e-Puzzles

http://euganke.fri.uni-lj.si

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The Team

- Laboratory for cryptography and computer security: (we also study algebraic combinatorics, coding theory and statistical design) `http://lkrv.fri.uni-lj.si/`
- Lab (LKRV/FRI):
  - Peter Nose, Ph.D.
  - Janoš Vidali, Ph.D.
  - Aleksandra Franc, Ph.D.
  - Martin Vuk, Ph.D.
- CS and EE Students
  - Tilen Faganel
  - Jaka Hudoklin
  - Miha Pleško

Project e-Puzzles (1)

Financed from the (European Union) grant

Developement of e-service and mobile aplications
for public and private nonprofit Organizations 2012-13

Ministry of Education, Science and Sport, Republic of Slovenia
and the Institute for Mathematics, Physics and Mechanics.

REPUBLIKA SLOVENIJA
MINISTRSTVO ZA IZOBRAŽEVANJE, ZNANOST IN ŠPORT

Naložba v vašo prihodnost
OPERACIJO DELNO FINANCIRA EVROPSKA UNIJA
Evropski sklad za regionalni razvoj
Kohezijski sklad
Evropski socialni sklad

Project e-Puzzles (2)

The purpose of the application e-Puzzles is to transfer the natural science subjects from behind the desk, laden with piles of textbooks and notebooks, into everyday lives.

This way we provide people with cerebral entertainment anywhere and anytime.

Our application will provide an easier access to 40 years of carefully chosen problems (with numerous verified solutions) to a wide audience of youngsters and older fans of Math and CS.

Project e-Puzzles (3)

Math Puzzles can now be accessed on the internet, on tablets and cell phones.

- Android
- iOS,
- Blackberry
- Windows Phone

Sample Puzzles (1a)

Once upon a time there was a ranch in the middle of the desert where a rich sheikh lived. As he was getting older and weaker, he decided to talk to his two sons. He told them:

"My dear children,
I can tell, that I am loosing my power.
I will give my land to one of you,
the one that proves to be smarter.

Saddle your camels, ride to the nearest temple
and bring back an item that proves you were there.

"The one whose camel is the last to return
will become the new master."

"Go, my sons, may Allah guide you!"

The sons listened quietly and then took their leave.

Sample puzzles (1b)

Slowly they rode through the desert to the temple
and finally turned back, more slowly still.
Neither wanted to be the first to return,
but they could not survive much longer
in the hot and dry desert.

On the way back they encountered an old bedouin.
They told him about their problem and
the old man thought about it for a moment.
Then, he whispered something
and the sons jumped on the camels
roding home as fast as they could.

"And why did he say it
to both of them at once?"

Sample puzzles (1c)

Solution: The old bedouin has advised them to switch camels.

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Solution: The old bedouin has advised them to switch camels.

Indeed their father had said:

"... The one whose camel is the last to return will become the new master."

This caused the two sons
to ride back as fast as possible,
each on the others camel.

Sample puzzles (2a)

On the first day of school the teacher asked the students to write their names and birthdays on the blackboard. She was then called away to take an urgent phone call in the teachers' lounge.

As she returned, she noticed that two of the students shared a last name and a birth date.

She has also noticed that they looked exactly alike, so she said:

"You two must be twins!"

But the answer surprises her:

"No, we are sisters,
but we are not twins."

Sample puzzles (2b)

"How can this be (find a convincing explanation)?

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Solution: They were two of the triples.

The third one was ill and did not come to school that day.

Sample puzzles (3)

Do you know the story of the merchant
who was selling a duck egg and a half
for a dollar and a half,
and the people kept asking
how much for an egg.

Then one day a mischievous boy asked the merchant:

"If three and a half chickens lay
three and a half eggs in three and a half days,
how many eggs can we expect
from seven chickens in a week?"

Sample puzzles (3)

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"If three and a half chickens lay
three and a half eggs in three and a half days,
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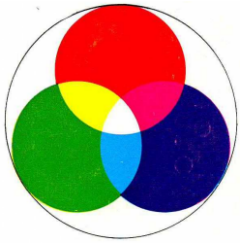
Solution: Fourteen.

Problem sets - Presek

These entertaining problems were (and still are) taken from the extensive treasure trove of the periodical Presek.



The user chooses his or her area of interest:

- geometry
- numbers
- combinatorics
- probability
- logic
- graph theory
- cryptography
- computer science
- physics
- ...

or a combination of those.

Problem sets - Beaver (Bober)

Computer science problems were obtained from the organizers of the international competition Beaver.

