, security aspects, etc. is the new challenge for informatics. Let me express my hope that talented young people like you will help in advancing the understanding of information and information processing.

PROGRAMME

Monday, July 12

Time	Contestants	Leaders
-	**Arrival of Delegations**	
19:00	**Dinner** (pub „U pažravca“)	
20:00	**Free Time**	**Jury Meeting** (hotel Akadémia)

Tuesday, July 13

Time	Contestants	Leaders
08:00	**Breakfast** (hotel Akadémia)	
09:30	**Opening Ceremony** (UPJŠ, Moyzesova 11, lecture room M5) Scientific Lecture (prof. V. Geffert: Multiway in-place merging)	
11:30	**Practice Session** (Faculty of Science, Jesenná 5)	
13:30	**Lunch** (Faculty of Science, Jesenná 5)	
15:00	**Sightseeing** (Scientific Library, Hlavná 10)	
19:00	**Dinner** (pub „U pažravca“)	
20:00	**Free Time**	**Jury Meeting** (Faculty of Science)

Wednesday, July 14

Time	Contestants	Leaders
07:15 - 07:45	**Breakfast**	-
08:00 - 08:30	-	**Breakfast**
08:30 - 10:30	**1st Competition**	**Questions**
10:30 - 13:30	**1st Competition**	**Free Time**
13:30	**Lunch** (Faculty of Science)	
14.30	**Results of Evaluation** (Faculty of Science)	
15:00 - 18:00	**Free Time** (Gym, Medická 5)	
18:30	**Free Time**	**Jury Meeting** (Faculty of Science)
19:00	**Dinner** (pub „U pažravca“)	
20:30	**Bowling - Spot** (Čermeľská cesta 1)	

Thursday, July 15

Time	Contestants	Leaders
07:30	**Breakfast** (hotel Akadémia)	
08:30	**Trip to High Tatras:** A choice: Štrbské and Popradské pleso (pleso = a glacier lake) B choice: Téry Chalet	
19:00	**Dinner** (pub „U pažravca“)	
20:00	**Free Time**	**Jury Meeting** (Faculty of Science)

Friday, July 16

Time	Contestants	Leaders
07:15 - 07:45	**Breakfast**	-
08:00 - 08:30	-	**Breakfast**
08:30 - 10:30	**2nd Competition**	**Questions**
10:30 - 13:30	**2nd Competition**	**Free Time**
13:30	**Lunch** (Faculty of Science)	
14.30	**Results of Evaluation** (Faculty of Science)	
15:30	Popular Lecture (prof. Ing. P. Sinčák: Humanoid robot Nao in CIT TU Košice)	
17:00 - 18:00	**Free Time** (Gym, Medická 5)	
18:00	**Free Time**	**Jury Meeting** (Faculty of Science)
19:00	**Dinner** (pub „U pažravca“)	
20:00	**Sport, Activities** Prepared by Guides	

Saturday, July 17

Time	Contestants	Leaders
07:30	**Breakfast** (hotel Akadémia)	
08:30	**Trip** to Krásna Hôrka Castle and Zádiel gorge (the buses in front of the Akademia)	
19:00	**Dinner** (pub „U pažravca“)	
20:00	**Sport, Activities** Prepared by Guides	**Jury and Organizing Committee Meeting**

Sunday, July 18

Time	Contestants	Leaders
08:00	**Breakfast** (hotel Akadémia)	
10:00 - 13:30	**Excursion**: Museum of Aviation in Košice	
13:30	**Lunch** (Student Dormitory, Medická 4)	
16:00	**Awarding and Closing Ceremony** (Historical hall, Šrobárova 2)	
18:00	**Dinner** (Tip Top Restaurant)	

Monday, July 19

Time	Contestants	Leaders
07:30	**Breakfast** (hotel Akadémia)	
-	**Departure of Delegations**	

