How to use the 2DCPackGen?

1 Introduction

A complete description of the generator can be found in the paper "Silva, E., Oliveira, J. F., Wäsher, G. 2013. 2DCPackGen: *A problem generator for two-dimensional rectangular cutting and packing problems*. Submited for publication, 1-18."

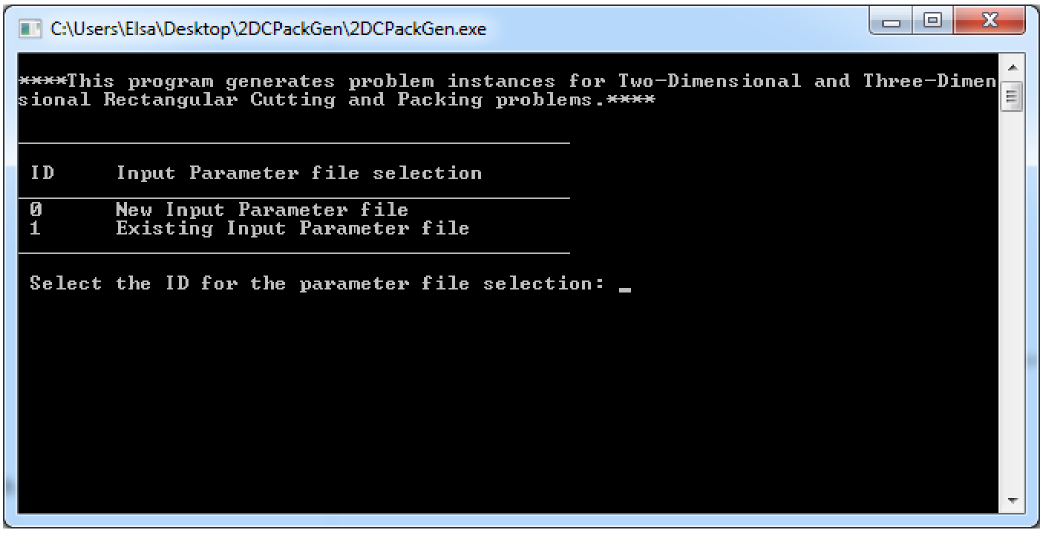
The executable version compiled for Windows (2DCPackGen.exe) as well as the source code (2DCPackGen.cpp and 2DCPackGen.h) are available at ESICUP website.

The problem generator was coded in C++ and compiled with Microsoft Visual Studio 2008.

In order to use the beta distribution, the BOOST library for C++ was used. This library is free and can be downloaded in `http://www.boost.org/users/history/version_1_54_0.html`.

2 First Execution of the 2DCPackGen.exe

The first information that should be given by the user is whether the program must create a new empty input parameter file or if an existing one should be used. The program window can be seen in Figure 1.

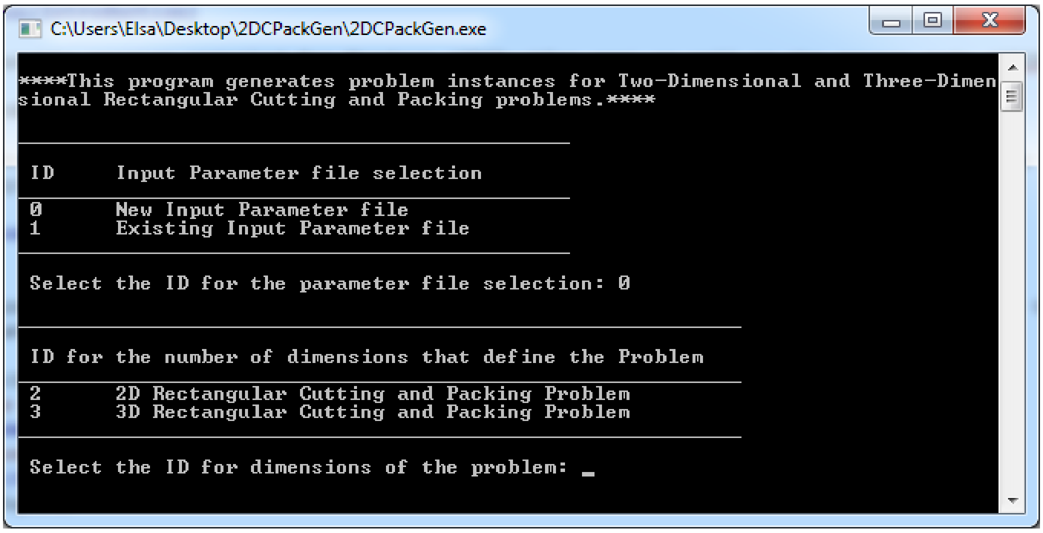


```
C:\Users\Elsa\Desktop\2DCPackGen\2DCPackGen.exe

****This program generates problem instances for Two-Dimensional and Three-Dimen
sional Rectangular Cutting and Packing problems.****

-----------------------------------------------------------
 ID      Input Parameter file selection
-----------------------------------------------------------
 0       New Input Parameter file
 1       Existing Input Parameter file
-----------------------------------------------------------

 Select the ID for the parameter file selection: _
```

