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## **Handbook for Non-U.S. Intel ISEF Finalists**

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**Institute of Computer Science**  
**Academy of Sciences of the Czech Republic**

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Petr Klan

Technical report No. 994

May 2007



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### Abstract:

This handbook describes all steps of preparation for your Intel ISEF presentation. It gives the entire instructions how the non-U.S. participant of Intel ISEF is supposed to go ahead. It means from the moment of nomination of his project at the affiliated fair up to the proper participation in Intel ISEF. Some genuine documents and experience of the several-year-activity in Intel ISEF are presented here. The handbook is written through the eyes of a non-American student. whose work has been nominated for Intel ISEF. This student describes all the steps of preparation in his own project that he takes for Intel ISEF and he introduces various related examples.

### Keywords:

science presentation, paper writing, abstract creativity, oral presentation

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# Handbook for Non-U.S. Intel ISEF finalists

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Free download: <http://www.cs.cas.cz/~pklan/isefhandbook.pdf>

*This handbook describes all steps of preparation for your Intel ISEF presentation. It gives the entire instructions how the non-U.S. participant of Intel ISEF is supposed to go ahead. It means from the moment of nomination of his project at the affiliated fair up to the proper participation in Intel ISEF. Some genuine documents and experience of the several-year-activity in Intel ISEF are presented here. The handbook is written through the eyes of a non-American student, whose work has been nominated for Intel ISEF. This student describes all the steps of preparation in his own project that he takes for Intel ISEF and he introduces various related examples.*

## 1 On nomination of the project at affiliated fair

The best assumption to be nominated for the Intel ISEF is *an excellent placing* at affiliated fair. The latter is a (national) science competition that is a member of the ISEF network. A complete list of affiliated fairs including contact information is on the web site

[http://www.sciserv.org/isef/aff\\_fairs/aff\\_fairsearch.asp](http://www.sciserv.org/isef/aff_fairs/aff_fairsearch.asp) (1)

However, affiliated fair jury can take into account additional aspects such as:

- Language skills of the competitor.
- Thematic relationship of his project with the Intel ISEF category.
- Time possibilities of the competitor in regard of the preparation, that Intel ISEF requires.

A broader nomination has really proved, because it is good to have several alternates in reserve for the case that someone gives it up during the preparation.

It is usually true that the originality of the project, its performance and contribution have crucial impact in success at the fair competition. On the other side, practically all the Intel ISEF projects are original, well-made and bringing some contribution. They are sorted out through the screen of several hundreds up to thousands of projects, which participated in the affiliated fairs. It is possible to say, with certain exaggeration, that they are likely the same from the point of their evaluation. The situation is similar to searching for the singing „superstar”. Competitors, who take part in the final rounds, are able to sing almost for sure (they got short listed) and they will sing some hit. How to distinguish among them afterwards if a jury member wants to be objective and rational?

According to what is the project exactly evaluated? Jury members say that *the crucial point is how the Intel ISEF finalist is able to explain his work and which methodology he uses.* Largely it is a matter of placing. To some extent, it is a paradox, because speaking-well finalist with some average project shines in the eyes of jury more than genius, who is not able

to express himself properly. Similarly, in the singing superstar mainly shine those, who communicate well and have an interesting performance than those who sing well “only”.

That’s why the verbal presentation of the project is so important. Jury members of the affiliated fairs confirm that after the meeting with the project documentation they had done some preliminary rate and afterwards verbal presentation they changed it in a deeper manner. That’s why for the Intel ISEF, the projects should be chosen, which are not only expertly good, but moreover, they fulfill additional criteria showed in Appendix 1: 7 rules for success projects.

## **2 I am nominated**

My project is called “New Task for Human Intelligence Measuring”. It is attached to Appendix 4. I placed first at the affiliated fair in the category of Mathematics. When presenting, I went by the 7 rules showed in Appendix 1 because:

1. *Project fits well in the category.* Every jury member knows that human intelligence tests are spread very much. They are used by the companies, universities and individuals. Prestigious workplaces deal with the creating of these intelligence tests. Mathematicians, physicians or computer scientists try to define intelligence as some process. There is even a great field of artificial intelligence available.
2. *The title accurately says what the main point in this project is.* The project is absolutely and precisely defined. It combines something new with the known and exciting task.
3. *Project means the progress.* It is new. Nobody else has ever proposed such a test.
4. *Project is explained understandably.* When I use this task, I am able to test some stage of human intelligence. It is based on the table of numbers (matrix) and seeking symmetry in this table. Moreover, symmetry behaves like a natural phenomenon. It is possible to observe it both in animated and in unanimated nature. That’s why it is logical, that affects human intelligence as well. The faster the symmetry is found in a given task the higher the intelligence is.
5. *Project is consulted with a university expert.* He told me, which testing tasks exist already, how they relate to the intelligence rating, explained contemporary methodology of intelligence measuring and helped to formulate contribution of my project. He suggested certain improvement at the same time. After consultations with him I really gained good track of this scientific field.
6. *Project is connected to well-structured verbal presentation.* I said which testing tasks had existed so far, which idea I came up with, what justified my research and what was the goal of my project. Furthermore, I described which steps I took while suggesting the testing task and what the task consists of. I introduced some calculations. In the conclusion I compared the suggested testing task with another tasks. I also said and afterwards showed advantages and contributions of the new testing task. There was wide discussion with jury members. They appreciated the original idea. I had to answer numerous questions regarding my procedure and results as well. I think I acted convincingly thanks to many experimental results which I could introduce.

7. *Project points to some passionate mathematician.* Over the mathematical problem or good mathematical book I am able to spend the night. When I talk to my friends, after a moment I put my talks to mathematics. When we sit in the sweetshop at some ice cream, first of all I talk about which problem I am dealing with. I fall asleep and wake in the morning with that problem in mind. The worst thing is when I date with a girl. I do not have a lot of other topics which I could talk about. Luckily the girls I know are familiar with that and sometimes I feel that talking on mathematics makes them happy. But I prefer talking to my granny most of all. She always cooks me something delicious and I keep on talking and talking and my granny listens to. She even does not ask much and it makes me so happy while talking.

Now the main task is to get ready properly for the Intel ISEF. My school consultant told me that I have had a good chance to succeed because I have obtained some original results. He will lead me expertly. I would like to cultivate a high competitive “flower” related to my project similar to the illustrative Fig. 1 and not to spoil the preparation. Every improvement is definitely worth doing. First of all I will find out some information available. I will have a look at associated WWW sites. The program will probably be stuffed.



Figure 1: To cultivate the high competitive “flower” requires certain attempts and special leading (source: J. Toman, 1980: How to perfect myself. Svoboda Prague)

### 3 The Intel ISEF

I found a lot of information about Intel ISEF on WWW sites. Only to be acquainted with this. I tried to pick the essential ones at least. I also found out that to some extent, the Intel ISEF evokes “the Olympics”. I felt a little bit pressured whether my project would succeed in such competition.

The full title of Intel ISEF is *Intel International Science & Engineering Fair*. It is probably the most prestigious competition in the world. It is considered the greatest world scientific celebration of scientists-teenagers. It is always held in the middle of May in some of the U.S. states with the participation of more than 1400 finalists from more than 40 states of the world and 50 U.S. states. It is organized by organization called *Science Service* ([www.sciserv.org](http://www.sciserv.org)),

which ISEF established in 1950. Detailed information about Intel ISEF is available on WWW site [www.sciserv.org/isef/](http://www.sciserv.org/isef/). From each foreign country, or more precisely from each affiliated fair is possible to nominate two individual (single author) projects and one of the team projects for Intel ISEF. The long-term sponsor of ISEF, the company Intel, is the known producer of the processors for computers.

Finalists compete in more than 10 categories of science, for example Mathematical Sciences, Physics and Astronomy, Chemistry, Computer Science, Biochemistry, Animal Sciences, Medicine and Health Sciences and so on. A complete list with their specification is on <http://www.sciserv.org/isef/rules/rules4.asp>. In these categories of science, the projects having single author are considered. There are about 80 projects on average to compete in each category. Team projects are sorted out according to the same categories of science, but from the point of their evaluation, they are collected in one specific category. We can find up to 150 projects in this category.

The logo of the Intel ISEF is shown in Fig. 2.



Figure 2: The logo of the Intel ISEF (source: <http://www.sciserv.org/isef/>).

The number of projects in separate categories of one year of Intel ISEF shows the diagram given in Fig. 3. Similar numbers are kept in the other years.