TEAMS

BULGARIA	
Team Leader:	Emil Kelevedjiev
Deputy Leader:	Pavlin Peev
Contestants:	Anton Anastasov, Vladislav Haralampiev, Rumen Hristov, Mihail Kovachev

CROATIA	
Team Leader:	Ivo Šeparović
Deputy Leader:	Luka Kalinovčić
Contestants:	Stjepan Glavina, Ivan Katanić, Ivica Kičić, Adrian Satja Kurdija

CZECH REPUBLIC	
Team Leader:	Daniel Kráľ
Deputy Leader:	Pavel Töpfer
Contestants:	Lukáš Folwarczný, Filip Hlásek, Michal Mojzík, Štěpán Šimsa

GERMANY	
Team Leader:	Wolfgang Pohl
Contestants:	Simon Bürger, Patrick Klitzke, Aaron Montag, Klaas-Hendrik Poelstra

HUNGARY	
Team Leader:	Gyula Horváth
Deputy Leader:	László Zsakó
Contestants:	Patrik Adrián, Richárd Palincza, Zoltán Szenczi, Ágoston Weisz

POLAND	
Team Leader:	Jakub Radoszewski
Deputy Leader:	Tomasz Kulczyński
Contestants:	Igor Adamski, Adrian Jaskółka, Jan Milczek, Anna Piekarska

ROMANIA	
Team Leader:	Zoltan Szabo
Deputy Leader:	Andrei-Paul Puni
Contestants:	Vlad-Alexandru Gavrilă, Victor-Cristian Ionescu, Alexandru Tache, Bogdan-Cristian Tătăroiu

SLOVAKIA 1	
Team Leader:	Andrej Blaho
Contestants:	Matej Balog, Tomáš Belan, Ján Hozza, Filip Sládek

SLOVAKIA 2	
Team Leader:	Andrej Blaho
Contestants:	Michal Anderle, Martin Pitoňák, Ján Sebechlebský, Marek Špano

SWITZERLAND	
Team Leader:	Sandro Feuz
Deputy Leader:	Adrian Roos
Contestants:	Thomas Leu, Lazar Todorović, Josef Ziegler, Никола Ђокић

Dean's Office, Moyzesova 16, Košice

Scientific lectures

Multiway in-place merging presented by prof. Viliam Geffert

Prof. Geffert is one of the world-known scientist in the area of computational complexity and formal languages. His main areas of interest are: grammars and descriptional complexity of automata, sorting algorithms and sublogarithmic space.

We shall present an efficient algorithm for solving the following problem. Given an array A, containing k sorted subsequences A1,...,Ak of respective lengths n1,...,nk, where n1 +...+ nk = n, we need to rearrange the array A into a single sorted sequence.

As a typical example, the array A may contain sorted telephone directories of Berlin, Bratislava, Bucharest, Budapest, Košice, Prague, Sofia, Štrbské Pleso, Warsaw, Zagreb, and Zurich, which should be unified into a single sorted directory. Clearly, any sorting algorithm could solve this task. However, such algorithm does not utilize the fact that our array is composed of very few subsequences that are quite long, but all sorted. Thus, a general sorting algorithm would use an unnecessarily large number of comparisons. Moreover, we require the algorithm perform the task in-place, i.e., besides the space occupied by the array A, we have a very limited additional memory available, namely, only a constant number of variables for sorted elements or indexes, no recursion.

We shall present an algorithm solving this task in-place and in linear time, performing log k . n + o(n) element comparisons and 3 . n + o(n) element moves. Note that the number of moves is independent of k, the number of input sequences. (Here "o(n)" represents some small value, satisfying $\lim_{n\to\infty} o(n)/n = 0$.) It has also been shown that the above algorithm is almost optimal; no algorithm can solve this task using fewer than (log k) . n comparisons.

