

TopDev Association

Subject of the programming contest

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Subject of the Contest

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I. THE PROCESS OF THE CONTEST

I.1. Schedules

The beginning of the competition : Friday January 27th 2006, 14:00:00 (GMT+1, hour of Paris, Copenhagen, Madrid)

Deadline for submission : Sunday January 29th 2006, 23:59:59 (GMT+1, hour of Paris, Copenhagen, Madrid)

All deliverables described further on, will have to be on the server before this deadline.
The delivery order must be sent to the email : topdev06@gmail.com

Once this delivery order is received, access to the delivered files is locked.

I.2. Conditions of use of the servers

Disk space and CPU resources on the TopDev Server provided to you, are meant to be used only for simple tests. It has a limited memory and treatment capacity. Each candidate using too much server resource could be excluded from the TopDev Contest.

Even if files delivered in the disk space happened to be technically still accessible after the submission deadline, their modification after the deadline is forbidden, and the infringement of this rule will lead to exclusion from the TopDev Contest.

I.3. To be read !!!

I.3.1. Documents describing the contest subject

This subject of the contest is composed of :

- The present document, being a file containing
 - general specifications
 - detailed specifications
 - a description of the requested deliverables
- One text file making up a test set
- A zipped directory containing :
 - Some pictures
 - a CSS file
 - Some screenshots describing the graphic charter

I.3.2. Deliverables

Deliverables are :

- the software application, installed and directly usable on the provided disk space (except for J2EE developments)
- Source code of the software application (uncompiled source code) and the process describing its installation (if compilation is necessary)
- Compiled source code of the software application and the process describing its installation.
- the database structure dump (including, if necessary, the creation of entries in the database) in a .SQL format
- a documentation (see below)
- a delivery order (see below)

Your deliverables must be in the « contest » directory on your private area (you will explain where is this directory in your delivery order). It contains 2 sub directories :

- « source » : compiled and uncompiled source code
- « doc » : .SQL, documentation, delivery order

What is more, in the « contest » directory, put a « your_login.zip » which contains both sub directories source and doc.

I.3.3. Description of documentation to be delivered

The purpose of the documentation is simple :

It must contain all pieces of information necessary for a quick understanding of the realised development.

It must enable the jury to comprehend your work as fast as possible.

This part of the contest tests your capacity to communicate, your ability to transfer your knowledge, and the maintainability of your work.

Some examples :

- to describe the role of a complex method, with the basic structure of its algorithm. Note : The purpose is not to provide description of very simple items, such as, e.g. get_id() methods.
- to explain the algorithm enabling the generation of questionnaires
- to list the session variables
- to describe the content of the cookies
- to specify what and where are the global parameters of the application
- ...

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Furthermore, following information will be necessary :

- an explanation of how to deploy the application (especially if particular data needs to be created)
- a detailed description of the database (especially if temporary tables exist, or if the use of some fields or tables needs to be explained)
- a methodology describing how to set up another language
- a general procedure explaining how to exchange data towards external software applications (as described at the end of the present document)

It is not necessary to write a voluminous documentation, around 5 pages should normally be largely enough.

PLEASE TAKE CARE TO USE CORRECT ENGLISH OR FRENCH !!!

I.3.4. Delivery order

The delivery order will be sent per e-mail to following address : topdev2006@gmail.com

The e-mail's subject will be : Login - Delivery order

The e-mail will contain the delivery order (directly in the e-mail's body).

It will describe all functionality present or missing in your application software.

II. TECHNICAL SPECIFICATIONS

II.1. Common technical specifications

II.1.1. Database

One unique database will be available for the contest (MySQL 4.1.16).

User names, passwords, database name,... will be included in a parameter file.

Please define carefully the field or table names. All table names should begin with the same common prefix, being equal to your login.

Indexes, temporary tables, possible system for creation of tables with prefixes... must be presented in the documentation.

II.1.2. Multilingualism

The application will have to be multilingual, i.e. to be potentially accessible by a user in any available language.

For the contest, only one language will have to be set-up, but the addition of a second language will have to be quick, easy, and the procedure for the translation will have to be duly documented in the delivered documentation.

