

Description of *Collisions Exporter v.0.1a*

The *Collisions Exporter* program is a supplement to the *Collisions Search* program and not needed for its work. It allows multiple projects from the *Collisions Search* program to be uploaded, and has a more flexible filter for search results. The program is written in Delphi 7 with assembler inserts. This version is available only for Windows.

Collisions Exporter can also save all or part of the search results of each project in files in Life 1.05 format. For each processed project, it allows a blank project to be made with one additional object, in which the original objects of processed project are saved. These blank projects are suitable for opening and running in *Collisions Search*.

1. Additional folders and files for the program

The *Collisions Exporter* program is not used for searching. However, for proper selection of search results it requires information about the tables of objects and their descriptions. Therefore, the program also needs to be able to find the **Tables** folder to load the objects table referenced in the **tables.txt** and **groups.txt** files. This folder is shared in common between *Collisions Search* and *Collisions Exporter*.

2. Starting the program

Initially the program reads the **tables.txt** file. Lines in this file are read in pairs, as follows:

The first line in each pair of lines gives the size of the square grid used to separate patterns, in an associated table file. In other words, the first line specifies the spacing between objects, and the spacing must be the same in the X and Y directions. The second line gives the name of the table, which must be located in the **Tables** folder. The format of table files can be Life 1.05, Life 1.06, RLE or BMP picture.

The **groups.txt** file is commonly used to describe eaters. If a **groups.txt** file is present, the program reads a few lines describing one specific type of objects. Then there is a dividing line, "-----", followed by the next group of lines relating to another type of object, and so on. The first group contains 3 numbers in the following order:

- The number of a row from the objects table loaded from the **tables.txt** file, which describes an object or multiple objects;
- The initial column number of the objects group;
- The final column number of the objects group.

Groups of eaters are logically categorized by their type. For example, a block might be by itself in one group, 8 variants of a hook might make up another group, and so on. The following lines contain 2 numbers in the following order:

- The initial column number of the objects group from the same row;
- The final column number of the objects group from the same row.

These groups are a way of logically associating different eaters that can work in a similar manner, but have different sizes or shapes. For example, for the group

containing a hook, in the subsequent rows you can set the range of columns describing hook in 8 variants, and a snake in 4 variants. The hook and the snake can work in a similar way (like a rock), and have minimal size among all eaters of that type in the collection. It does not make sense to include eater4, for example, in the “hook” group -- it can also operate as a rock, but is unnecessarily large.

These groups allow the program to automatically select variations on solutions.

3. Description of program controls

Selective loading of projects is carried out by pressing the **Load files** button and selecting one or more files. Loading of all project files in a single folder are carried out by pressing the **Load folder** button and selecting a folder that contains project files with a *.txt extension. A list of projects that have been loaded into the program is at the top left of the window.

Each of the projects in the list can be viewed by clicking on it. The list of groups of search results for the active project is displayed on the left in the middle of the window. The active group is marked by color. Elements of the active group are listed at the bottom left of the window. These are the solutions of the current project. The groups contain solutions where the active reaction takes the same course, but there are differences in the stable parts of eaters in regions that do not take part in the reaction.

Solutions can be marked in the lower list manually or automatically by applying the export settings. Only marked solutions will be saved to files when the appropriate command for the single project is received. The group of solutions can also be marked. The group is automatically marked when at least one of its elements is marked. If a group is marked manually, all its elements are marked as well as the group.

The names of generated .lif and .txt files are constructed in a similar way to the construction rule for solutions names in the list at the bottom left of the window. The codes formed from the coordinates of birth (and live) cells of all previous generations for current solution are written in decimal format. It also changed the order of the numbers (see section 1.6).

The following is a description of the controls related to export settings.

If the **Refresh** button is clicked, the export options are applied and the active project is updated.

The selection mode for the export of solutions in the groups can be choosing on the **Export options** tab. There are 3 possible variants:

- If the **First solution from the group** checkbox is chosen only the first solution of the group is marked.
- If the **Several solutions from the group** checkbox is chosen, several solutions of a group can be selected, as described in the **groups.txt** file in the folder **Tables** folder. This option is applicable to projects which contain only one object of variable type and variable coordinates. The number of this object, from the **Initial filling** table of the **Collisions Search** program, must be specified in the **Eater №** text box. Then the program checks if this object is present in one of the groups described in the **groups.txt** file. If so, then all other solutions with a matching object from the same group (between “-----” dividing lines in the **groups.txt** file) are also marked.
- If the **All solutions** checkbox is chosen, all solutions of the group are marked.

The following is a description of the controls on the **Export options** tab.

When the **Do not export if a number of solutions is not more than** checkbox is checked, the edit box to the right of the checkbox may contain the maximum number of group elements at which it is marked. Its elements are also marked with the selected options.

When the **Do not export if a duration of solution is less than** checkbox is checked, the program compares the value in the corresponding edit box with the number of consecutive generations of solution, starting with the number of the generation when it was found, which also satisfy the search conditions. If the value in the edit box is greater than this number, then the solution is not marked.

When the **Export only stable solutions** checkbox is checked the program will be marked only solutions with the mark “stab”, which are obtained when the mechanism the decision of the reaction end is triggered.

When the **Export only signal solutions** checkbox is checked, the program will be marked only solutions with the mark “sig”, which are satisfied the additional search conditions.

When the **Do not export duplicate solutions** checkbox is checked, the duplicate solutions of one project, i.e. the same solutions with different order of objects in the solutions are not marked if one of these solutions was marked earlier.