Humanoid robot Nao in CIT TU Košice presented by prof. Peter Sinčák

Prof. Peter Sinčák's main interests are various tools of Computational Intelligence. He is a head of Computational Intelligence Group (see http://neuron-ai.tuke.sk). Generally application domains of the group are: application in Environmental industry (Remote Sensing & Hydrology), Financial Cybernetics and Control Engineering. Prof. Sinčák is a member of European Neural Network Society and Slovak Neural Network Working Group.

Nao is definitely one of the coolest humanoids. Fully programmable, the 23-inch bot boasts 25 degrees of freedom, affording it an impressive range of motion. Check it out in Nao's new promo vid after the jump. Nao can grasp objects with its prehensile hands; process image and sound data; and navigate its environment using its sonars. Multimedia features include high-fi speakers, microphones, and CMOS digital cameras.

In the lecture, there will be presented Nao and the other technologies used in the artificial intelligence.

CEOI 2010 is organized

Under the auspices of Ministry of Education of the Slovak Republic

Organizers
Faculty of Science, P.J. Šafárik University in Košice, Slovakia
Slovak Society for Computer Science
Faculty of Mathematics, Physics and Informatics, Comenius University in Bratislava, Slovakia

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Zuzana Bedécsová (Poland)
Mária Dolinská (Bulgaria)
Ivana Ďurčová (Germany)
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FACULTY OF SCIENCE

The tradition of higher education in Košice begins with the foundation of Academia Cassoviensis by Bishop Benedict Kisdy as early as in 1657. A Golden Bull issued by the Holy Roman Emperor Leopold I has granted this university similar privileges to those enjoyed by universities in Vienna, Prague and other European cities. In various forms, first as a Royal Academy and later as a Law Academy, the university lasted until 1921.

The University in Košice in its modern form was established in 1959 as the second university in Slovakia. Its foundation was an important contribution to the development of educational and research activities in the second largest Slovak city. The University is named after an outstanding personality of Slovak history, Pavol Jozef Šafárik (1795 – 1861), who was a scientist, poet, linguist, ethnographer, archaeologist and educator. At the time of its foundation the University consisted of the Faculty of Medicine and the Faculty of Philosophy. Gradually, other faculties were created in Košice and nearby Prešov, namely the Faculty of Science (founded in 1963), the Faculty of Law, the Faculty of Education, the Greek-Catholic Theological Faculty and the Faculty of Orthodox Theology.

The Faculty of Science at Pavol Jozef Šafárik University in Košice was established as the second scientific centre in Slovakia and was brought into being in the year 1963. In the course of its existence, it has educated more than 5000 graduates of both single- and double-major study curricula in all branches of natural science, mathematics, and computer science.

At present, the Faculty provides education leading to the Bachelor and Master degrees – single- or double-major – in the following branches: Biology, Environmental Ecology, Geography, Physics, Chemistry, and Computer Science. This means that these are studied as single majors or as teacher training study in the combination of two of the above stated specializations. The Faculty employs the generally accepted three-level model of higher education (3, 5, and 9 years of study for successive degrees) and the credit system is also implemented, encompassing all specializations at the Faculty. Implementation of the ´European dimension´ into the university education started in the year 1999 within the framework of the TEMPUS PHARE programme and in the academic year 1999-2000, the first participants among students and teaching staff used the mobility within the framework of the SOCRATES/ERASMUS programme, which opens access to study at the universities in the European Union countries. At present, approximately 10 per cent of the students studying for their Master degree spend at least one semester of their studies at a university abroad. Significant attention is given to the third level of university studies – the PhD. degree.

In addition to the above, the Faculty represents an important research and scientific institution. Outcomes attained in all the natural scientific, mathematical, and information specializations, a large number of publications, international contacts, and co-operation in the field of internships, rank our Faculty in a prominent position among research and scientific institutions in Slovakia, in Europe, and world-wide.