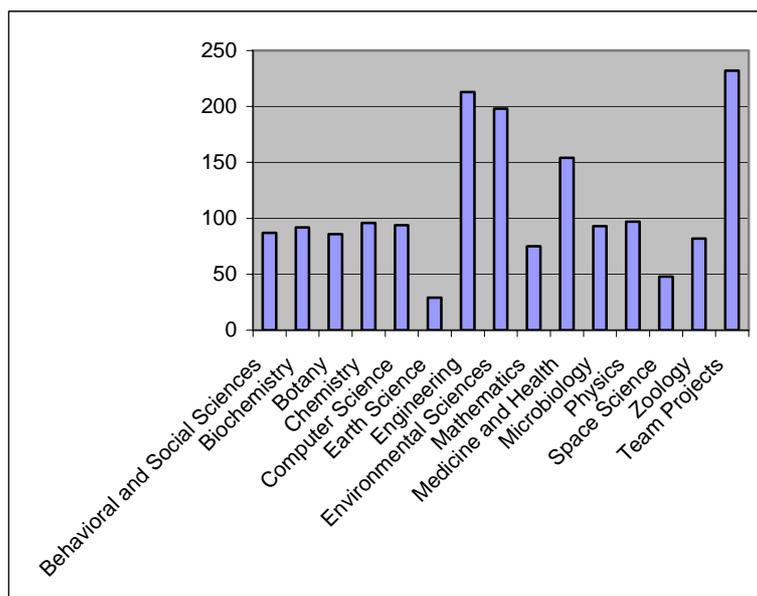


Figure 3: The number of projects in separate categories of Intel ISEF (source: the author).

I am searching for some more information. For instance, was anybody there from our country? I found out an article published in the most-read newspaper in our country which is called “High school-students succeeded in science. Follow them”. It is introduced in Appendix 2. I imagined what exactly expects me and figured out that it is possible to succeed in such a great scientific party as well.

My head was little spinning around from that information, I did not know where exactly to start. I am trying to write an e-mail to fair director, which I found out in our country on the WWW site (1). I simply introduced, that I found some information about the Intel ISEF on the Web and do not know where to start. And I also asked what he would want from me and what will be ensured by him. The fair director answered right away and sent me a procedure of the preparation. I got one step further again.

## 4 Preparation steps

The preparative steps for the Intel ISEF include:

1. *Administrative part* – sending and proper filling of needed documents. The fair director will guide me through this. He knows the rules of the Intel ISEF and warns me about the parts of the project, which I have to have according to the rules.
2. *Scientific part* – writing abstract, preparation for the whole presentation and so on. The abstract of the project is sent beforehand. The use of English language is taken for granted. The fair director recommended me some *expert adviser*. It will be possible to consult with him through the preparation. He also helps me with choice of Intel ISEF category which is appropriate for my project.

Honestly, it did not say too much to me, because I have not sensed what the abstract of the project was (probably some kind of annotation) and how to write it. So I will ask my expert adviser. English is also about to give me some difficulties. At least I know there is no need to care about the organization too much. I also hesitate, where to include my work, either in “*Mathematical Sciences*” or in “*Computer Science*”.

Will I lecture on the abstract anywhere there? No, the fair director answered to me. Each project has a single presentation stand, where the finalist displays information about his project. During the days of the contest the jury members as “visitors” come separately up to the stands and the finalists introduce their project to them and they answer their questions at the same time. Everything has given rules in advance (including the size of the stands) and the precise time frame as well.

I really do not know how I am about to build the presentation stand. I am thinking over, whether we have a domestic handyman. The fair director suggests me the thing, which I intuitively feel like immensely useful. The fair director organizes one-day Saturday meeting focused on both the preparation of administrative things and the preparation of scientific part. All the things connected with the preparation for the Intel ISEF are about to talk through together here. Moreover, the tight time schedule of the preparation is set in order not to have time lapses. The finalists will see what expects them and if they are strong enough to pack it up at all. They also get to know each other in advance and mutual exchange of experience is possible. The meeting will be held at a time, when there is still relatively enough time for the

preparation. The finalists are asked to prepare their document proposals for the administrative part and also for the scientific part (abstract) in advance. Then the fair director will help them to prepare necessary forms for the assembly and the expert adviser the abstract so that to fit in the conventions and the rules of the Intel ISEF.

So it is time to take up working on the abstract of the project. I am little browsing the Internet and I am writing an e-mail to my expert adviser at the same time to let me know, how to write such things and how to realize the presentation stand. The expert adviser responds to me immediately and he sends the instructions, how to write the abstract. He also writes that after preparing the abstract, he will talk through it with some related scientific expert whether the abstract is properly scientific and understandable written. He stimulates me and suggests that some specific journal or magazine could help with the preparation of the presentation in stand. They certainly have a graphic studio and they would help and I could publish my project there. Other possibility is to work as a “reporter” for them, to check out the Intel ISEF projects in my category and report, which new things I exactly saw there. I have to say that the latter possibility of being the reporter would fairly interest me and enjoy me. The expert adviser offers to help with the choice of the specific journal or magazine and he has offered to introduce me or I can try it on my own. I will see.

He also sends me one sample abstract (it is short, so I insert it at once in Fig. 4) and the rules, how to write scientific journal papers (paper is longer than the abstract, it typically contains 6 pages). The sample abstract is from finalist, who won the prize in the Intel ISEF. He noticed, that a collection of the Intel ISEF abstracts is possible to purchase right in the contest, including the older issues. If I need, he will get some of the issues.

He asked me to prepare a first concept of the abstract and advises me to write it in the way I feel and that he will have a look at it and he will help me to move it further. Both abstract and scientific paper is very important document. The abstract is the first, which members of jury come across and the scientific paper will help me to get all the results together, to compare them with what has already been done in the field and also to report them to the professional public. That’s why it is important to pay attention to them and mainly of all to write them comprehensibly and understandably.

After all that I know at this moment, I would not mainly be the finalist who copies some real scientist. It could tempt me to present rather his ideas than my own ones. Some slight special “cultivating” support might be effective, which forwards me. But most of all I want to be me in the Intel ISEF.

While thinking about it, the journal which helps with the preparation of the presentation stand in exchange for writing about my project there, it really seems like a good idea. Even the school I visit could help me. I represent it exactly. I will try to come to my class teacher and ask her to make some arrangements. She could ask some known people for the participation who will support my project (e.g. the school director). I could present my work to the other classes to train its verbal presentation. The town mayor also could show an interest, I could also write into the local newspapers. I am sure that my parents will help according to their possibilities as well.

## LANs without Network Cards

Nowadays, computer networks are becoming more and more important in communication and computing. Most computers presently available on the market can be provided with some specific networking equipment allowing connection to a computer network, namely in the form of an interfacing card. However, if schools and offices often have many computers as potential candidates for networking, they will need a fair amount of money to purchase interfacing cards for creating networks. Moreover, there may be some troubles when installing cards into older computers or in many notebooks.

In this work it is suggested to use instead of network cards the existing serial and parallel interfaces which are standards in all computers. A software for emulating functions of a network card is proposed, thereby building a fully functional computer network without the need for any additional hardware aside from the necessary cabling.

Since the goal is to interconnect more than two computers using the current serial and parallel interfaces, it is necessary to have two individual simulation programs, a hardware driver and a router. The hardware driver controls serial or parallel ports and emulates network cards. The router forwards packets among network computers via standard parallel and serial cables.

The benefit of this work is in a substantially reduced cost when introducing computer networks. Schools, offices and homes can take advantage of this work in order to connect computers into LANs and to share Internet services, application software, databases and printers.

Figure 4: The sample abstract for ISEF (source: the author).

## 5 I am creating the abstract

I would never sense, how much work is connected with that. The abstract is exactly annotation of the project in several paragraphs. Even if it is a short thing, it takes much energy and time. Not to look like diy (do it yourself) abstract. Clearly, it must be created by me however written properly. When imagining, that a member of jury reads dozens more similar abstracts, it should attract. So look at what I have received from my expert adviser.

The abstract sent to Intel ISEF (250 words maximum, whereas each indefinite article or conjunction is considered a word) is a brief characteristics of the project. It contains some title, the name of the author and the body. For the title hold the recommendations mentioned above. The body of the abstract typically consists of 4 paragraphs arranged from not too long and simply readable sentences. The following table shows a frame content of these paragraphs.

<b>1<sup>st</sup> paragraph</b>	Present state, motivation for proposed project (Why?)
<b>2<sup>nd</sup> paragraph</b>	Description of solution, methods, experiments (How?)
<b>3<sup>rd</sup> paragraph</b>	Most important results (What?)
<b>4<sup>th</sup> paragraph</b>	Contribution, progress, novelty, the use of results (For what?)