Figure 1: First execution of the program.

2.1 New Input Parameters File

Let us assume that the user is running 2DCPackGen by the first time, thus a new input parameter file should be created as can be seen in Figure 2. Notice that different settings for the parameters may correspond to different input files.

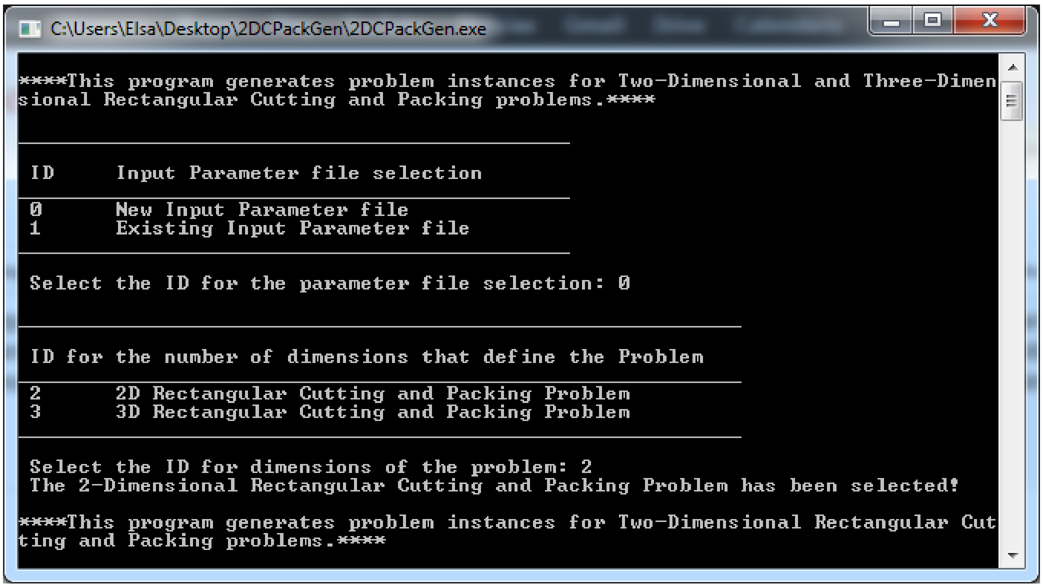


```
C:\Users\Elsa\Desktop\2DCPackGen\2DCPackGen.exe

****This program generates problem instances for Two-Dimensional and Three-Dimen
sional Rectangular Cutting and Packing problems.****

-----------------------------------------------------------
 ID      Input Parameter file selection
-----------------------------------------------------------
 0       New Input Parameter file
 1       Existing Input Parameter file
-----------------------------------------------------------

 Select the ID for the parameter file selection: 0

-----------------------------------------------------------------------------
 ID for the number of dimensions that define the Problem
-----------------------------------------------------------------------------
 2       2D Rectangular Cutting and Packing Problem
 3       3D Rectangular Cutting and Packing Problem
-----------------------------------------------------------------------------

 Select the ID for dimensions of the problem: _
```

Figure 2: New input parameter file.

2.1.1 Number of dimensions of the problem

If a new input parameters file is created, the user have to choose between two- and three-dimensional problems. In this example we considered the two-dimensional problem, as can be seen in figure 3.

