

Beaver competition 2008 in Estonia

Report for the international Beaver community

May 6, 2009

1 General information

In Estonia, the Beaver competition was held in two rounds: the first and the second round. In both rounds, the competition was held on 3 levels: Benjamins (up to grade 8), Juniors (grades 9 and 10), and Seniors (grades 11 and 12). Examination in all three levels consisted of 15 questions.

The first round was held from the 10th to the 14th of November 2008. The examination system was provided by Miksike LearningFolders <http://www.miksike.ee>. The system of online tests developed by Miksike is a web-based environment with accounts for teachers and their students. Every student had to have a supervising teacher who opened the questions for the student to answer in 45 minutes.

The second round was held in 15th of February 2009 in Tartu. Participation in the second round was by invitation only; approx. 1.5% of the students participating in the first round were invited to the second round.

The questions for both rounds were selected mainly from those that had been created in Beaver international workshops 2006–2008. The distribution of the topics was carefully followed: every level had

- 1 question on computer history,
- 1 or 2 questions concerning computer ethics,
- 3 questions concerning computer software,
- 1 question on computer hardware,
- 1 computer-related problem on geometry,
- 1 or 2 questions on algorithms,

- 2 questions concerning information comprehension,
- 1 question concerning logics,
- 3 questions on other fields of discrete mathematics (combinatorics, graphs, binary system, etc.).

The tests in Estonian as well as the results are available in
<http://www.math.olympiaadid.ut.ee/kobras/>.

The publicity made for the competition consisted of a short note in the all-Estonian teachers' newspaper, e-mails to relevant mailing-lists, direct e-mails to high schools and a note in the Miksike environment (seen by every visitor of the environment).

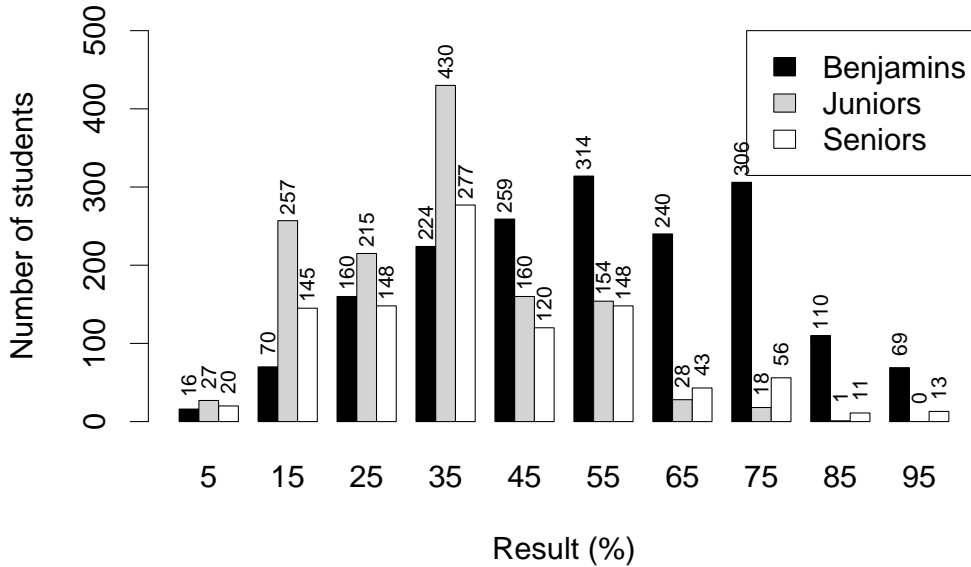
2 Competitors and results

2.1 First round

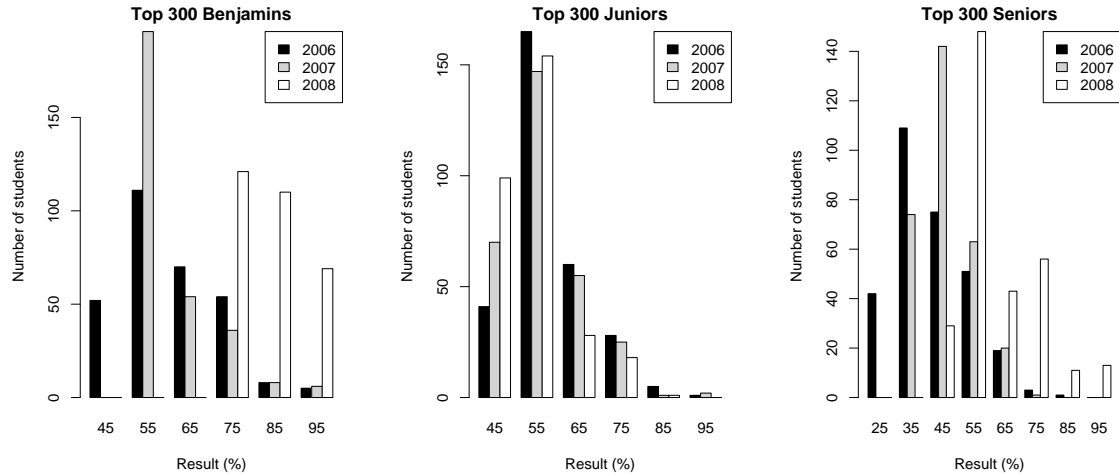
There were 1768 Benjamin, 1290 Junior and 981 Senior students competing. In Junior level the number of participants increased by 24% and in Benjamin and Senior levels by 42% compared to the previous year. The maximum score for all levels was 30 points (2 points for each question).