Groups of problems (73+73+60+30):

- Little beaver
  (grades 4 through 6 of primary school)
- Young beaver
  (grades 7 through 9)
- Beaver
  (grades 1 and 2 of secondary school)
- Old beaver (grades 3 and 4)

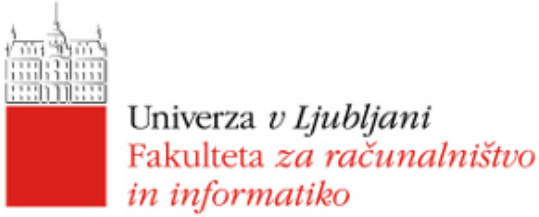
Problem sets - courses VIS/OVS

A collection of problems from the courses on

Introduction to Probability and Statistics (OVS)

and

Probability and Statistics (VIS).



- More than 450 problems from e-classroom (exported from Moodle).
- Pilot study on 200/300 students.

Problem sets

In the future we wish to collect new problems and run new pilot studies:

- new courses (cryptography, . . .),
- quizzes during the lecture,
- practice for contests (Kangaroo, Beaver, . . .),

- supplementary courses and student clubs (math, logic, . . .),
- learning through fun,
- prize draws.

Application - implementation

The application works on mobile operating systems and in web browsers (the website is coded in HTML5).

For app developement the mobile development framework Cordova (PhoneGap) was used.

(It allows users to create mobile applications for Android, iOS, Blackberry and Windows Phone ... based on HTML, CSS and Javascript.)

Application - server, database

The application is connected to the Apache server which containes a database of

- problems,
- solutions and
- links to corresponding articles.

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The information is stored in a PostgreSQL database.
A server application written in Pyramid
- Web Application Development Framework using Python and serves the data in JSON format.

Application - adding problems

Adding problems into the database is possible by using a special LaTeX and JSON template, or through a web form (in developement).

Each problem can be tagged with various tags such as

field

- maths,
- computer science,
- physics,
- astronomy,
- chemistry,
- . . . ,

subfield

- geometry,
- numbers,
- logic,
- recreational,
- geometry,
- game theory,
- probability,
- algebra,
- graph theory,
- combinatorics,
- inequalities,
- misc, . . . ,

authors, date, solutions, hints, etc.

Application - types of questions (1)

There are a lot of people on this planet.
How are they distributed throughout the continents?

1. Numerical answer

   There are [_____] people in the world.

2. Numerical answers (vector)

   In Asia there are [__]%, in Africa [__]% and in Europe [__]% of the total world population.

3. Short answer

   What is the internet country code for Slovenia? [_____]

Application - types of questions (2)

4. Matching

Match the names of the continents to the number of people living there.

Europe	1 billion
Asia	3 billion
Africa	1/2 billion

5. Multichoice

Which countries have a population greater than 1 billion?

[ ] Slovenia
[ ] China
[ ] Brazil
[ ] India

Application - JSON format


```
var exercise = {
  "title": "Number of people on Earth",
  "data": {
    "type": "text/html",
    "text": "There are a lot of people on this planet.
  "questions": [
    {"type": "numerical",
     "data": {
       "type": "text/html",
       "text": "There are"},
     "answer": [{
       "data": {
         "type": "integer", "text": 7000000000},
         "meta": {"precision": 1000000000},
         "label": "N = "
     }]
  ...
```

Application - LaTeXformat


```
\begin{problem}
  \begin{source} VIS \end{source}
  \begin{title} Throwing a die \end{title}
  \begin{autor} Peter Nose \end{autor}
  \begin{tags} mathematics, probability \end{tags}
  \begin{text}
    A fair die is cast once.
  \end{text}
  \begin{question}{numerical}
    What is the probability that the outcome is 3?
    \begin{hint} There are 6 possible outcomes.\end{hint}
    \begin{result}{0.01} 0.17 \end{result}
    \begin{answer}{}
      The probability that the outcome is 3 is 16.7%.
    \end{answer}
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Conclusion

- The kids will watch less television and will not be bored in the waiting rooms, on the bus, in the car... They will have to access entertaining challenges on their mobile devices.
- This will help improve their problem solving abilities and will lead to increased interest in the disciplines which are important for their future growth and developement.
- We will have introduced a new and contemporary way of offering existing works to a wider audience.
- For example, in Slovenia a lot of government money has been used to publish medicine handbooks which now lie unused in libraries far away from the ER waiting rooms even though the patients and their families would be happy to have them at hand during the long wait.

DEMO