It is possible to say it in a more specific way like this:

1. The opening sentences related to the studied problem, why it is important, definition of the goal of the project, the reasons for that goal.
2. Several sentences about the method proposed to reach the goal with details left out.
3. The summary of the achieved key results, not the details about the results, neither tables nor graphs are used.
4. The conclusions from the results, possible applications of the results, possible extension of results or their generalization, contribution of the project, benefits for society.

The expert adviser also draw my attention to the sample abstract on the Web right from the administrators of the Intel ISEF [www.sciserv.org/isef/primer/abstract.asp](http://www.sciserv.org/isef/primer/abstract.asp). Moreover, I have to add, that there exists a shoptalk document „How to write an effective abstract“, which is really super. It was written directly by one of the chairperson of Intel ISEF John Cole and it is very graphic. It is possible to ask a copy of it via e-mail at address dejavu@msn.com.

So I got down to work immediately. In the Appendix 3 I introduce, how I realized the abstract. It is for my project on the intelligence measuring. I tried to make it understandable, even if it looks mathematically. It is such a toy, but you might read it enthusiastically. For sure I myself also read it for hundred times.

Now I would get down to working on the paper. I am stimulated the expert adviser complimented my abstract. I gather some information how to write a scientific paper. The basic structure of such a paper, in the way that the expert adviser sent it to me, I introduce in the following chapter. But now I am “illuminated” how to write such a paper.

## **6 I am writing scientific paper**

It is worse situation with the paper than with the abstract. Although it contains the abstract as well, which is shorter than that for the Intel ISEF, the paper is much longer. However, it will probably be better because of the possibility to introduce more results here, to put some figures in and in general to describe my results in detail. I would like to introduce some mathematical relationships there as well, to see how it is professionally performed.

The article is a standard form of scientific communication. It has its usual scheme. In English terminology this scheme is called IMRAD - Introduction, Materials and Methods, Results and Discussion. The following table introduces more about individual parts of the paper. At present the best computer format to prepare such a paper is in the PDF (Portable Data File) for Acrobat Reader. But I am sure it does not surprise anybody who deals a little bit with the computers.

Notice what else might occur in a paper: mathematical relations, formulas, references, schemes/tables, flowcharts, paintings/drawings, figures, diagrams/graphs, photos.

Title	Up to 10 words
Author (authors)	Name, address, e-mail
Abstract	Brief characteristics, 50-100 words
Keywords	Characteristic words, word phrases (10 maximum)
Introduction	Introduction to the problem Present state Citation of references Brief description of solution Why – innovation, contribution, justification
Material and methods	Definition of the problem Material, methods and experiments used Solution, results Examples, applications
Conclusion	Discussion Summary of results Comparison with the present state Contribution, innovation
References	List of references
Appendix	Instants complicated for reading Software listings Description of the software Proofs of theorems Detailed schemes

I am determined to try my own paper. I went to the library and borrowed some issues of a scientific journal that the expert adviser recommended me. To have a look, how the paper really looks like. I was also browsing „Web of Science“ and „Current Contents“ on the ISI Web of knowledge, (<http://portal.isiknowledge.com>) and searched for the related papers, to make sure that my results are really original and my project has a justification. I went through the searched results, red through several papers in the journal and felt being ready for getting down to write. How the paper resulted in, you kind reader are able to read in the Appendix 4. I even do not know how many times I was rewritten it. In the evening I liked it and in the morning I fell out of liking. The expert adviser had the range of constructive suggestions.

## **7 I am on the preparation meeting**

Winter culminates in our country and I am going to the preparative one-day meeting promised by the fair director. I carry the abstract and article proposal with me. I talked through it with my school consultant moreover my relatives helped me with English. In the warm lecture hall of academic institution, where the meeting is held, the fair director and the expert adviser

welcome me. First time I am meeting them personally. So far I have merely known them through the electronic mail and internet phone. The video is playing from the last year of Intel ISEF. We browse a photo-gallery of several presentations right from the Intel ISEF (see the Appendix 5). For the image, how the presentation stands look like and also for seeing of their amazing diversity.

We are obtaining basics about Intel ISEF. How the journey, program, presentations look like. Various trips and social events are also part of this contest. That's why I enclose a record from one Intel ISEF party taken place in Phoenix that I received at the meeting. There is detailed description of the program day by day. I recommend reading it. There are even things, which in fact I would not expect. For example, to exchange pins during the whole contest party. It is a good way how to get acquainted with other people through the pins. You say "Have you a pin" and the conversation can get under way, with the girls as well. That sounds good. I would like to find abroad a similar researcher as I am. For example we could do something together or to visit one another during the holidays.

The Appendix 6 introduces the record mentioned above. The first part of meeting is over with that. I must not forget to book some trip in advance. I would like to look a little bit about the countryside of the town in which the Intel ISEF will take place and get to know with local science as well.

The expert adviser takes a seat on one end of the lecture hall, the fair director on the other one. We join them individually. With the fair director we are talking through organizational matters. We are mainly filling in various forms of application and we are arranging until when the application needs to be sent. We will meet a few days before the date of sending and we will do everything through Internet. I do not have to care about any payments. Then I join the expert adviser and we are talking through the abstract. The expert adviser says his opinion, we agree with the some corrections. Similarly, it is with the paper. It is important to keep given structure. Jury members are used to the latter and something else makes them problems and it may decrease the project rating.

When we sequentially change with other finalists, furthermore, we talk about the plan for another preparation. We focus on perfecting the abstracts. We also start thinking about the presentations. There is enough inspiration from the Intel ISEF photos. In the afternoon we finish and I have my mind full of plans. I wonder how I catch up with all that, school, Intel ISEF. But the fair is a great opportunity. It is worth to put some time and effort into it. Moreover, we received basic information, how to make presentations. They are involved in the following part. Basically, the posters are printed in order to stick in the presentation stands. The journal could provide printing according to the pattern, which I would prepare. It is also good, if there is something practical, I will try to make some model of matrix for my project. I consider writing specific software of some medially-oriented task for visitors of my project. There are so many plans, the question is who is about to do it.

## **8 I am creating presentation box**

First I summarize what I have learned about the presentation from my expert adviser and from the Internet. In spite of diversity and imaginativeness of the presentation stands it is possible to observe their certain structuring. It can be possible to encounter with the opinion, that what is scientific is also complicated. It cannot be like this with the presentation and the

presentation is about to persuade, that science can be done and presented in the understandable way. It is about to look, that among the numerous stands it should attract attention of jury members and other visitors.

Each project has its own presentation stand in the Intel ISEF fair. It consists of the table of maximum height of 36 inches (91 cm) as a base including electricity. Some model, computer etc. can be put upon it. Each finalist has to prepare and bring the back board and both side boards beforehand. That's why three-armed self-supporting folding constructions are still very popular, which are put together during the transport. While presenting, they are spread and put up. The maximum sizes of the presentation stand are not allowed to exceed:

- 30 inches to the depth (76cm),
- 48 inches to the width (122cm),
- 108 inches to the height (274 cm),

- including the table. Particularly the title of the project, facts, figures, describing statistics, statements of the authorities, illustrative stories, definitions, humor, laws and so on are placed into the presentation stands. All in upper cases for a good legibility, briefly, with emphasis on the main features of verbal presentation, balanced at sight (eye-attracting) and reasonably colored (color supports meaning).

Especially the logical arrangement of the presentation stand, graphs and photos support the verbal presentation. They gain in conclusiveness. The following table brings the tips for such an optimal organization:

<b>Board</b>	<b>Contents</b>
Left side	Problem, goals
Back	The title above, research below, results
Right side	Contribution, conclusions
Base	Computer, real model, one-page abstract (for handing out, it is provided by bz organizers), detailed documentation, published papers etc.

In the part titled

*Problem*, the problem, which the project is solving, is specified clearly and understandably.

*Goals*, the goals of the project are formulated.

*Research*, the method, experiment or procedure are presented, which were used to achieve the goals. In this part it is appropriate to introduce carefully the main performed steps and also the data examples acquired from the measuring devices.

*Results*, there is data evaluation acquired from the research for example that data is put into the graphs. New results are formulated.

*Contribution*, contribution and practical meaning of results or new observations for the science and society are claimed.

*Conclusions*, achieved results are compared to the declared goals and possible new horizons and future goals are suggested.

In Fig. 5 there is an example of such well performed presentation stand in the Intel ISEF fair. The stand was constantly in the center of attention of visitors, moreover, the finalist made it

more special with the occasional playing the displayed exhibits. Acoustics of Tibetan bowls was the topic of this project. From Fig. 5 and possibly also from the photo-gallery of the Appendix 5 we can get the basic view, how such the presentation stand is. In the Intel ISEF they stand one next to the other in the long lines according to the categories of science. In the fair there are ideally two days reserved to build the stands. In fact, one day and half, because of the approval process to have presentation stand without defects, being safe, having no exceed sizes etc. needs to be caught up. Sometimes the approval process may be longer and finalist finds a message about violations on the table. That's why the good preparation from home is recommended beforehand, to only complete or glue it together there. It is also important do not have the construction heavy and spacious, it will be carried by plane and there could be some trouble.