(Source: http://www.science.upjs.sk/English/public_media/index.html)

FACULTY OF MATHEMATICS, PHYSICS AND INFORMATICS

Faculty of Mathematics, Physics and Informatics is a part of Comenius University, contributing to the University's mission by enhancing creative knowledge, education and research in mathematics, physics and informatics. It provides research in full range of the above mentioned disciplines. Unlike other research institutions, the Faculty independently decides on research goals and orientation of study programmes. It has attained and maintains its identity as a research and education facility of highest international standard.

Education provided by the Faculty is based on the latest knowledge in science and technology, including the results of its own research. Students are offered excellent conditions for study in wide spectrum of programmes. The graduates are well trained to represent not only high professional, but also personal and human qualities.

As a part of Comenius University, the Faculty guarantees freedom and democracy not only within the facility, but considers wide-spreading of these principles outside it as one of its primary objectives.

(Source: http://www.fmph.uniba.sk/)

SLOVAK SOCIETY FOR COMPUTER SCIENCE

The Slovak Society for Computer Science (SSCS) is a nongovernmental, unprofitable professional organization which is concerned with theoretic an applied computer science, software engineering, information engineering, computer science education and related fields. Its principal aim is to provide the conditions for the development of computer science and information technologies in Slovakia. The society was founded in 1993 after splitting of Czech-Slovak Society for Computer Science.

SSCS is a representative of the Slovak computer science community in international organizations such as IFIPS (International Federation of Information Processing Societies) and CEPIS (Council of European Professional Informatics Societies) and maintains contacts with similarly oriented foreign professional societies. It organizes courses, discussions, excursions, conferences, symposia and seminars. Its program includes providing expert opinions, publishing, editorial, and the other activities in the field of computer science. The Society submits its suggestions and proposals to state and public authorities and institutions.

A further aim of the SSCS is to facilitate the professional growth of young computer specialist; to that purpose it provides support for their participation in professional events through scholarships, grants, organization and support of various competitions and so on.

(Source: http://www.informatika.sk)