II.1.3. Browsers

The created web site has to be designed for use with both Microsoft Internet Explorer (6.0.x) and Mozilla FireFox (1.0.7).

Cookies and javascript can be used.

ActiveX or Applets can be used as well.

II.1.4. Others...

Your application must be running regardless of the path of its main directory : even if the main directory is not the top directory, all links will have to keep working.

The file "index.html" will have to point towards or to redirect the user to the main home page of your application.

Pictures and CSS files provided in the Graphic Charter may be modified (this is even recommended), provided that the final application respects the general "look and feel" defined in the Graphic Charter.

Please take care to clearly structure your source files and directories.

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The use of external tools is authorized, but they will have imperatively to support the GPL license. Their installation will have to be possible without requiring a "root" account. If an external software application has to be used, it will of course have to be properly documented : Each tool used will have to be mentioned in the documentation, with URL where the application can be downloaded and where documentation can be found.

IMPORTANT :

One of the main points of the TopDev Contest is the easiness with which the Jury will manage to understand your code.

This will be decisive for the designation of the winners of TopDev 2006.

II.2. Language-specific Technical Specifications

II.2.1. Python

Python coding will lean on an Apache server in mod_python.

Versions are :

- apache : 2.0.51
- mod_python : 3.1.3

You have to install your application on the [topdev-amen.be \(62.193.238.115\)](http://topdev-amen.be) in your private directory.

The http access is : http://your_login.topdev-amen.be

II.2.2. PHP

PHP 4 and PHP 5 are authorised for TopDev 2006.

PHP4 version is : 4.3.x

Files will have to have the extension .php4 or .php

PHP5 version is : 5.0.x

Files will have to have the extension .php5

The use of template managers and other GPL-licensed tools is authorized, but they will then have to be exclusively made of .php files.

You have to install your application on the [topdev-amen.be \(62.193.238.115\)](http://topdev-amen.be) in your private directory.

The http access is : http://your_login.topdev-amen.be

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II.2.3. .Net

.Net environment is 1.1.

Authorised languages are :

- c#
- VB.Net

You have to install your application on the topdev06-amen.be (62.193.237.122) in your private directory.

The http access is : http://your_login.topdev06-amen.be

II.2.4. Java

The presented problem is simple, and may be handled using only JSP and Servlet, hosted on a Tomcat server.

The delivered application software will have to be installable directly on a Tomcat server. The system will have to work in Windows and Linux environments.

TomCat version is 4.1.31 (or Tomcat 5.0.19 which is installed on your personal TopDev environment)
JDK : 1.4.1

Delivery will be made through .war file, to be left in the "contest - source" directory. The name of the application will be your login for the contest.

You have to install your application (not the .war) on the topdev06-amen.be (62.193.237.122) in your private directory.

Your files must be in the directory <httpdocs/java>. (you must create the [java](httpdocs/java) directory)

The http access is : <http://topdev06-amen.be:8080/subdomains/yourlogin>

This TomCat restarts every hour. (from hh:00 to hh:02)

If the proposed solution uses J2EE, Struts or another framework, the documentation will have to be very accurate (installation, deployment, model...).

In this case, the documentation should contain more than 5 pages.

III. SUBJECT OF THE CODING EXAMINATION

III.1. General functional background

The application software will be implemented by a company providing a skills evaluation system thanks to questionnaires ('quizzes'). Skills evaluation system can be used by single persons or by companies to evaluate their employees' or candidates' skills.

The target is to set up :

- An interface to manage the questions and the themes available for this questionnaire
- A tool generating questionnaires on demand using the questions database
- A system, where candidates to the skills evaluation system answer to the generated questionnaires
- A reporting tool for statistical analysis of the results, enabling to send information to third parties (client companies sending candidates)

The questions are created by questionnaire managers via a dedicated interface.

A questionnaire is made up of themes, each theme containing a certain number of questions. The questions of each questionnaire are randomly chosen among the available questions in the questions database. A balancing system must ensure that all generated questionnaires have the same difficulty level.