Figure 5: The example of the Intel ISEF presentation stand (source: Lukas Vidensky, with permission).

I like the three-armed construction for its practical functions. I will make it. I will get three light boards from thin plywood cut in the do-it-yourself shop (two sideways and one back, the side ones sized about 100 multiplied by 45 cm and back 100 multiplied by 90 cm) and I will put them together with simple hinges. It will be opening, large enough and when it is not open widely also smaller than allowed sizes.

Before I get down to work, I will outline schematically, how the presentation could look. In Fig. 6 there is the final result after 1-week of thinking about. I will build like this and I will attend the fair with that. After the consultation with the selected journal there is no problem for them to produce the suitable posters in their graphic studio. I will put the model of symmetric matrix on the table (see Fig. 6). I will construct some wooden frame. I will bore holes from the side and pull through the wires. I will pull bored ping-pong balls from both sides on them, which I will mark with the numbers. They will be scraping, so that it will not be hard to change them.

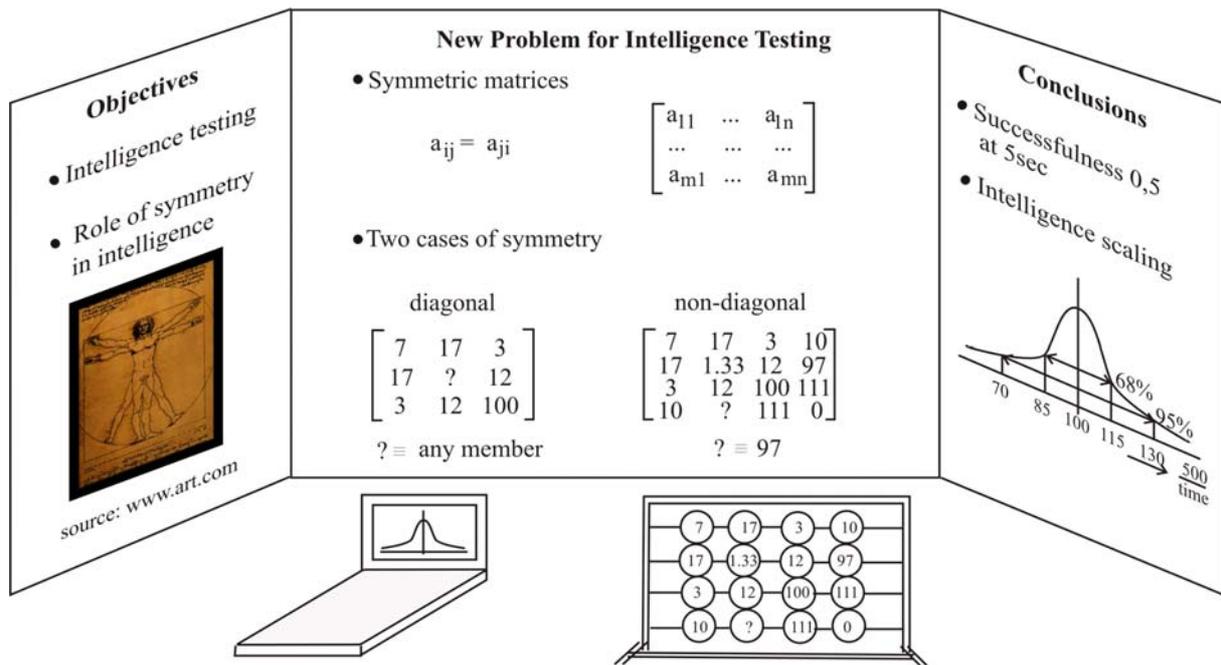


Figure 6: Presentation stand of the project (source: the author)

## 9 How to discuss the project with jury members

The fair will be coming soon. My presentation is ready according to the Fig. 6. I was talking it through continuously with the expert adviser, school consultant of my project and the others. I can see the competitive days near at hand, when I face my stand and the jury members are approaching. „What to say to them“, and how to organize the verbal presentation has already been mentioned in the Appendix 1. The discussion of the project in face of a jury member belongs to the part of the presentation, which apparently tells most about success. That’s why it is useful to focus on “How to say it” as well. When preparing the verbal presentation it is basically good to take procedure mentioned in the Appendix 7 into consideration.

I introduce the real story mentioned by the expert adviser about that the verbal presentation really matters most. Recall that there are excellent projects nominated for the Intel ISEF. On the other side it can be seen that the verbal presentation of the high quality and the art of a good communication with members of jury can conclude to a “surprise”.

There were two individual Intel ISEF projects denoted simply by *A* and *B*. The project *A* demonstrably had higher scientific value than the project *B*. It certainly influenced the placing at the affiliated fair, where the project *A* placed first and the project *B* placed second. Though, it was on the contrary in the Intel ISEF. While the project *B* received one of the grand awards in this high competition (also the fourth place is huge success in this competition), the work *A* did not win any prize. Why the juries has evaluated differently? In the Intel ISEF fair the purpose of the entire project is evaluated complex. It means its scientific value, the real usage, the need or justification to solve this problem, the attempt to finalize the solving up to the application. And it was clearly seen, that while the author of the project *A* concentrated on the scientific value of his project (though high) only, the author of the project *B* also highlighted the other aspects of his project while presenting. And it probably basically signified the placing. If then the author of the project *A* received grades for example (in analogy with figure

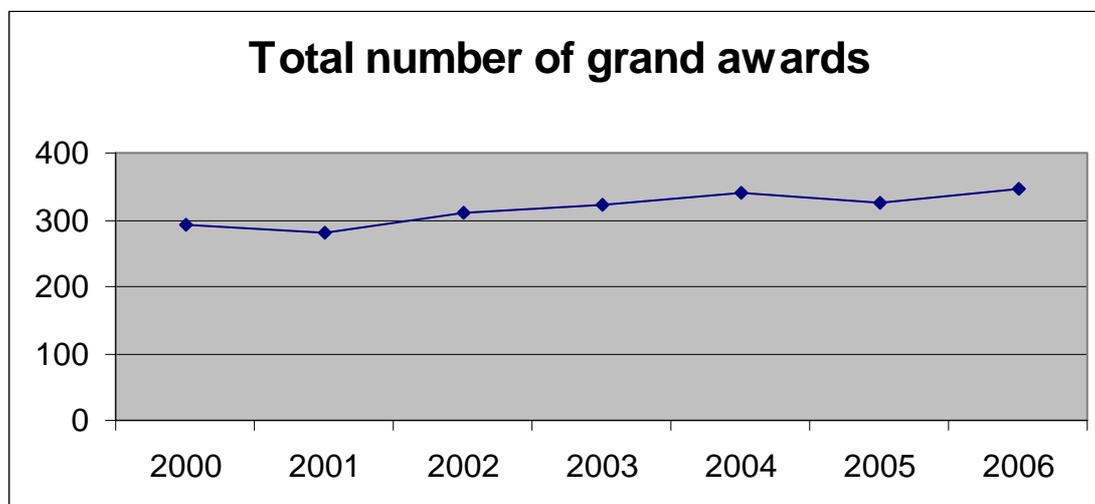
skating) for scientific value, the applicability, the need and finalizing 10,2,2,2 and the author of the project *B* 5,5,5,5, the simple arithmetic mean is still 4 in the former and in the latter 5. In other words, the project *B* was rated better.

## 10 On a chance to win?

Even if in the Intel ISEF one up to the three first to fourth places are valued by grand awards for each scientific category, it is 12 awards per category at the full number. In each category *the absolute winner* is designated as well. Furthermore, the range of special prizes from scientific societies and manufacturing corporations is to be awarded. The awards are both material and financial nature and they range from several hundreds up to several thousands of USD. It needs to be taken into account that it mainly is the U.S. fair and all non-U.S. projects primarily enhance competitive background in favor of domestic finalists. That's why from the non-U.S. finalists' point of view it is far more effective, if they mainly consider the Intel ISEF fair as an amazing opportunity to extend the knowledge and to meet the scientific competitive setting. However, an award means the huge success.

The graphs show the number of grand awards in single years, probability of obtaining some grand award by non-U.S. finalist through all the categories and only for the category of Mathematics. We can see that the total number of grand awards slightly increases. Probability of obtaining award by non-U.S. finalists increased in the last years to 0.2, and that this probability in the category of Mathematics is much higher in some years, which might be very encouraging for non-U.S. mathematical projects.