The maximum score was achieved in Benjamins' and Seniors' group, the best in Juniors achieved 26 points (86.7%). The average results were 16.8 points (56.1%) in the Benjamins', 10.6 points (35.4%) in the Juniors' and 12.2 points (40.8%) points in the Seniors' group. Compared to the results of the previous year, the averages of Juniors' and Seniors' are generally the same (fall and rise by approx. 5 percentage points, respectively), but the average of Benjamins' group is 14 percentage points higher than in the previous year. The histogram of the results is the following.

Beaver in Estonia 2008



The histograms of the results of 300 top students of three consecutive years (2006... 2008) are as follows.



From these diagrams we learn that for the top students in Benjamins' and Seniors' group, the questions in this year were easier than in previous years. For Benjamins' even too easy! For the top students in Juniors' group, the difficulty level has not changed much.

The schools that gave more than 200 competitors in total were Võru Kreutz-

wald Gymnasium (351), Kärđla Common High School (288), Ahtme Gymnasium (225), and Pärnu Ülejõe Gymnasium (204).

After the results were opened, an incident of cheating was suspected: eight students of the 11th grade from one and the same school appeared to have maximum score in the Seniors' group. Since the Seniors' questions had been considered quite hard, such a result seemed improbable. We contacted the teacher who supervised the contest there and she admitted that indeed some of those students did extensive teamwork. Hence, the results of these students were annulled in the meaning of individual ranking and they were not invited to the second round. This incident urges the need to think over how to ensure honest competition in the contest, perhaps also more precise written rules should be compiled.

2.2 Second round

The second round took place in the second day of the Estonian Olympiad in Informatics. Participation in the second round was by invitation only; approx. 1.5% of the students participating in the first round were invited to the second round.

Depending on the group, only 50%...75% of the students that had been invited indeed showed up in the second round. There were 15 Benjamin, 13 Junior and 8 Senior students competing. All students answered at least two questions correctly; the maxima were groupwise 28, 26 and 22 points, respectively. In all groups, five students were awarded and the lower bound for getting awarded was groupwise 25, 20 and 18 points, respectively. The awarding of the best students took place together with the final ceremony of the Estonian Olympiad in Informatics.

In addition to the competition, the students were offered a trip in a computer museum (<http://muuseum.at.mt.ut.ee/>) and a lecture concerning computer networks. Every student participating in the second round obtained a participation certificate and a book "Computer Hardware and Technical Documentation" (Indrek Zolk, Tartu 2008). For forthcoming years, there are plans to make such educational program more extensive, involving excursions to hardware and software companies, etc.

3 Comments about questions of the first round

Correct answers are printed in bold, comments that are not part of the question text are in italics. Where not stated otherwise, in every question four radio buttons were given with the obligation to select exactly one.

Since full results of the second round are available at <http://www.math.olympiaadid.ut.ee/kobras/> and the number of students was really limited there, only the first round is considered in this section.

3.1 Mandatory questions

This year one question from each level was mandatory to include in every country. The respective data for Estonian competition is presented below.

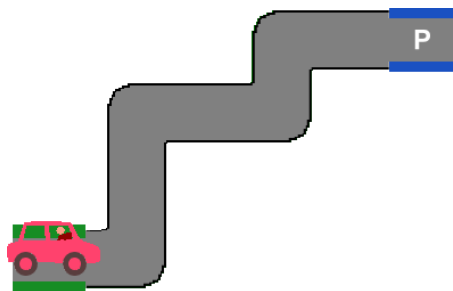
3.1.1 Benjamins

Question 5. You can describe the path of the car from the given position to the parking place by the following commands:

forward – go forward to next curve or to the parking place,

left – turn left in a curve without moving forward,

right – turn right in a curve without moving forward.