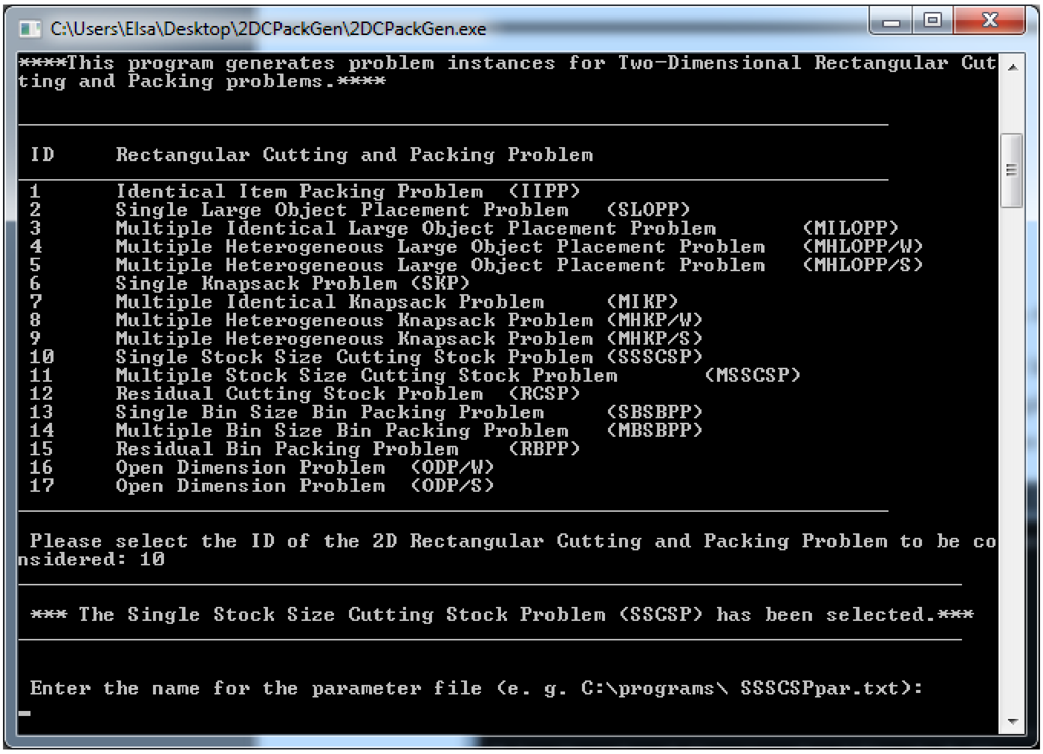


```
****This program generates problem instances for Two-Dimensional and Three-Dimen
sional Rectangular Cutting and Packing problems.****

 ____________________________________________
 ID      Input Parameter file selection
 ____________________________________________
 0       New Input Parameter file
 1       Existing Input Parameter file
 ____________________________________________

 Select the ID for the parameter file selection: 0

 __________________________________________________________
 ID for the number of dimensions that define the Problem
 __________________________________________________________
 2       2D Rectangular Cutting and Packing Problem
 3       3D Rectangular Cutting and Packing Problem
 __________________________________________________________

 Select the ID for dimensions of the problem: 2
 The 2-Dimensional Rectangular Cutting and Packing Problem has been selected!

****This program generates problem instances for Two-Dimensional Rectangular Cut
ting and Packing problems.****
```

Figure 3: Number of dimensions of the problem.

2.1.2 Intermediate Problem Type Selection

After deciding the number of dimensions of the problem, i.e. two- or three-dimensions, the user will select one of the seventeen rectangular intermediate problem types. In this example we have decided to create problem instances for the problem with ID 10, i.e. is the Single Stock Size Cutting Stock Problem (SSSCSP). This step can be seen in figure 4.