The Appendix 8 summarizes some reflections and observations about, why the finalists won or not some prizes. Let them be some inspiration to succeed in the Intel ISEF fair. Good luck for that. And here I close my saying. That is to say, I am leaving for the Intel ISEF. I tried to introduce here all the aspects of my preparation. I really tried to prepare as best I could. Most of the steps I had to search hard somewhere or to consult. That's why I wrote this handbook, to make it easier for my non U.S. followers. So stick up for me, I will also keep my fingers crossed for you.



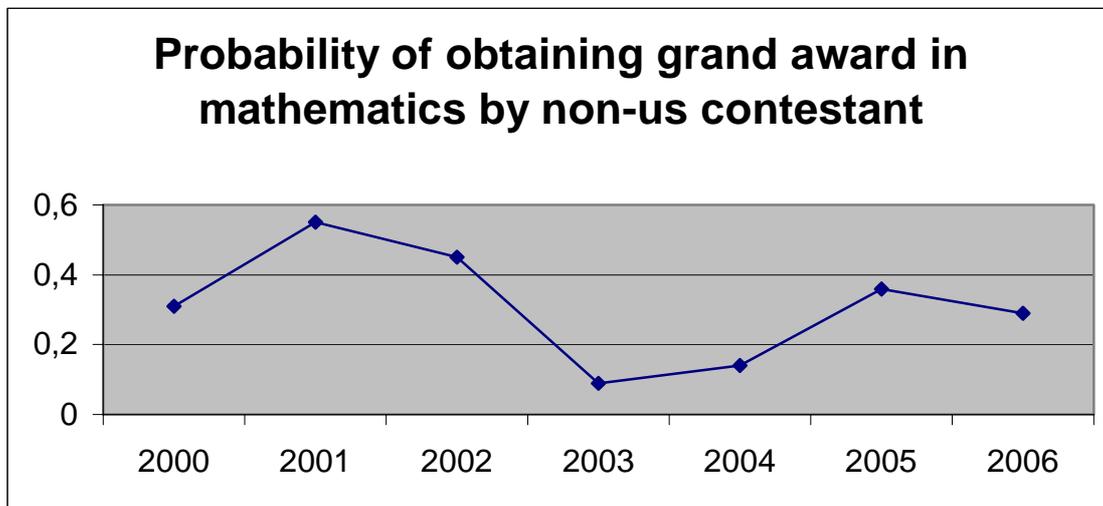
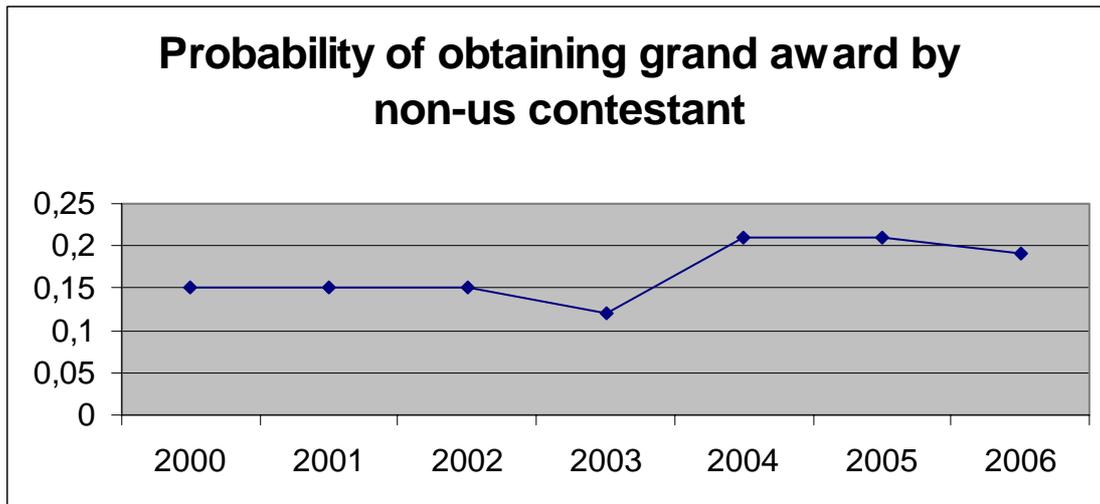


Figure 7: Probabilities of obtaining grand awards. Some of all grand awards above, by non-U.S. finalists in the middle and for the category of “Mathematics” below (source: the author).

## Acknowledgements

The author is grateful to the management of the Intel in the Czech Republic for giving long term sponsoring to our finalists. He also gratefully acknowledge the support of Institute of Computer Science and National Children and Youth Institute of Ministry of Education, Youth and Sports of the Czech Republic and in particular Ing. Miroslava Fatkova.

## Appendix 1: 7 rules for success projects

1. *They fit well in the scientific category.* Jury members mostly are specialists representing one scientific category. An inter-category project might cause the decrease of evaluation, because contribution in other category does not have to be fairly clear them. It also is fine to fits well in the context of the known method or theory. The jury members are familiar with

the known results or methods and it is a good way to take use of them both in the work and in the verbal presentation. For example, the project is somehow to extend results known in the literature. The jury member exactly gets the direction, which way the project takes. That is the assumption leading to ability to explain the project.

2. *Their title is cogent.* To say simply the title is brief, precise and pregnant. The title should be a view-tower of the entire work such as in Fig. 1: interesting, attracting attention, luring to view. The jury member should glance over the project easily from the title. As for the way of choosing the title, we comment on some titles of the Intel ISEF projects - absolute winners in the category of Mathematics (see Grand Awards Winners on <http://www.sciserv.org/isef/results/index.asp>).



Figure 1: Title should be a view-tower of the entire work (*Terezka* view-tower, the Czech Republic, source: the author)

*“C-Transformation Introduction of a New Geometric Transformation”* The word “new” is the key word here, which promises, that the work solves or brings something new. The words such as “new”, “novel” and “improved” are universally suited for the use in the titles, if they really characterize the project. It means that this project brings some new method, sight, algorithm etc. It is concerned with the innovative or innovatory work. It is significant to present the project in this manner as well. New is always the object of enhanced interest not only from the side of the jury members.

*“Determinantal Sequences”* This title is ideal in the sense that defines exactly certain methodology. Each jury member will know immediately, where to put the project in. Now it is already very easy for the finalist to show and for the jury member to judge, whether the project is “only” exploration of known facts or brings something new. This kind of projects belongs to those, which are both presented and judged most easily, because there is no need of any deeper introduction.

*“Rainbow Ramsey Theory: Rainbow Arithmetic Progressions and Anti-Ramsey Results”* This is the classical case of so called stuffed title. The project titled like this would almost certainly place, even if the finalist hesitated elsewhere. On one side it is not concerned in certain part of theory as in the previous case, but directly with the entire theory. Progress is straight mentioned here and together with “anti” results. It is basically combination of previous two

types of titles in one. Progress can be understood as a synonym introducing something new and possible results hold straight for the entire theory. But not just the results, also “anti” results, which is again taken for meaningful positive, when the finalist proves, that something in given theory does not hold true.

“*Continued Fractions of Quadratic Laurent Series*” It is referred to the title delivering combination of two specific topics (Continued Fractions and Quadratic Laurent Series). It is related to another possibility, how to announce creation of something new. The point is that a combination of current things can promise something new. It is again related to easily “readable” type of the title, because the jury members generally know something about combination of current theories or topics or methods or they imagine what it is to expect from such combination. Instantly, a new horizon for discussion is about to open here.

3. *They contribute or they mean progress for given category or society.* It is good to describe contribution or progress right in the title of the project (see mentioned titles above). Every possible contribution is good to find and also highlight or present. The project then gains certain credit in the eyes of the jury. It gets importance, why it was actually carried out and that it is not „work for work“.

4. *They are explained comprehensibly.* Both good comprehensibility of verbal presentation and good English are great positive. At the beginning of the verbal presentation the finalist introduces his project to the jury member about 3-5 minutes. It is literally tragedy, when he feels touched that the jury member possibly does not understand eventually the presentation is not intelligible to the jury member. In any case, it is therefore good to be prepared for the feeling of success or failure about the meeting with the jury member and not to give “fatal” importance to it, because in a while another jury member comes and it is necessary to present for 100 percents (see Fig. 2)



Figure2: The finalists are waiting for the arrival of the jury members (source: the author)

5. *They were consulted by an academic or industrial expert.* He has necessary view of theory and practice and is able to coordinate the project well and to introduce it to the current category. He draws attention to assets and weak points of proposed solution and he can help with preparation for the fair. After that the finalist generally makes better in the related methodology.