Which sequence of commands properly describes the path of the car from its starting position to the parking place?

a) forward, left, forward, left, forward, left, forward, right, forward;

b) forward, left, forward, right, forward, left, forward, left, forward;

c) forward, left, forward, right, forward, left, forward, right, forward;

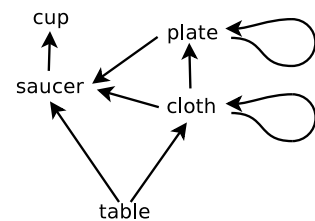
d) left, forward, right, forward, left, forward, right, forward.

Variant	Points	Number of participants	Percentage
a)	0	186	10.5%
b)	0	250	14.1%
c)	2	976	55.1%
d)	0	349	19.7%
unanswered	0	10	0.6%

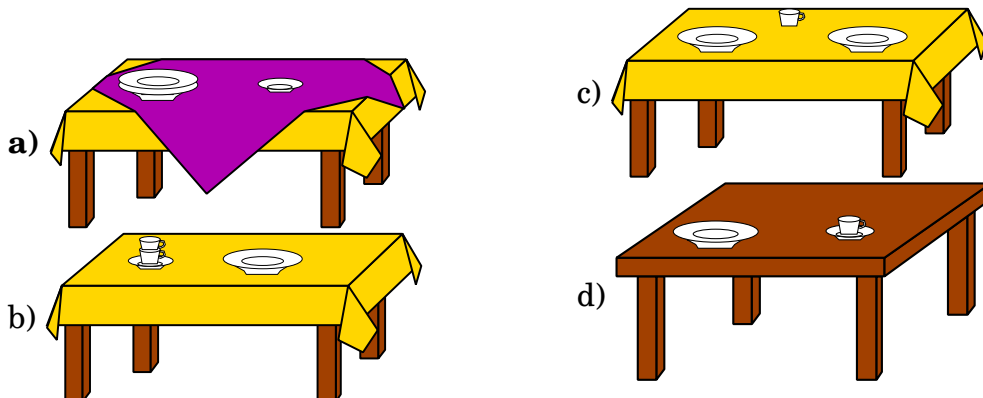
3.1.2 Juniors

Question 6. Beaver's job in a restaurant is to lay the tables. A picture defines in what way things may be put on each other.

An arrow from A to B ($A \rightarrow B$) means that a thing of type B may be put on a thing of type A . A thing of type B must not be put on a thing of type A , if there is no arrow from A to B .



Which of the following tables is laid correctly according to this picture?



Variant	Points	Number of participants	Percentage
a)	2	399	30.9%
b)	0	545	42.2%
c)	0	212	16.4%
d)	0	127	9.8%
unanswered	0	9	0.7%

3.1.3 Seniors

Question 6. A ferry runs frequently to an island in the Baltic Sea, transporting cars without and with caravans. The length of the car deck is 20 meters and it contains three lanes to place cars and caravans. These lanes are broad enough to host every car and caravan. Suppose that the length of a car is 3 meters and the length of the combination of car and caravan is 8 meters.

In which case all the cars and caravans can be transported on this vessel in one time?

- a) If there are 20 cars without a caravan.
- b) If there are 10 cars without a caravan and 4 cars with a caravan.
- c) If there are 6 cars without a caravan and 5 cars with a caravan.**
- d) If there are 4 cars without a caravan and 6 cars with a caravan.

Variant	Points	Number of participants	Percentage
a)	0	223	22.1%
b)	0	115	11.4%
c)	2	438	43.3%
d)	0	193	19.1%
unanswered	0	42	4.2%

3.2 The easiest and the hardest questions

3.2.1 Benjamins

The easiest (82.1% correct answers) was

Question 1. The following picture was taken in 1981. Analyse it and figure out what it is:

- a) a cash register;
- b) a double CD player;
- c) the first laptop in the world;**
- d) car radio.



Variant	Points	Number of participants	Percentage
a)	0	133	7.5%
b)	0	119	6.7%
c)	2	1454	82.1%
d)	0	53	3.0%
unanswered	0	12	0.7%

The question was meant to be easy: a cash register should not have two slots, a double CD player would not have a keyboard and a car radio should have neither the slots nor the keyboard. Despite simplicity, we like such history questions with logically deducible answer more than "know"–"does not know"-type history questions, especially for the Benjamins.

The hardest (18.3% correct answers) was

Question 11. There are three websites: "Male", "Hüvasti, kollane kass" and "Tähed". Which websites are returned when we search with query: **kass AND valge**?