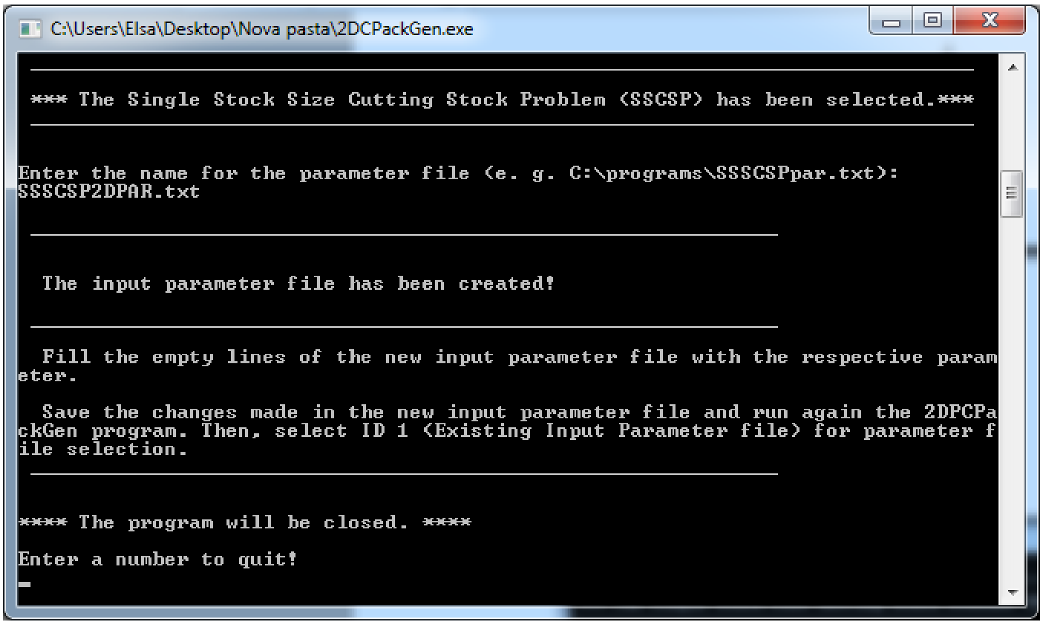


```
****This program generates problem instances for Two-Dimensional Rectangular Cut
ting and Packing problems.****

 ________________________________________________________________________

 ID      Rectangular Cutting and Packing Problem
 ________________________________________________________________________
 1       Identical Item Packing Problem  (IIPP)
 2       Single Large Object Placement Problem   (SLOPP)
 3       Multiple Identical Large Object Placement Problem       (MILOPP)
 4       Multiple Heterogeneous Large Object Placement Problem   (MHLOPP/W)
 5       Multiple Heterogeneous Large Object Placement Problem   (MHLOPP/S)
 6       Single Knapsack Problem (SKP)
 7       Multiple Identical Knapsack Problem     (MIKP)
 8       Multiple Heterogeneous Knapsack Problem (MHKP/W)
 9       Multiple Heterogeneous Knapsack Problem (MHKP/S)
 10      Single Stock Size Cutting Stock Problem (SSSCSP)
 11      Multiple Stock Size Cutting Stock Problem       (MSSCSP)
 12      Residual Cutting Stock Problem  (RCSP)
 13      Single Bin Size Bin Packing Problem     (SBSBPP)
 14      Multiple Bin Size Bin Packing Problem   (MBSBPP)
 15      Residual Bin Packing Problem    (RBPP)
 16      Open Dimension Problem  (ODP/W)
 17      Open Dimension Problem  (ODP/S)
 ________________________________________________________________________

 Please select the ID of the 2D Rectangular Cutting and Packing Problem to be co
nsidered: 10
 ______________________________________________________________________________

 *** The Single Stock Size Cutting Stock Problem (SSCSP) has been selected.***
 ______________________________________________________________________________


 Enter the name for the parameter file (e. g. C:\programs\ SSSCSPpar.txt):
_
```

Figure 4: Problem Type Selection.

2.1.3 Name of the input parameters file

After the user has decided the type of problem, the program will require a name for the input parameters file. This file should be a text file with .txt extension. If only the name of the file is given by the user, the file will be saved in the same folder where the program is. However, if the user wants to save it in another location, he only has to give the path together with the name of the input file, as it is shown in figure 5.