To answer to the questionnaire, a candidate must choose for each question among possible values for answers, or skip the question and go to the next one. To finish a questionnaire, a candidate must answer (or skip) to each question for each defined theme. The candidate has a time limit to answer to the questionnaire. A candidate can answer only one questionnaire at the same time.

Results will afterwards have to be analyzed statistically, and information about the results will have to be sent to third parties.

There are two possible uses for the application :

- Either on the internet, having in this case a rather infrequent use : about 2 simultaneous users
- Or locally, in class or exam rooms, having in this case more than 30 people using the application at the same time

NB : Keep this in mind, in order to limit the memory usage.

There are three user profiles :

- Questionnaire managers : they create the quizzes, specify the themes, define the questions and possible answers. Furthermore, they analyze the results of the candidates, and carry out information exchange to third parties. (Questionnaire managers are called 'Managers' in this document)
- Authenticated candidates : After being registered and authenticated in the site, they can answer the quiz and their results will be stored in the database. (They are called 'Authenticated' in this document)
- Not authenticated candidates : Visiting the web site by internet, they can answer the quiz but their results will not be stored in the database. They can find links to register or to sign in. (They are called 'Anonymous' in this document).

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Roles of the Managers are :

- The creation of the base of available questions.
- The definition of the possible answers of each question (multiple-choice questionnaire)
- The definition of the correct answer for each question
- The determination of a weighting factor (representing the difficulty of the question) for each question. Default weighting factor is equal to 10.
- The assignment of each question to a theme.

Questions will be presented grouped by theme. All defined themes will have to be tackled by each candidate answering a questionnaire.

A questionnaire is composed of a given number of questions per theme, randomly drawn out of the possible question base for this theme. The number of questions is the same for each theme per questionnaire, defined in the site parameters (to be chosen : txt, XML, database, ...). The design of an interface for maintenance of these parameters is not necessary, but the explanation of these data has to be present in the documentation.

The average weighting factor of a generated questionnaire must be equal to the default value (set to 10) for each theme.

Furthermore, a system will have to be dedicated to the validation that all questions can possibly appear in at least one questionnaire. In other words, a program has to verify, that, for each question, a questionnaire exists containing this question and having an average weighting factor equal to 10, taking into consideration the weighting factor of the question, the weighting factor of the other questions, and the number of questions to be selected per theme.

A user of the application is recognised after authentication as being a Manager thanks to a field to be defined in the database, which contains a particular value for Manager registered users. It is not necessary to plan an interface to modify the value of this field (modification done directly in the database).

III.2. Detailed Specifications

III.2.1. Home Page

The Home page is the first page of your site, and contains the links giving access to all services.

See the sample page in the graphic charter to see how the application should look like.

This Home Page is composed of :

- an authentication system (only for Anonymous)
- a link for registration (only for Anonymous)
- a link to answer a quiz (for all)
- special links for the Managers (only for Managers) :
 - Manage themes and questions
 - Access to statistical data on past tests
 - Check consistency of questions' weighting factors
 - Exchange information with third parties

If the user is authenticated, the first text of this page is : « Hello FirstName Name »

III.2.2. Registration

Only Anonymous people are able to register.

This page is composed of 6 free fields with a maximal length of 30 characters.

Field Name	type	detail	example	mandatory
Last Name	string <30 characters		COASSIN	Yes
First Name	string <30 characters		Damien	Yes
Login	string <30 characters	Must be unique	P025640	Yes
Password	string <30 characters		*****	Yes
Password confir- -mation	string <30 characters		*****	Yes
Company customer	string <30 characters		TopDev, Learn- ingTree	No

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To simplify the data for the contest, the last field 'Client Company' will be a single string field, in which users will themselves write the name of their society. NB : in a real life, this field will be completed by a back-office employee, chosen inside a list of Client Companies. Internet users do not belong to any Client Company.

This registration is only possible if the 5 first fields are not null, if the login is not already used by another declared user, and if both passwords (password and confirmation) have exactly the same value.

At the end of the registration, the user is automatically redirected to the Home Page, becoming at same time Authenticated.