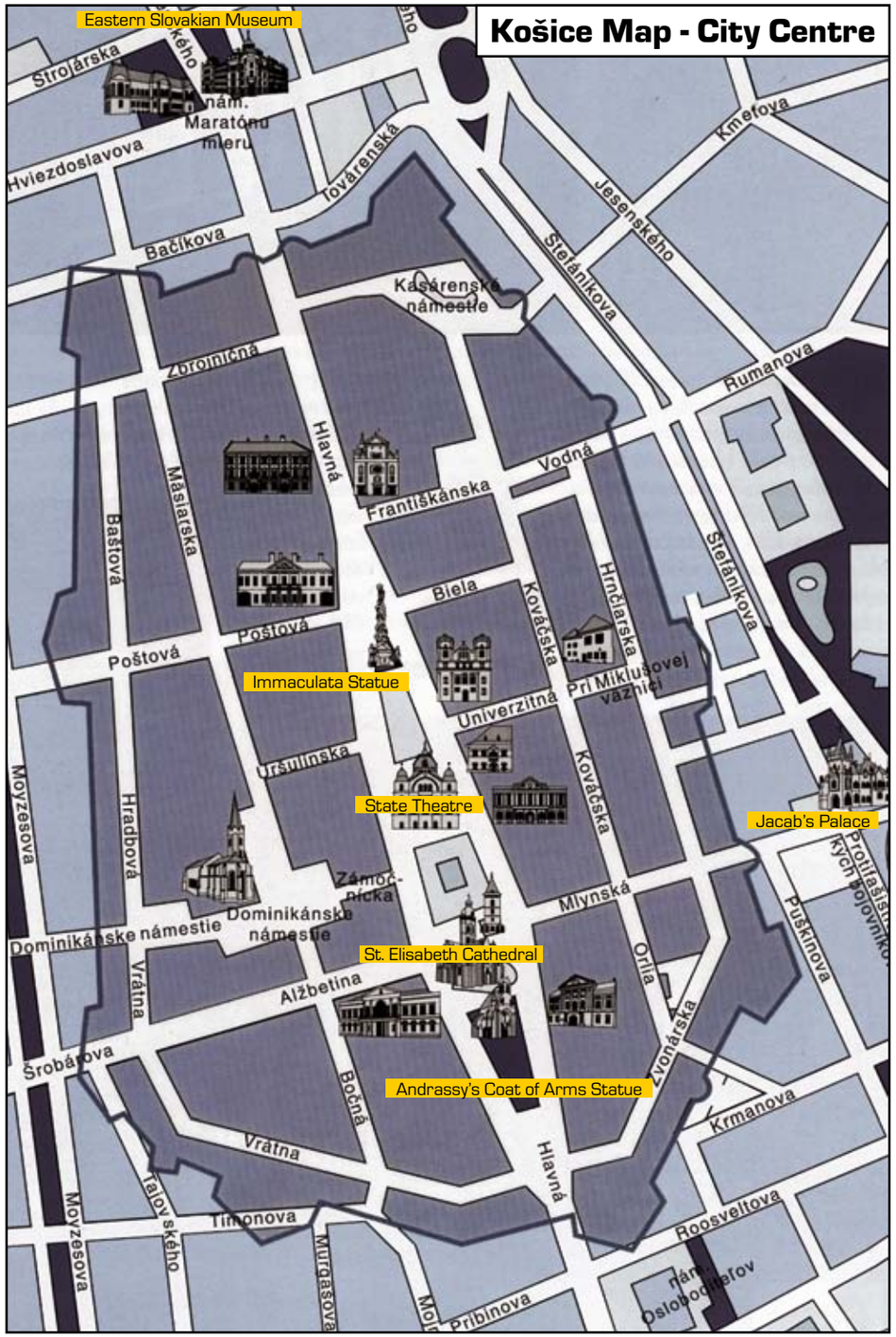
KOŠICE

Košice, with almost three hundred thousand inhabitants the second largest city in Slovakia, has been the natural metropolis of Eastern Slovakia ever since the time of its foundation. From what existed at the end of the 12th century in the form of a royal residence, following the influx of colonists from Lower Saxony during the second half of the 13th century, there grew a town in the true sense of the word, encircled with fortified walls. The mediaeval history of the city is closely tied up with the growth of trade and crafts. Košice was at the same time both a focal point for many crafts which became associated into dozens of guilds and a market centre bringing together surplus production from a wide surrounding area for subsequent trading in the Balkans and, more importantly, in Northern Europe around the area of Hanseatic towns. Košice remained an important name in long-distance trade throughout the whole of the 14th and 15th centuries. It was at this time that town gained the privileges of a free royal city, one of the largest and richest in the whole of Hungary. This was also period when the city´s most beautiful historic buildings were erected.

After this period of economic bloom and relative peace, in the 16th and 17th centuries Košice went through some more eventful times as the country came under constant threat of Turkish invasion, and was then rocked by series of social uprisings. As a result of these frequent wars, Košice was transformed into the strongest city fortress in Hungary and became the headquarters of the Captain-general. Despite all the clashing of weapons, it was at this time that the city became a seat of university and secondary schooling in connection with the re-Catholicization movement. Printing houses also started up operations here, and several new churches were built. The birth-pangs of the modern age gave way to peace and steady growth through the 18th and 19th centuries. New baroque architecture caught on, to be overtaken in turn by classicism and romanticism, and as the nobility took up residence in the city there was increasing patronization of the arts and the theatre and development of refined social life. By the end of the 19th century Košice had become one of the most significant industrial centres in Hungary. The city increased in beauty as well as in size, and took on the character of an ethnic melting-pot containing Germans, Hungarians, Slovaks and Jews, all with their various religions and cultures. Košice maintained its cultural and ethnic variety up until the middle of 20th century, despite the fact that from the end of 1918 it became part of the Czechoslovak republic. The German occupation of 1938-1945 ultimately brought with it renewed economic and demographic decline, and in particular the annihilation of the significant Jewish community in the city. At the end of Second World War, Košice became for a time the capital of the reconstituted Czechoslovakia.