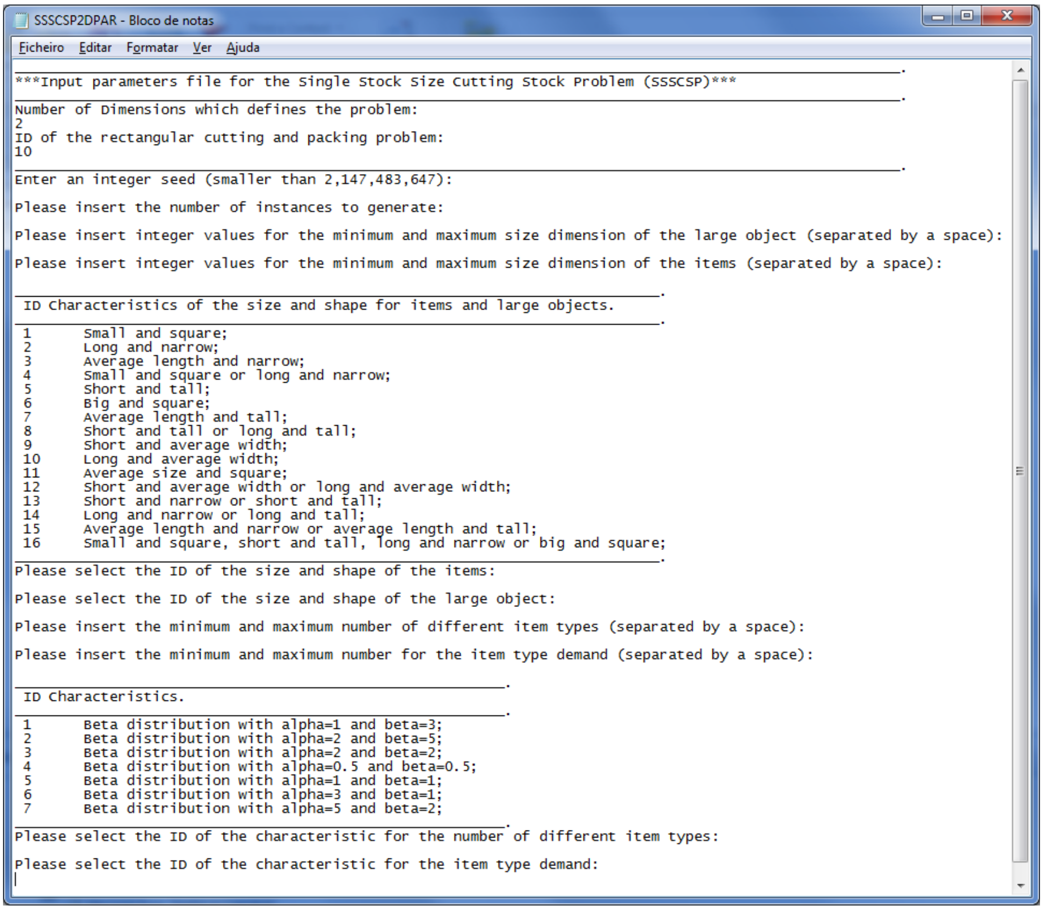
```
 *** The Single Stock Size Cutting Stock Problem (SSCSP) has been selected.***

Enter the name for the parameter file (e. g. C:\programs\SSSCSPpar.txt):
SSSCSP2DPAR.txt


  The input parameter file has been created!


  Fill the empty lines of the new input parameter file with the respective param
eter.

  Save the changes made in the new input parameter file and run again the 2DPCPa
ckGen program. Then, select ID 1 (Existing Input Parameter file) for parameter f
ile selection.


**** The program will be closed. ****

Enter a number to quit!
_
```

Figure 5: Name of the input file.

Given the name of the input parameters file, the program gives a message informing that the input parameters file was created and requesting the user to fill the blank lines in the input file and to save the changes. Once the input parameter file has been created the program will close, after the insertion of any number by the user.

The problem instances can be generated after the definition of the parameters by running the 2DCPackGen.exe again and choosing ID 1 for the input parameter file selection.

In figure 6 can be seen the input parameter file created by 2DCPackGen program. The first lines do not need to be filled in by the user since they give information about the number of dimensions needed to describe the problem and define the problem type. The first parameter which should be introduced by the user is the seed.