In case of errors, the user stays on this page, and errors are displayed in red.
A link button 'Back to Home Page' is always present.

A user is known as 'Manager', thanks to a particular field defined directly in the database (please just explain which one in your documentation, no interface for modification required).

III.2.3. Manage Themes

From the Home Page, This link "Theme Management" leads to a page displaying a list of all defined themes inside a table, with a button to create new themes, and offering possibility to modify each theme.

A 'theme' is only a single string, with less than 100 characters (for example : "questions about PHP", "questions about UML",...).

The number of themes is not limited, but, in normal use, it will not exceed 3.

(this part of the contest is not an essential point. You should avoid to spend too much time on it)

On this page, a link gives access to the list of all questions belonging to each theme ('Manage questions of a theme').

III.2.4. Manage questions of a theme

On the 'Theme Management' page, from each theme, you can access to the list of the questions linked to this theme.

The questions of the theme are listed in the chronological order (most recent on top). Only the first 100 characters of the question and the weighting factor are visible. A click on the question text opens the modification page for this question.

At the bottom of this page, a button opens a page enabling the creation of a new question. The newly created question will necessarily belong to the current theme.

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III.2.5. Create a question

At the bottom of the list of questions belonging to a theme, a button "Add a question" opens the page enabling to create a new question.

This new question will be linked to the theme where was the button "Add a question".

To create a new question means to write the question text, to write 4 answers, to tell which answer is the correct one, and to give a weighting factor (representing to the question's difficulty).

The fields needed are described in the following table (obviously, you are allowed to add any other necessary field in your database)

Field Name	type	detail	example	mandatory
Question text	Text without limit (about <2000 characters)		« Which of these functions is used to count charac- ters in a string? »	Yes
Coefficient	Integer (bigger than zero, lower than 20)	Default value (de- fine in the global parameters)	10 12 5	Yes
Answer A	Text without limit (about <2000 characters)		ComptNbCar()	Yes
Answer B	Text without limit (about <2000 characters)		str_count()	Yes
Answer C	Text without limit (about <2000 characters)		strlen()	Yes
Answer D	Text without limit (about <2000 characters)		strstr()	Yes
Right Answer	(your choice)	From the list of answers	(your choice) Answer B	Yes
Theme	string < 100 char- acters	From the list of themes	Questions about PHP	Yes

The layout of the page is presented in the graphic charter.

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III.2.6. Modify a question

To modify a question, the 'Manager' has first to retrieve the question (using the previous process). Then, after selection of the question to modify, the modification page looks like the creation page.

But, it is not possible to modify which is the right answer (especially since the question has already been answered in a quiz). This rule helps the storage of the past quiz results.

The link to the theme is also not modifiable.

The only part, which can be changed, is the content of the question, the text of the 4 answers, and the weighting factor.

The controls of mandatory fields are the same ones as during a creation.

III.2.7. Delete a question (out of scope)

The deletion of a question would imply some severe functional consequences, and is therefore not in the scope of the TopDev contest.

III.2.8. Check consistency

This part of the contest gives you the possibility to choose between 3 difficulty levels. 3 different specifications are offered. According to your skill level and to your available time, you will have to choose between one of the described options. Please choose your option and specify in the delivery order which option you took.

Consistency check has to verify several aspects :

- that at least one questionnaire is realisable :
 - the total number of available questions for each theme is greater than the number of questions per theme, defined in a parameter,
 - for each theme, the set of available questions enables the construction of a questionnaire having an average weighting factor equal to the default value. (Counter-example : If the default factor is 10, and all questions of a theme have a factor equal to 5, then it is impossible to build a questionnaire with average factor equal to 10)
- that no question is "inaccessible", i.e. that each question has the possibility to appear in at least one questionnaire (see hypothesis below). It is not necessary to check that the probability for a question to appear in a questionnaire is the same for all questions.

Search for "inaccessible" questions : Choose your option and specify it in your delivery order.

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Option 1 (simple) :

Hypothesis is made, that the number of questions asked per theme is even (multiple of 2).