When the **Do not export duplicate solutions of different projects** checkbox is checked, duplicate solutions of various projects loaded to the program are not marked if one of these solutions was marked earlier. That is, a new solution is skipped if it is the same as a previous solution except for a different order of objects.

When the **Do not export false solutions** checkbox is checked, the solutions are not marked if they have objects, the removal of which does not change the reaction on this generation.

When the **Export results to lif files** checkbox is checked, when the export procedure runs, .lif pattern files for each solution will be created in Life 1.05 format, in the folders of the same name as the name of the projects (without the extension).

When the **Do not export object №** and the **Export results to lif files** checkboxes are checked, the solution object with the number specified in the edit box to the right of the checkbox will not be saved in a .lif file when the export procedure runs. The object may be taken from the objects table loaded from the **tables.txt** file.

When the **Make the project files of the next level** checkbox is checked, then when the export procedure runs, new .txt project files compatible with the **Collisions Search** program will be created in each project folder, with a number of objects in the search settings increased by one. This option can be applied only to projects that contain only one object of variable type and variable coordinates and unlimited number of objects of a fixed type and fixed coordinates. The initial configuration of the new projects will include all objects of fixed type and fixed coordinates from the original project. The object of variable type and variable coordinates of the original project is duplicated in new projects, but the duplicate becomes an object with fixed coordinates and fixed type, matching the current solution. This object is also included in the list of objects that must be found at any generation with unchanged form and without shift. The rectangular area for the additional object of variable type and variable coordinates in new projects is changed to the maximum area taken up by all previous generations of the configuration. The coordinates of the upper left corner are further decreased by the maximum size of all variants of such object plus 2, and to the coordinates of the lower right corner is added 2.

When the **Start step is the current step of solution** and **Make the project files of the next level** checkboxes are checked, the start generation number for calculation in a new blank project will be changed to the generation number of the solution from which the new project is generated.

When the **Computation area is not more than** and **Make the project files of the next level** checkboxes are checked, the rectangular area of the object of variable type and variable coordinates in new blank projects will be limited to the rectangular area defined in the **Xmin**, **Ymin**, **Xmax**, and **Ymax** edit boxes below the checkbox.

When the **Ignore gliders** and **Make the project files of the next level** checkboxes are checked, the rectangular area of the object of variable type and variable coordinates in new blank projects changes to the maximum area ever taken up by all previous generations of the configuration, except for any gliders. The row number of the glider is taken from the **Glider No** edit box below the checkbox. This row number must match the row number of the glider in the object table loaded from the **tables.txt** file. This option is hard-coded in the program to check columns 0-15, so the 16 variants of the glider must start from the first column in the object table.

When settings have been chosen for all of the above controls, there are three export options available:

- Click the **Export solution** button to begin the export procedure for active solutions (marked in the list in the lower left part of the window).
- Click the **Export project** button to begin the export procedure for all marked solutions of active project.
- Click the **Export all** button to begin the export procedure for all loaded projects according to the export settings.

In any of the above cases, solution .lif files and blank project .txt files will be created if the appropriate export options are set.

When a solution in the list on the bottom left of the window is selected, it is marked with a gray color and generation 0 is displayed in the view field on the right. The following is a description of the viewing options and controls.

If the **Start/Stop** button is clicked (or the **Enter** key is pressed on the keyboard), the search starts or stops running in continuous mode. During a run, the current generation number, number of live cells and number of birth cells are displayed at the top of the view field.

The delay in milliseconds between calculations of generations for the continuous viewing of configuration can be set in the **Delay** edit box. At a delay of 0, the current generation information is updated every 100 generations, and the configuration is redrawn every 100 generations only if the **Display** checkbox is checked.

If the **One step** button is clicked (or the right-arrow key is pressed on the keyboard), the search is done in steps of 1 generation.

For the viewing field, the scale (screen pixels per cell) can be set with the **Scale** edit box, and the coordinates of the upper left corner can be set with the **X0** and **Y0** edit boxes. The configuration can be dragged and the coordinates of the cell can be determined with help of the mouse cursor. The information is displayed on top of the viewing field (the **X:** and **Y:** labels).

If the **Historical mode** checkbox is checked when displaying a configuration, the “new” dead cells are marked in gray color and will not be removed from the screen. This allows the size of the configuration to be determined for all previous generations. This option works with the single-step mode, as well as continuous viewing mode at a

delay greater than 0. If the scale or position of the configuration on screen is changed, the information about dead cells is lost.

When the **Select mode** checkbox is checked, the mouse cursor will mark an area of the field with a green rectangle, instead of dragging the view. The coordinates of the rectangle are displayed on top of the viewing field (the **Selected:** label). The two points displayed are the top left corner and the bottom right corner of the selection.

When the **Fix the viewing area** checkbox is checked, the scale of view and coordinates of the upper left corner of viewing area does not change when a new active solution is chosen.

Click the **Copy** button to copy generation 0 of the current solution to the clipboard in Life 1.05 format.

4. Limitations of the program

The *Collisions Exporter* program has hard-coded limits for the following elements:

- The size of **Initial filling** and **Final filling** tables: 500 rows
- The maximum number of live cells in any configuration: 1000000
- The maximum number of rows in any configuration that include live cells with the same y-coordinates: 100000
- The maximum number of live cells in a row in any configuration: 100000
- The maximum number of live cells in polyplet of any configuration: 100000
- The maximum number of polyplets in any configuration: 100000
- The maximum total number of live cells of all table elements: 100000
- The maximum number of cells in polyplet of a table element: 10000
- The maximum number of polyplets in the table element: 100
- The maximum size of a stable pattern: square, 100 x 100 cells

These numbers may be increased in the next version of the program.