SSSCSP2DPAR - Bloco de notas
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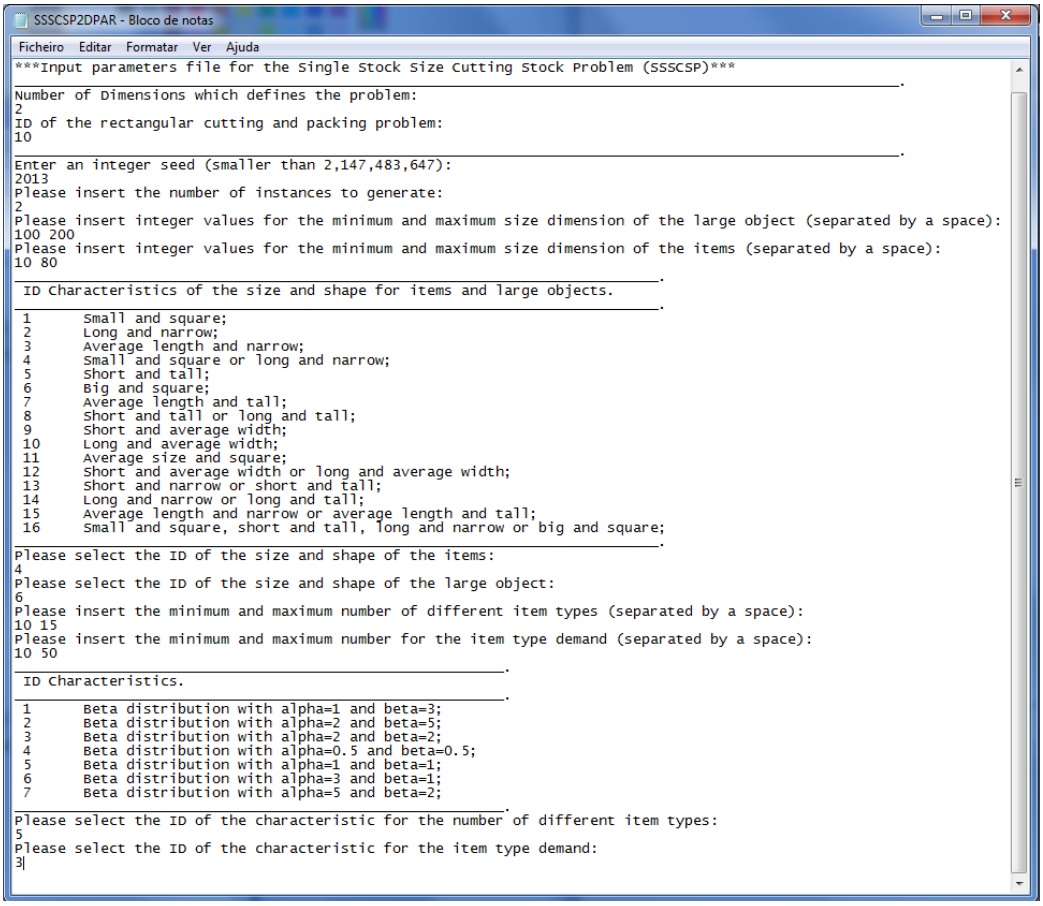
```
__________________________________________________________________________.
***Input parameters file for the Single Stock Size Cutting Stock Problem (SSSCSP)***
__________________________________________________________________________.
Number of Dimensions which defines the problem:
2
ID of the rectangular cutting and packing problem:
10
__________________________________________________________________________.
Enter an integer seed (smaller than 2,147,483,647):

Please insert the number of instances to generate:

Please insert integer values for the minimum and maximum size dimension of the large object (separated by a space):

Please insert integer values for the minimum and maximum size dimension of the items (separated by a space):

____________________________________________________________________.
 ID Characteristics of the size and shape for items and large objects.
____________________________________________________________________.
 1      Small and square;
 2      Long and narrow;
 3      Average length and narrow;
 4      Small and square or long and narrow;
 5      Short and tall;
 6      Big and square;
 7      Average length and tall;
 8      Short and tall or long and tall;
 9      Short and average width;
 10     Long and average width;
 11     Average size and square;
 12     Short and average width or long and average width;
 13     Short and narrow or short and tall;
 14     Long and narrow or long and tall;
 15     Average length and narrow or average length and tall;
 16     Small and square, short and tall, long and narrow or big and square;
____________________________________________________________________.
Please select the ID of the size and shape of the items:

Please select the ID of the size and shape of the large object:

Please insert the minimum and maximum number of different item types (separated by a space):

Please insert the minimum and maximum number for the item type demand (separated by a space):

_________________________________________________________.
 ID Characteristics.
_________________________________________________________.
 1      Beta distribution with alpha=1 and beta=3;
 2      Beta distribution with alpha=2 and beta=5;
 3      Beta distribution with alpha=2 and beta=2;
 4      Beta distribution with alpha=0.5 and beta=0.5;
 5      Beta distribution with alpha=1 and beta=1;
 6      Beta distribution with alpha=3 and beta=1;
 7      Beta distribution with alpha=5 and beta=2;
_________________________________________________________.
Please select the ID of the characteristic for the number of different item types:

Please select the ID of the characteristic for the item type demand:
```

Figure 6: SSSCSP2DPAR.txt input file - empty.