The questionnaire generation system will then have to take the questions 2 by 2 : Each question selected must then be linked to one question having the "complementary" weighting factor, so that the average of each couple of questions is equal to the default value.

This is only possible if the number of questions to be asked per theme is even.

Coherence check is then simplified, because for each question to be "accessible", we only need to look for a "complementary" question.

Example (based on an average coefficient equal to 10) : If a question has a weighting factor equal to 7, we only need to find a question with weighting factor equal to 13 to be sure that the question is "accessible".

End of Option 1.

Option 2 (average difficulty) :

The number of questions asked is free, bigger than 2.

Hypothesis is made, that coefficients of the questions of each theme are regularly dispatched around the average coefficient (equal to 10)

To generate a questionnaire, the following method can be used :

1/ process A

For each theme, **N** questions are randomly selected. If the average of the coefficient is not 10 :

You have to check if one of the **n** selected questions could be exchanged with another question in the base, to get exactly the right average for this theme. (i.e. **S** is the sum of the coefficient of the **N** questions selected, **Cn** the coefficient value of each **n** selected question ; you must find if a non-used question exists in the base which coefficient value is : $10*N - S + Cn$)

If no exchange is possible, go to process B.

2/ process B

if the average of the **N** selected questions is bigger than 10, one of the selected questions (with a coefficient bigger than 10) must be randomly exchanged with a non-used question in the database (with a coefficient lower than 10). And reciprocally...

This process B must be launched several times (and the average will become nearer of 10). It will be launched 3 times (which is an imposed choice from TopDev)

After these 3 launches, if the average is not right, process A will be launched one more time.

In order to avoid any infinite loop, it is necessary to limit the sequences of these 2 processes A and B to a fixed number of times (limited arbitrarily to 3 times). If after all, no questionnaire has been created, an error message will be specified. And it will be necessary to start again the generation of a questionnaire.

Consistency check has to try to generate a questionnaire with the processes A & B, by fixing one question (which could not be exchanged during various processes A and B). And to check this by fixing each question of the base.

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This process of checking can be optimized with the following reflexion: To fix one of the N questions whose coefficient is C_n , is the same thing as To check if a questionnaire can be generated for $N-1$ questions, to obtain a sum of coefficients equal to : $N*10 - C$.

(Nota : this checking method is not exhaustive)

End of Option 2.

Option 3 (exhaustive method) :

A question is valid as soon as it belongs to at least one combination of questions with the right average coefficient.

The verification is performed, question by question, by withdrawing from the search space (defined by the set of questions to be validated) the questions that belong to a valid combination.

The process ends when a question does not belong to one of all possible valid combinations or when the set of question to validate is empty.

The subsidiary query is to provide (in your documentation) the complexity of your algorithm of validation (from the theoretical and practical points of view).

The extra-bonus is given when the management of the validation uses a differential representation depending on the deletion (and modification,...)of questions between two demands of validation.

End of Option 3.

These checking processes can be optimized with the following reflexions :

- if one question with a coefficient C is « accessible », every question with the same coefficient is also « accessible ».
- When a question is verified as « accessible », every question being in this right questionnaire is also « accessible ».

The Manager check this consistency from a button in the home page.

The result of this checking is written like :

- « a questionnaire can be generated» or « impossible to generate a questionnaire »
- "every question is accessible" or "the question with the coefficient XX is inaccessible"

Only one of the inaccessible question has to be showed in the result page.

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III.2.9. Answer a questionnaire

Any candidate can answer a questionnaire and see his score at the end of the questionnaire. Results will however not be stored for Anonymous users.

A candidate can answer to one questionnaire at a time, but can answer successively to as many questionnaires as he wants. Note : This is only for the contest, in real life environment, a candidate would need to pay beforehand in order to be entitled to answer a questionnaire. This simplification only aims to ease the unit tests for the TopDev contest.

Dates and hours of the questionnaire must be stored for authenticated candidates.