6. *They have well-structured verbal presentation.* Jury members are used to established schemas and patterns. Any deflection means a possible loss in their evaluation or possible misunderstanding. It follows that the finalists are often rather helpless, if they come into the conventional environment of the scientific results presentation. Even if they get some base by the participation in the affiliated fair, it is good to cultivate them further, because the jury members consider cultivated presentation of the results as the base and every lapse from the established pattern can entail lower evaluation.

7. *They do not calculate with success beforehand.* The jury generally recognize very rapidly, whether the project has been done with enthusiasm for work or with calculation for success. The finalist excited for his work is in this case highly welcome.

The 7 points mentioned above form 7 aspects to improve the participation in the Intel ISEF. In doing so they are attached to each other. It is like the moving nativity scene shown in Fig 3. Single element pieces are firmly synchronized here through one another. If one of them misses, the pieces will move, but everybody sees that there is something wrong with it. In the fair the jury also reveals easily offences against conventions and established rules. That's why it is always better for the finalist to shine with his or her originality, but of course on behalf of the established rules.



Figure 3: Improvement of the participation in the fair is a set of connected elements (Nativity scene, Museum of Karlstejn, the Czech Republic, source: Iso Wyrsh, with permission)

Let's illustrate the use of the rules mentioned above by using an example of the possibly winning project. An author has finished the project titled "*The new electromechanical model of Watt's regulator*". In Fig. 4 there is a photo of the model. The author has applied 7 rules mentioned above for his project.

1. *Project fits well in the engineering category.* Each jury member knows that real models intended for lab-experiments are part of the well introduced engineering category. I felt good when presenting, since I said that the goal of the project had been construct a new model and mentioned lab-models which are currently used in labs.

2. *The title accurately says what the project is dealt with.* The project is defined well by the title. It is obvious at first view, what the topic of the project is and where to put it.

3. *Project gives progress.* It is new and nobody else has ever proposed such a model.

4. *Project is explained understandably.* Watt's regulator was used for locomotive steam engines. It was attached to the rotating wheels. Its task was to keep the speed of the locomotive constant as good as possible. It worked in the way that when the locomotive speed went up, axle base of the governor arms increased by centrifugal force. The piston-rod attached to the governor arms turned down steam supply and the locomotive slowed down. On the contrary, lower speed meant lower centrifugal force. Axle base was decreased and the piston-rod was moving in the opposite direction. It opened steam supply. There was more steam in the machine and the steam locomotive accelerated. So let's acknowledge that it is understandable.

5. *Project is consulted with the university expert.* He told me which models have already existed, explained the methodology of mechanical models and helped to formulate contribution of my project. He also suggested tiny corrections. After having consultations with him I really got the good view to this scientific category.

6. *Project has well-structured verbal presentation.* I introduced, which models have existed so far, which idea is leading and what the goal of the work is. Furthermore, I described, which parts the model is consisted of and which development steps were used. Some calculations are introduced. In the conclusion, I compared the model with the other models. I clearly explained and showed advantages and qualities of the model.

7. *I am a passionate designer.* I also invested some money in the model. I was making them by snacks sale which were prepared by my mum. But do not say it to her she would certainly be upset, because she prepared the snacks so thoroughly early in the morning. And my friends loved them (even such, that I had some waiting list and I could raise the price as well).



Figure 4: The electromechanical model of Watt's regulator (source: the author).

## **Appendix 2: High school students succeeded in science. Follow them.**

*One first and two fourth positions were occupied by our students in the U.S. world's fair.*

The view that a successful scientist has at least three academic degrees and spends all days in the lab is not quite accurate. Even young high school students might succeed in the world's scientific category. Having a good idea is enough and not to keep it to oneself.

High school students probably do not believe, that the school theme which give them some pleasure and in which they take more interest, can bring them up to the community of the Nobel Prize laureates. However, some of our students have succeeded by this way. This year six students from secondary schools participated in the World's contest for young scientists International Science and Engineering Fair (ISEF). The event that is annually held by an American non-profit organization for the support of science "Science Service" was this year participated by a total of 1417 young students – 736 boys and 681 girls nominated in an affiliated fair.

All of them came together to Phoenix in the U.S. state of Arizona in May 2005 to present their ideas and projects to both expert jury and laic public. At the end of the entire five-day-competitive party three of our secondary school students were awarded in two cases by the fourth and in one case by the first place during monumental grand award ceremony with participation of scientists and the Nobel Prize laureates. If we consider that in one scientific category there may compete about eighty up to one hundred of projects, it is a matter of real success.

How exactly to attain to such a placing? First of all it requires having an idea. For example, to think of how much Geography has changed since the days of the ancient maps, which way to improve mathematic graphs or why and how to fight against fungous diseases of plants. Then you have to send up your project to affiliated fair, to be nominated in this contest and you can set out for ISEF.

The special thing about the contest ISEF is, that instead of writing some extensive work you are about to prepare a presentation, which you vindicate orally afterwards. The presentation is possible to liken to some fair stand. Then the jury members and other visitors walk around and finalists introduce their results to them. They both show the results displayed on the presentation boards and they explain, what every result means. If we take into account, that you have to present your project in a foreign language to the jury, it is recommended to have both special knowledge about the project and some language skills. English with its vocabulary related to a given scientific category comes in handy, the finalists who are not able to make themselves understood in English can ask for an interpreter.

Young scientists have to spend two main days of the contest standing at their presentation stands which are arranged in the endless lines in one huge exhibition hall. Everything is split in sections according to current scientific categories. On the first day the exhibition hall is open only for the finalists, who are at their presentation stands and the jury members who walk around them individually. Each of the jury members is interested in what the work consists of and he asks questions. When presenting the work, an emphasis is mainly put on clear and understandable formulation of goals, used scientific methods, the results and contribution of the project for the society. It is considered that every work is visited by five up to six jury members in average. The second day the students' projects in the exhibition hall

are accessible to public. The neighboring schools and parents with their children particularly come to meet the finalists' projects and finalists answer their questions. The goal of the public day is to find out whether the finalists are able to explain the principle of the project understandably and briefly and its contribution to outsiders.

### **Appendix 3: What abstract I created**

#### **New Task for Human Intelligence Measuring**

My name

My school address

Intelligence measuring is a part of many tenders for attractive leading functions in the major world companies. Intelligence is perceived here as a set of dispositions to learn and solve problems. It is measured by the specialized tests which are taken by applicants. However, they do not contain the questions focused on symmetry observations that are the one of the essential feature of nature. These observations have possibility of predicting much about human intelligence. That's why this project analyses the task of symmetry in human intelligence and on its base it proposes new method for intelligence measuring.

The proposed method works with symmetric matrices. It makes use of basic feature of symmetric matrices that is the matrix symmetry according to its diagonal. The task of the tested applicant is to distinguish symmetry and its usage to complete the missing matrix elements. In doing so, two cases are distinguished. The missing element lies either on the main matrix diagonal or beyond it.

The achieved results show, that intelligence measuring by using the proposed method is basically more precise than by using the known methods up to now. It is also shown that time necessary for testing can be reduced up to half. In doing so, symmetric matrices are programmed well on the computers. In such way the testing tasks can be graphically very schematic.

If the proposed method was tested by the firms, specialized in intelligence measuring, they could test more applicants during the same time. It would bring them greater flexibility when testing and it would save financial costs. Moreover, it was done with essentially more precise results. The applicants will meet requirements of world companies better.

### **Appendix 4: What paper I created**

#### **New Task for Human Intelligence Measuring**

My name

My school address

**Abstract:** *Intelligence is perceived as a set of dispositions to learn and solve problems. We can deduce about intelligence from the degree of acquired education and from success in the*

*occupation. If we need more precise evaluation, we use sets of specific testing tasks. This paper is concerned with developing the original testing task. It originates from symmetry observing, that is one of the fundamental feature of nature. The paper analyses the proposed symmetry task in details and also the possibilities of its solving and evaluating.*

**Key words:** intelligence measuring, testing task and symmetry.

## 1. Introduction

Human intelligence measuring is a part of many tenders for attractive leading functions in the major world companies. In literature [1] there is a typical test introduced, which is used for intelligence measuring. It is a collection of several testing tasks. They are evaluated by points. All achieved points are scored to the tested applicant. When evaluating, the following proportion holds: “the more the number of achieved points and the less time necessary for working out, the higher the intelligence level is”. If we look at the test in [1] in more details, we can see, that just one testing question regarding symmetry is involved. It introduces four symmetrically written numerals and the tested person is about to continue in this sequence.