World War II was the greatest disaster for European cities in this century. Košice was lucky during World War II. Except the bombing in 1941, the city was saved from air raids and destruction. However, the following years had not saved either the city or its historical core. Change of ownership, neglect of maintenance of the state owned residential and non-residential buildings had caused that the main part of the historical core was prepared for physical liquidation. However, there still remain many buildings from various periods of history which are worth seeing.

(Source: http://www.kosice-city.sk/uvod/auvod.htm)



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http://www.dpmk.sk/

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Important numbers

Hotel Akadémia..... 055 726 07 00
Chair of organizers 0915 333 324, 0944 564 947
Chair of Guides..... 0944 564 944

Important addresses

Address	GPS
Faculty of Science, UPJŠ, Jesenná 5, Košice (Competition, Lunches, Gym)	48.72879 N, 21.24819 E
Hotel Akadémia, Južná trieda 10, Košice (Accommodation, Breakfasts)	48.71219 N, 21.26153 E
Pub "U pažravca", Hotel Centrum, Južná trieda 2/A, Košice (Dinners)	48.71565 N, 21.26130 E
UPJŠ Main Rector Building, Šrobárova 2, Košice (Awarding ceremony)	48.71880 N, 21.25136 E
UPJŠ, Moyzesova 11, Košice (Opening ceremony)	48.72044 N, 21.25178 E

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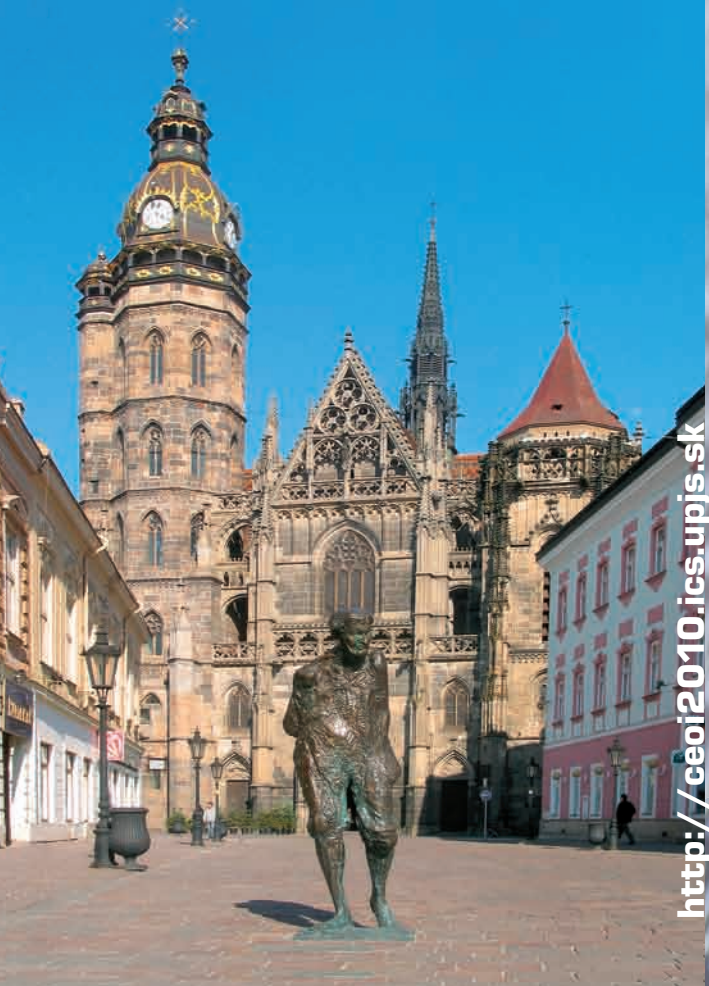

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