The questionnaire is generated at the moment of the request to display a new questionnaire. The number of questions per theme is read inside a system parameter (set to 4 questions for the contest). Default weighting factor is also stored and read in a parameter (set to 10 for the contest), but each question has its own factor, which was defined by a Manager (see "Create a question"). The number of themes of the questionnaire is equal to the number of themes currently defined in the system (set to 3 themes for the contest). All themes defined must be talked in the questionnaire. The generation of the questionnaire must make sure, that the average of the questions' weighting factors is equal to the default value for each of the themes. A question can appear only once in a questionnaire. Questions must be chosen randomly, keeping in mind the constraints expressed above.

This part of the contest gives you the possibility to choose between two difficulty levels, in accordance with the choice made for the system of consistency check.

Each candidate will then answer a questionnaire containing different questions, but belonging all to the same themes, and having a similar overall difficulty level.

Questions of a theme are displayed in a randomly defined order. But this order must not change during the whole time a candidate answers a questionnaire, in order to avoid that the candidate got lost in the questions.

Possible answers to a question may be displayed in a randomly defined order. If this is the case, this order must not change during the whole time a candidate answers a questionnaire. This requirement is optional. **Choose your option and specify it in your delivery order.**

Option 1 (simple)

Answers are displayed for all candidates in the same order, this order being either an alphabetical order of the answers, or the same order that the one defined during the creation of the questions by the Manager.

End of Option 1.

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Option 2 (complex)

Answers are displayed in an order defined randomly for each candidate. In this case, during the whole time a candidate spends to answer a questionnaire, the answers must be displayed in the same order (to avoid user to get lost in the answers).

End of Option 2.

A candidate can "mark" a question if he wants to remember that he would like to come back to this question later (for example if he is not sure of his answer).

That's why a check box exists on each question, near the button that permit to go to the following question.

This button submits this page, saves the answer and the "mark" information. This button exists on each question excepted to the last one where the "Submit and Close the questionnaire" button is.

When the candidates "Submit and Close the questionnaire", the answer of the question displayed is saved (if there is a question), and the questionnaire is verified (if all question has an answer, if no question is still marked). The candidate is warned, if he has forgotten a question during his questionnaire.

This warning tells the candidate which questions are not answered, and which ones are marked. The candidate can always go directly to any question using the navigator on the left (described bellow). He can also close definitively his questionnaire with a button "Close definitively the questionnaire". Then, the result is displayed (in percent), it is impossible to come back and change any answer.

If no warning is displayed, the questionnaire is automatically "closed definitively".

On the left side of the questionnaire, a « navigator » allows to access directly to every question, shows which are answered (with a "+" icon), which are "marked" (in red), which is the current question (in bold). See the graphic charter.

Each click in the navigator submits the current question.

The button "Close definitively the questionnaire" is always present at the bottom of this navigator.

The candidate has a limited time to answer to the questionnaire (read inside the system parameter in minutes). At the end, the current question is automatically submitted, and the result page appears. Any change is now impossible, even using the back button of your browser.

(For this part, any technical choice is possible. Be careful with the security...)

At the top of the page, a countdown indicates the remaining time (formatted : mm:ss)

III.2.10. The questionnaire result

At the end of the questionnaire, the candidate sees his result, in percent.

Only authenticated candidates results are saved in the database.

You should save the answer of each question of a questionnaire (or only if each answer is right or wrong)

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III.2.11. Statistical analysis of the results

The Manager must have a reporting tool for statistical analysis of the results.

For the contest, only one statistic is needed.

The Manager is able to see every questionnaire result (for authenticated candidates), in the chronological order.

Data displayed are : name, first name, date and hour of the start, and the result in percent.

III.2.12. To send information to third parties

This application must be able to send information to third parties (client companies sending candidates)

Some candidates are sent by client companies, in order to test their skills.

These client companies want to receive (each month) the results of their candidates' questionnaire, to be included in their Information System.

Data to be exchanged are : name, first name, login, date and hour of the start, and the global result in percent, the result of each theme in percent (giving the theme name).

This part of the TopDev contest is free ; you can propose whatever technical choice, process,... (XML, Web Services, RSS,...email...)

You can only explain your solution without coding it.

A particular part of your documentation must explain your answer.

--- End of this Subject of the TopDev Contest ---