Symmetry has fascinated human mind since the beginning of time. It is often very hard to recognize it. Latter useful ability relates to intelligence. We say about an object that it is symmetrical, if it is possible to do something with it and it remains the same, as it was before. The objects are often symmetrical in nature. Perhaps most symmetrical object, which we are able to imagine, is a ball and nature is full of them. They are stars, planets and water drops. Crystals show a great amount of various kinds of symmetry. Animals and the realm of plants show a certain degree of symmetry. Mathematical formulas of physical laws are symmetrical related to certain transformations since they do not change when making these transformations (e.g. Lorentz’s transformation, specified in [2]).

In regard of such important natural principle in its diverse forms, there is not sufficient how it is used in the intelligence measuring. That’s why in the following there is another testing question introduced, which is based on this important feature in completely another form than in the [1].

## 2. Used theoretical tools

In the following we are going to work with matrices. The current marking of matrices will be used. It means that we will mark matrices in upper case  $A$ ,  $B$  and others. Their elements will be denoted in lower case,  $a_{ij}$  will be an element of matrix  $A$ . Recall the basic definitions. Matrix of the type  $(m, n)$  will be understood the arranged table of the numbers of  $m$  lines and  $n$  columns

$$A = \begin{bmatrix} a_{11} & \dots & a_{1n} \\ \dots & \dots & \dots \\ a_{m1} & \dots & a_{mn} \end{bmatrix}.$$

Symmetrical is such matrix, for which the equality  $a_{ij} = a_{ji}$  holds for each element. Clearly,  $a_{ii} = a_{ii}$  holds for all the elements of the diagonal.

### 3. The formulation of new testing task

The proposed testing task makes use of the basic feature of symmetrical matrices, which is symmetry according to diagonal of matrix. Purpose of this testing task is to recognize symmetry of matrix and to complete the missing element. In doing so, two cases might occur. The missing element lies either on the main diagonal or beyond it.

1. If it lies on the main diagonal, it results in any number which is possible to introduce in the testing task. It has no effect on matrix symmetry. An example may be given by

the following matrix  $A = \begin{bmatrix} 7 & 17 & 3 \\ 17 & ? & 12 \\ 3 & 12 & 100 \end{bmatrix}$ . In the position of the missing element we can

complete arbitrarily, for example  $16 A = \begin{bmatrix} 7 & 17 & 3 \\ 17 & 16 & 12 \\ 3 & 12 & 100 \end{bmatrix}$  or  $1.33 A = \begin{bmatrix} 7 & 17 & 3 \\ 17 & 1.33 & 12 \\ 3 & 12 & 100 \end{bmatrix}$

and so on, without disturbing feature of matrix symmetry.

2. If the missing element lies out of the main diagonal, then the right completion is unique. For example, if an element  $b_{ij}$  is missing, whereas  $i \neq j$ , unambiguously the right answer is to introduce the known element  $b_{ji}$  in the position of the missing element, if the tested person is able to recognize the symmetry of matrix. Suppose for

example matrix  $B = \begin{bmatrix} 7 & 17 & 3 & 10 \\ 17 & 1.33 & 12 & 97 \\ 3 & 12 & 100 & 111 \\ 10 & ? & 111 & 0 \end{bmatrix}$ . Number 97 ( $=b_{24}$ ) is the right solution.

The way of the test evaluation is identical as in [1], it means for the right answer in both cases (in the first case the right answer is any number) 10 points, 0 points for the wrong answer.

### 4. Conclusion

The original testing task was proposed for the collection of questions aimed at human intelligence measuring. Experimental results including this testing task show the competence of such a task insertion, because success factor ranges close to value of 0.5. 768 randomly chosen people were tested. It shows the average intelligence, which is in accordance with [1].

### References:

1. J. Stepanek (1991): *Systemic and operation analysis*. Additional lecture notes. Edition centre CVUT Prague.
2. R.P. Feynman, R.B. Leighton, M. Sands (1985): *The Feynman lectures on Physics 2*. Alfa Bratislava 1985. Translated from the English original "The Feynman Lectures on Physics" published by Addison-Wesley Publishing Company in 1966.

## Appendix 5: Presentation of the photo-gallery

Source: the author

Figure 1 – Radar modeling of Hurricanes

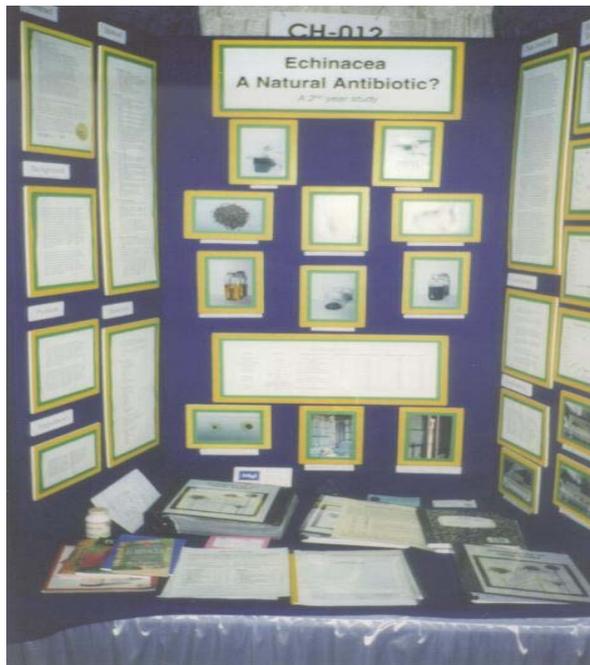
Figure 2 – Echinacea: Natural antibiotic?

Figure 3 – Evita Peron: A Woman, A People?

Figure 4 – Can Potato Produce Electricity?



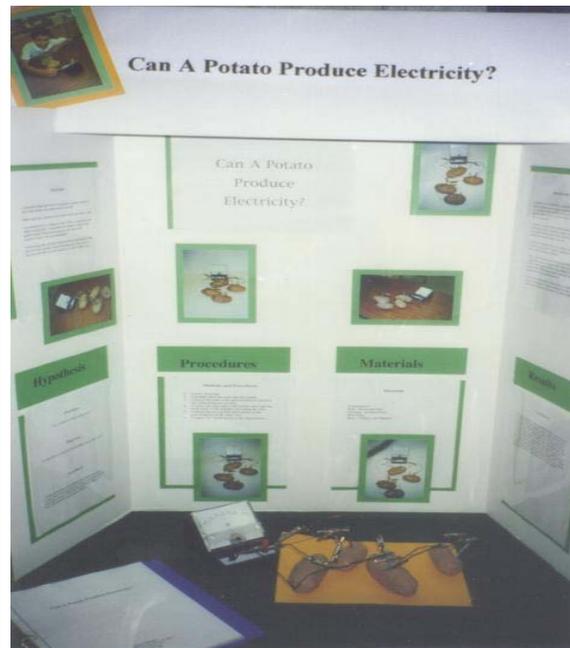
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## Appendix 6: The report from Intel ISEF 2005

Early mornings in May are being cold and the Saturday morning was no exception. While the celebrations of the anniversary related to liberation by American and Russian army from the WW2 were about to launch in many places, at the Prague airport a group of young people came together. They were loaded by not only common travel luggage, but also boards for the presentation of their projects. The goal of their journey was Phoenix in the U.S. state of Arizona, where the world's contest of young scientists Intel ISEF 2005 was held for the laureates of affiliated fairs.

The great number of participants from all over the world reflects that it was really a grand party: 763 boys and 681 girls. The contest is annually held by Science Service, U.S. non-profit organization for science support. The major sponsor of the contest is Intel Corporation (it mainly produces processors for computers). The Czech part of the Intel was also the sponsor of our participation in the ISEF.

When we say Phoenix and Arizona, it evokes the closeness of breath-taking natural sceneries, such as Grand Canyon (Fig. 1) or Sedona. However, it also is associated with heat, deserts and a very long journey. The city itself is situated in the desert area abundant for cactus woods. The fellow countryman would characterize it saying: this place is not for picking mushrooms. Thanks to an early departure and nine-hour-time lag we reached Phoenix the same day in the evening and in spite of being tired we moved into a booked hotel. However, one strange thing drew our attention. There were palms growing along the ways and from time to time we could see live fence of orange trees full of berries. To stretch out our hands was enough.



Figure 1: Scenery of Grand Canyon (source: [photos.reinvented.net/albums/grandcanyon/](https://photos.reinvented.net/albums/grandcanyon/))

On Sunday morning there was registration. Registration was provided in the Convention Centre called Phoenix Civic Plaza in the center of Phoenix (Fig. 2). It was separately for national and separately for international teams. The concern was for the administration check

of formal proprieties and payment of registration fees. Within the scope of registration the organizers also provided identification cards for all the finalists and escorts as well. It is impossible to get into the exhibition hall, venue of the contest, without those identification cards. The next step of successful registration of the finalists is to get so called golden stamp for their projects, which enables each finalist to build his or her presentation stand. If project has a violation, the latter must be corrected before obtaining the gold stamp. Sometimes, it is not so easy due to poorly written abstract, infringement of the fair regulations etc. Therefore, a “home” preparation to the Intel ISEF is so important to have no violence.