Male	Hüvasti, kollane kass	Tähed
Male leiutati vanas Indias. Seda mängitakse 64 ruudust koosneval laual, kus poolte ruutude värvus on must ja pooltel valge. Eesti Maleliidu president on Carmen Kass.	„Hüvasti, kollane kass” on Mati Undi esimene romaan. See kirjeldab maal kasvanud kooliõpilase eneseotsinguid.	Öösel maal taevasse vaadates näeme lugematul arvul tähti. Mõni on kollane, mõni punane, mõni hoopis valge.

- a) "Male"
- b) "Male" and "Hüvasti, kollane kass"
- c) "Male" and "Hüvasti, kollane kass" and "Tähed"
- d) "Hüvasti, kollane kass" and "Tähed"

Variant	Points	Number of participants	Percentage
a)	2	327	18.3%
b)	0	356	19.9%
c)	0	388	21.7%
d)	0	655	36.7%
unanswered	0	59	3.3%

Again, a search engine question was among the hardest. This was also the case in 2007. There, the issue might have been the quotation marks; here

many students must have confused AND and XOR.

3.2.2 Juniors

The easiest (78.6% correct answers) was

Question 14. Which symbol marks the end of a paragraph?

- a) ß
- b) #
- c) ¶
- d) &

Variant	Points	Number of participants	Percentage
a)	0	98	7.6%
b)	0	142	11.0%
c)	2	1019	78.6%
d)	0	24	1.9%
unanswered	0	13	1.0%

The fact that this question is easy for students encourages to believe that word processing is mostly taught reasonably – with formatting marks on.

The following three questions were harder than others.

Question 11. The data about all students of Beaver School has been saved in a database. The students have been divided into categories as given below.

	can swim	cannot swim
male	250	100
female	300	200

What is the number of students that satisfy the following criterion?
(can swim OR is male) AND is female

Answer	Points	Number of participants	Percentage
300	2	142	11.0%
other	0	1154	89.0%

It is surprising that a relatively easy logic question happened to be so difficult. The question had a text box instead of radio buttons; several given answers were even not multiples of 50.

Question 3. Which of the following has the largest area?

- a) screen area of a wide-screen 19" LCD
- b) screen area of an ordinary width 19" LCD

- c) screen area of a 19" CRT monitor
- d) A4 paper

Variant	Points	Number of participants	Percentage
a)	0	659	51.0%
b)	2	176	13.6%
c)	0	301	23.3%
d)	0	118	9.1%
unanswered	0	38	2.9%

The question should be easy: among the rectangles with diagonals of same length, the square has the largest area (hence: the wider the smaller); the true picture area of a CRT is smaller than of a LCD; A4 paper, if available, can simply be put on a screen to verify that its area is smaller. Yet students must have believed that "wide" is undoubtedly larger than "normal".

Question 15. Toomas scanned a paper of size A4 in a raster graphics program and wishes to shrink it into size A5. What is the enlargement percent? The area in the frame is of size A4 with dimensions 29.7 cm × 21 cm. Half of it (in gray) is of size A5.



- a) 50%
- b) 71%**
- c) 100%
- d) 200%

Variant	Points	Number of participants	Percentage
a)	0	782	60.3%
b)	2	216	16.7%
c)	0	146	11.3%
d)	0	143	11.0%
unanswered	0	10	0.8%

This question was meant to be tricky. Yet for those familiar with copying machines or fond of computations it should be easy.

3.2.3 Seniors

The easiest (61.9% correct answers) was

Question 1. Who constructed one of the first calculating machines?

- a) Euclid
- b) Edison**

- c) Pascal
d) Copernicus

Variant	Points	Number of participants	Percentage
a)	0	84	8.3%
b)	0	189	18.7%
c)	2	625	61.9%
d)	0	100	9.9%
unanswered	0	12	1.2%

The hardest (23.2% correct answers) was

Question 14. Hedi has made a table and a simple list of her friends in two columns and in alphabetical order:

Jaanika	Klaarika
Kadi	Riina
Kaur	Viljar

Jaanika → Klaarika

Kadi → Riina

Kaur → Viljar

Both of the objects would look similar when formatting symbols were turned off. Hedi wants to add some friends. Which object is more comfortable for adding her new friend Kristel?

- a) For adding a person, it is the most comfortable to use the table.
b) For adding a person, it is the most comfortable to use the simple list.
c) For adding a person, the table and the simple list are equally most comfortable.

d) Since the table as well as the simple list contain two columns, they are both uncomfortable for adding a person; some other method should be used for formatting such data.

Variant	Points	Number of participants	Percentage
a)	0	212	20.9%
b)	0	350	34.5%
c)	0	179	17.7%
d)	2	235	23.2%
unanswered	0	38	3.7%

Perhaps the volume of the data is too small: if the table and the list had contained hundreds of rows, the answers might have been different.