2.2 Existing Input Parameters File

In order to use the same example presented in the paper "Silva, E., Oliveira, J. F., Wäsher, G. 2013. 2DCPackGen: *A problem generator for two-dimensional rectangular cutting and packing problems*. Submited for publication, 1-18.", the input file was filled in with the same data presented in table 4 of the paper. The resulting file is presented in figure 7.



```
***Input parameters file for the Single Stock Size Cutting Stock Problem (SSSCSP)***
__________________________________________________________________________________________________.
Number of Dimensions which defines the problem:
2
ID of the rectangular cutting and packing problem:
10
__________________________________________________________________________________________________.
Enter an integer seed (smaller than 2,147,483,647):
2013
Please insert the number of instances to generate:
2
Please insert integer values for the minimum and maximum size dimension of the large object (separated by a space):
100 200
Please insert integer values for the minimum and maximum size dimension of the items (separated by a space):
10 80
_________________________________________________________________________.
 ID Characteristics of the size and shape for items and large objects.
_________________________________________________________________________.
 1       Small and square;
 2       Long and narrow;
 3       Average length and narrow;
 4       Small and square or long and narrow;
 5       Short and tall;
 6       Big and square;
 7       Average length and tall;
 8       Short and tall or long and tall;
 9       Short and average width;
 10      Long and average width;
 11      Average size and square;
 12      Short and average width or long and average width;
 13      Short and narrow or short and tall;
 14      Long and narrow or long and tall;
 15      Average length and narrow or average length and tall;
 16      Small and square, short and tall, long and narrow or big and square;
_________________________________________________________________________.
Please select the ID of the size and shape of the items:
4
Please select the ID of the size and shape of the large object:
6
Please insert the minimum and maximum number of different item types (separated by a space):
10 15
Please insert the minimum and maximum number for the item type demand (separated by a space):
10 50
________________________________________________________.
 ID Characteristics.
________________________________________________________.
 1       Beta distribution with alpha=1 and beta=3;
 2       Beta distribution with alpha=2 and beta=5;
 3       Beta distribution with alpha=2 and beta=2;
 4       Beta distribution with alpha=0.5 and beta=0.5;
 5       Beta distribution with alpha=1 and beta=1;
 6       Beta distribution with alpha=3 and beta=1;
 7       Beta distribution with alpha=5 and beta=2;
________________________________________________________.
Please select the ID of the characteristic for the number of different item types:
5
Please select the ID of the characteristic for the item type demand:
3
```

Figure 7: SSSCSP2DPAR.txt input file - filled.

Since the user already has a parameter file when the 2DCPackGen.exe is run, in the input parameter file selection, the user should choose ID 1 (Existing Input Parameter File).

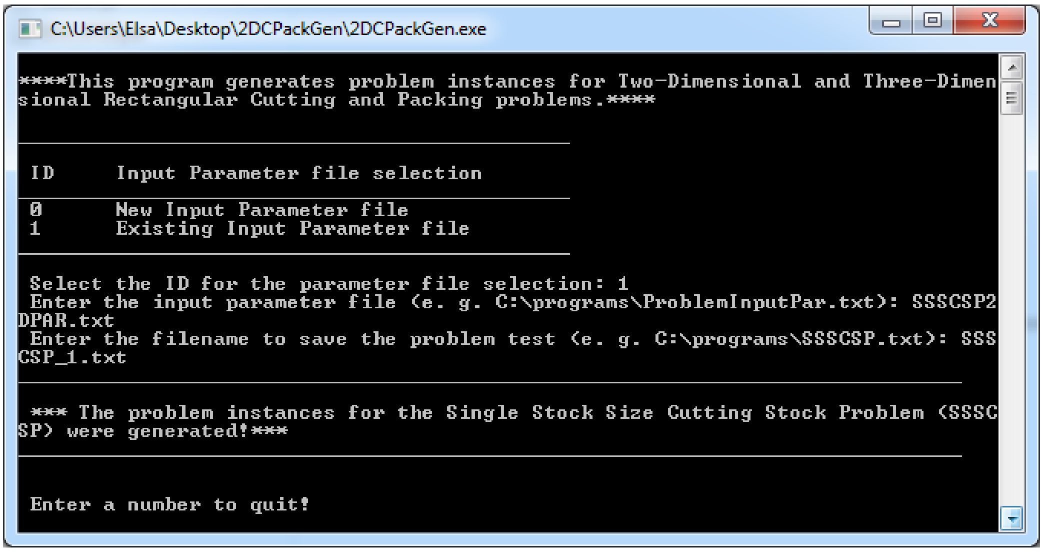
After this step, the program will require the name or the complete location of the existing input parameter file. In figure 8 can be seen that the name of the input parameter file which will be considered is the SSSCSP2DPAR.txt and it is located in the same folder as the program.

The program will read the input parameter file and if the parameters are not properly defined a message of the error will appear and the program will be closed. If the parameters are well defined the program will continue and will require a name for the file where the problem instances will be written.