Figure 2: Entry to the Convention Centre (source: the author)

The rests of Sunday, Monday and Tuesday are reserved for building presentations, clearing violations, trips to the surroundings (Grand Canyon and Sedona were taken for granted) and opening ceremony. Presentation stands are built up by each finalist in the pre-arranged place according to the selected scientific category of their project. Each finalist learns this place when registering. Presentation stands inform about the content and the main results of his or her work. Such presentation is possible to compare with the fair stand. Visitors walk around. They are mainly the jury members here. The finalists introduce their results to them by talking and showing the results displayed on presentation boards of each stand.

Most of the finalists took advantage of diverse offer of trips across Phoenix and its surroundings. They were rafting, walking around Sedona, amazing at Grand Canyon or watching rodeo show. They tried to energize themselves that way for Wednesday major competitive day and at the same time they were getting to know typical life of Arizona. Opening ceremony underwent on Monday evening outdoors, in the area of local university. The finalists apart from catering through local tidbits and a disco could visit the museum of history of Arizona or the house of science and technique, where it was possible through many practical experiments to observe functioning of various machines, devices, physical phenomena and live organisms. Furthermore, we were enabled to drive various drive-simulators of cars, planes and rackets.

Wednesday morning was a very hot day, so typical for local climate. All the finalists gathered together at their presentation stands. Big number of the finalists and endless lines of presentation stands are involved in one exhibition hall. Everything is split into scientific

categories such as mathematics, physics, informatics, chemistry and others, 15 categories in total. How it feels in such a hall during the contest, it is shown in Fig. 3.



Figure 3: Part of the exhibition hall including presentations (source: the author)

The exhibition hall is accessible only to the finalists on this day, who spend all day standing at their presentations. The jury members approach presentations sequentially. Each of the jury members listen to what the project consists of and he or she asks questions. While presenting the project, an emphasis is mainly place on clear and understandable formulation of the goal, used scientific methods, the results and whole contribution of the project. Each project is visited by 5 up to 6 jury members in average. The interpreter can help during oral presentation of the project, if the finalist asked for him. However, there might be one big danger. The interpreter might not have to know technical and other specific terms.

On Thursday as well the finalists are asked to be at their stands, because all the presentations are accessible to public on this day. Especially the neighboring schools take advantage of this opportunity and the finalists introduce projects and answer questions about them. Presentation skills of the finalists are developed again during this day. They must explain understandably and briefly the base of the project and its contribution to people, who are not universally related to the problem.

It is Friday, when the fair is over. It is reserved for grand award ceremony including the announcement of the results. Its signification is highlighted by participation of the major statesmen of Arizona, managers, scientists and the Nobel laureates. Grand ceremony brings our enjoyment and our success. One of our projects places first and then two projects place fourth. In such great competition (in one category there are about 80 up to 100 works) it is really considered a great success of our young scientists.

## **Appendix 7: How to deal with the verbal presentation**

1. *To select the right conception of presentation.* So called SPAM model (Situation, Purpose, Audience and Method) is used here which is related to success. The finalists are concerned to talk with regard to the situation (scientific contest), to the purpose (justification of the project, especially introducing of his or her own results and contribution), to the audience (the member of the jury, the expert directly from the field or related field) and to the method of presentation (understandable, simple, convincing and not too long – 5 minutes maximum).
2. *To choose the most important points.* Generally, it holds that thoughts and ideas come up if our mind is clear, so that we can exactly talk on the topic. The main points of the oral presentation is reasonable to write down in the form of the key words or phrases chronologically, how the presentation will move forward and to place them in the presentation stand.
3. *To talk about the content of the verbal presentation with an expert.* He has experience and knows the present state. It will refresh the presentation which is being prepared and on the presented problems we can get another point of view. It can influence credibility of the presentation positively.
4. *To consider, that the jury member is scientist who is otherwise perceptive, but he is to be skeptical according to the job specification.* That is why it is important to focus on logical procedure of the oral presentation and step by step to convince the skeptical jury member about benefit of our project.
5. *To take the content of the presentation stand as supporting material.* A right oral presentation is not a copy of the stand posters. However, it is useful to add some photos, graphs, tables/schemes, computer show, real model, humor etc. to the oral presentation.

## **Appendix 8: Considerations and observations why projects do not win awards**

The cause of not winning some of the awards could be:

1. Insufficient attention from the finalist's side to the documents preparation before the fair could be serious handicap during the fair.
2. Inconvenient choice of the scientific category. The project placed in the "Mathematics" by its content was rather to be placed in the "Computer Science". Contribution to the mathematics was not apparent, but contribution in the category of "Computer Science" was clearly and unambiguously visible and easy presentable. I am afraid that the jury above all consisted of mathematicians was not able to appreciate it properly.
3. Non-tactic oral communication with the jury members. Generally the students have no specific training of verbal communication with the jury members. That is why it rather depends on natural talent and communication skills. The jury members need to hear simply to achieved results and contribution.
4. The project seems to be a too specialized science (the finalist also publishes at the international conference), but the jury members cannot see clearly such things as practical contribution, the finalist's contribution to the whole project or the demonstration of some experiment.

5. The central idea of the project will remain lightless, the experiment results are unconvincing and excitement and dilettantism result from the project rather than some respectable attempt.
6. One of the jury members discovers a tiny mistake in the work. Although it does not mean that the results in a whole are going down, it influences evaluation. It is interesting, that nobody has discovered that mistake before at the affiliated fair.

Each “tiny thing” is visible in such project competition:

1. The project was very attractive through the media. It was even shown in a short film about the contest, which was screened at the end. The finalist linked special abilities to verbal speech very well. Because the experimental research which lacked some deeper theoretical analysis was concerned, I mean that just this could take effect on the jury members of the physics unfavorably from the point of possible awarding among about the 70 projects.
2. The project put effort rather on graphic design and figurative description. Appropriate “mathematics” remained a little bit in the background of the presentation and attempting. I mean the jury members-mathematicians would rather see there that mathematics is in the first position here. It would probably be better in this case to place the project for example in the category of “Engineering”.
3. The work solved the problem which was tightly bounded and socially interesting. However, the deeper insight into the problem, knowledge and more professional interest were missing. The finalist simply did not live for the problem, he did not have the problem in mind for full time, he did not wake up with the problem in mind and in the evening he did not fall asleep attached to that problem. Moreover, during the presentation he reacted kindly, but a little bit uncertainly.
4. The project solved the problem which had a clear goal, method, conclusion and also practical application. Such kinds of projects are often placed in the medal positions (it is enough to study through the index of awards). The finalist was also well prepared from the technical point of view. However, the presentation poster was a stumbling block here. Although “the new method” was the center of gravity of the project, there was just a range of photos on the presentation. There was no word about a method. Moreover, the author of all photos (source of figures introduced in the presentation is a must) was a father. So the jury members had the right to ask where the own work of the finalist exactly was. Even if having very good oral presentation the jury members had to ask: who is exactly the author of the project, the finalist or his father.
5. Through “the annual school” it is visible, what high-quality verbal presentation and the ability of good communication with the jury members really involve in this fair. After all that it was also confirmed by public shoptalk with several jury members. Verbal presentation is very hard to realize with full interpreting, because the interpreter generally does not know technical expressions. While the posters serve well to attract attention of passers-by (of course the jury members as well), verbal presentation and excitement are absolutely the key ones for the thing.
6. The project was awarded in the international contests of similar type, however in the Intel ISEF did not win grand award. What could the jury members of the Intel ISEF discourage from this project? Maybe paradoxically the obtaining of another award (the gain of another award does not have to lead to necessarily to the winning the award here), maybe performing from the position of “the star” (verbal presentation was not

from the position of the enthusiastic scientist), maybe exaggerated ambitions (I have another prize, I will automatically get it here as well).

7. The project was good (as all the works in the contest), however it solved the local problem too much. The project did not get out of this “shell” towards wider signification or contribution.

Two real observations:

1. Over the years of participation in Intel ISEF I have experienced several winners. Surprisingly he was the finalists who were extremely communicative and enthusiastic for the thing and it was their great interest to search for some bookshop related to science and to buy literature associated with their project from their spending-money.
2. Some similar device contested in the category of Engineering as was the result of our project. However, it was not focused so widely as our project as possible to measure physical magnitudes, but it measured the speed of sound. It means it had some particular focus. It was constructed for the specific purpose. It won the second grand award. It seems that the project with the clear determinate purpose might be evaluated more positively than the general project.