Referring to figure 8, the output file will be the SSSCSP_1.txt.

Once the program finishes the generation, a message saying that the problem instances were generated will appear in the program window.

The program closes by asking the user a number to quit.

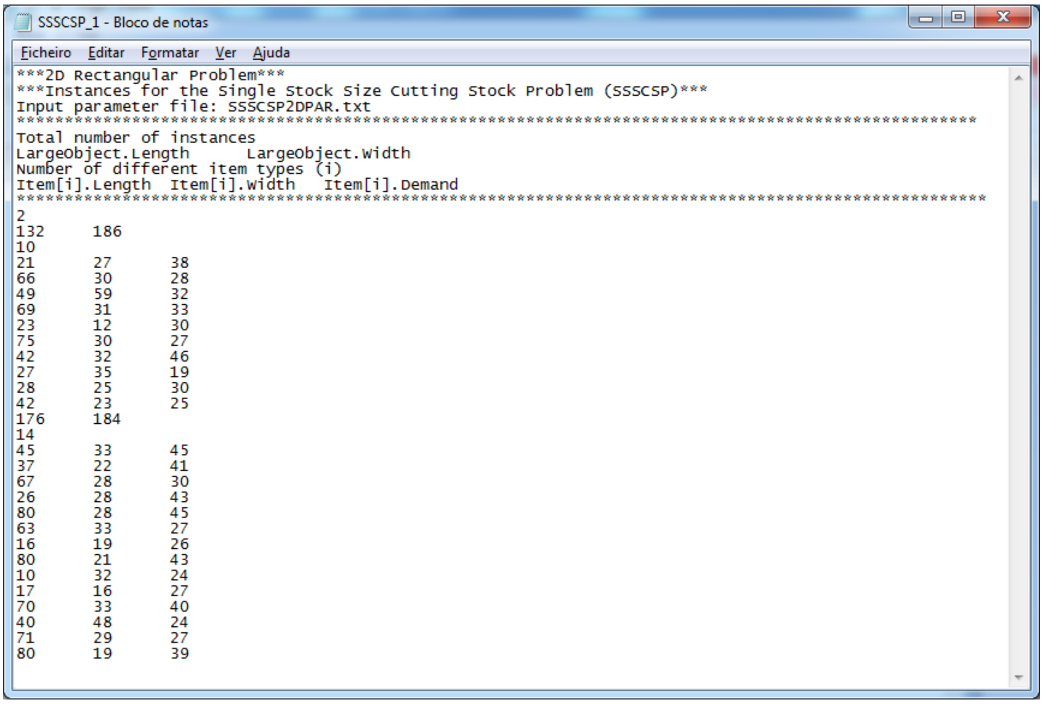


```
****This program generates problem instances for Two-Dimensional and Three-Dimen
sional Rectangular Cutting and Packing problems.****

 ID      Input Parameter file selection

 0       New Input Parameter file
 1       Existing Input Parameter file

 Select the ID for the parameter file selection: 1
 Enter the input parameter file (e. g. C:\programs\ProblemInputPar.txt): SSSCSP2
DPAR.txt
 Enter the filename to save the problem test (e. g. C:\programs\SSSCSP.txt): SSS
CSP_1.txt

 *** The problem instances for the Single Stock Size Cutting Stock Problem (SSSC
SP) were generated!***


 Enter a number to quit!
```

Figure 8: Problem instances generation.

2.2.1 Output File

The resulting output file is presented in figure 9. The first lines give information about the problem type for which the problem instances were generated, the number of relevante dimensions of the problem and the name of the input parameter file. The following lines give information about the structure of the file.



```
***2D Rectangular Problem***
***Instances for the Single Stock Size Cutting Stock Problem (SSSCSP)***
Input parameter file: SSSCSP2DPAR.txt
****************************************************************************************************
Total number of instances
LargeObject.Length      LargeObject.Width
Number of different item types (i)
Item[i].Length  Item[i].Width   Item[i].Demand
*****************************************************************************************************
2
132     186
10
21      27      38
66      30      28
49      59      32
69      31      33
23      12      30
75      30      27
42      32      46
27      35      19
28      25      30
42      23      25
176     184
14
45      33      45
37      22      41
67      28      30
26      28      43
80      28      45
63      33      27
16      19      26
80      21      43
10      32      24
17      16      27
70      33      40
40      48      24
71      29      27
80      19      39
```

Figure 9: Problem instances generation.