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CSC 2023 Assignment 2 Report

Correctness Testing

In the correctness testing I have used five different lists of size 10 to test the Next Fit and First Fit algorithms. The first two lists (containing various values) have been used to run the trace by hand. By drawing out every shape in these lists on paper I have used them to determine the correctness of the algorithms.

Using the first list for the Next Fit, based on the expected results the shapes should have been placed in 4 sheets (rough sketches):
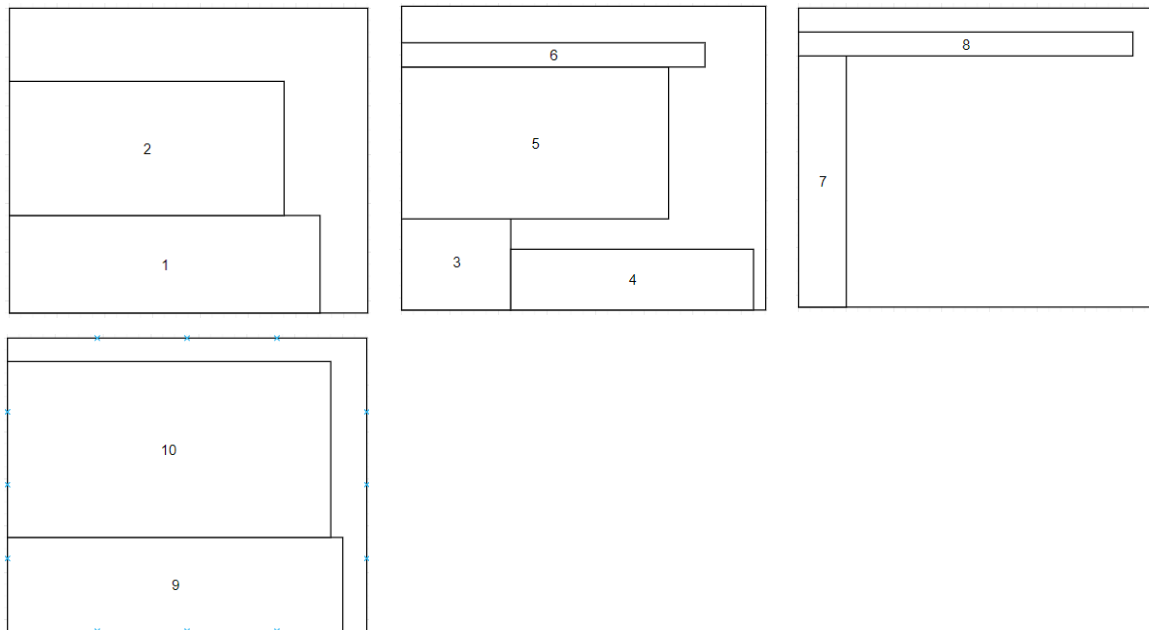
Using the first list for the First Fit, based on the expected results the shapes should have been placed in 4 sheets (rough sketches):
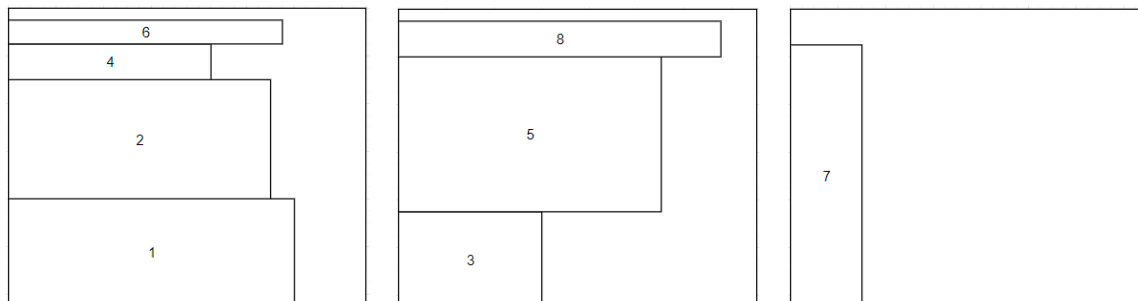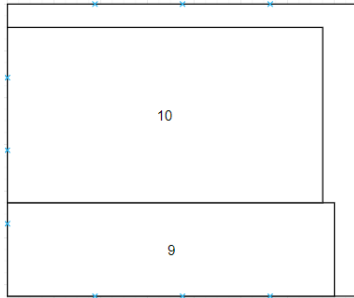
The output of the program shows that the shapes are placed correctly.

Using the second list for the Next Fit, based on the expected results the shapes should have been placed in 2 sheets (rough sketches):
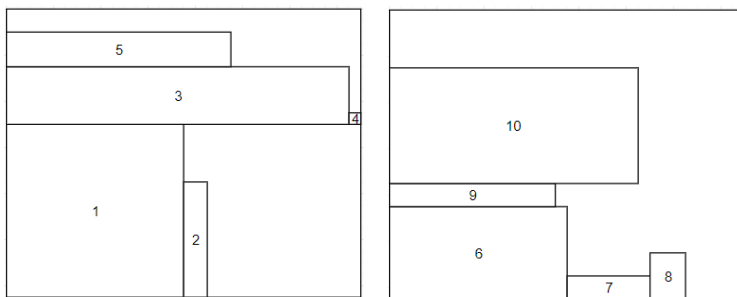
The output of the program shows that the shapes are placed correctly.

Using the second list for the First Fit, based on the expected results the shapes should have been placed in 2 sheets (rough sketches):
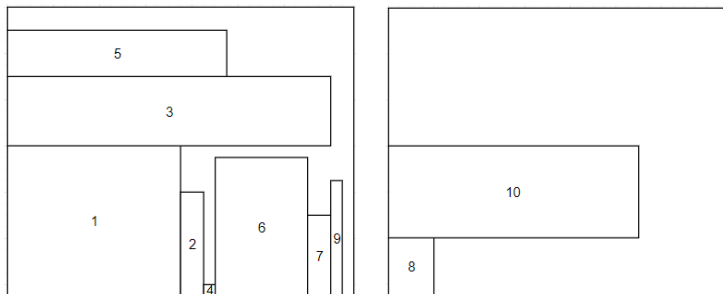
The output of the program shows that the shapes are placed correctly.

The third list contains shapes that are 1 in height and 1 in width to ensure that every shape in this list is placed in the first shelf and only one sheet is used. The output of the program shows that the shapes are placed correctly.

The fourth list contains shapes with values that are the same size as the sheet itself to check if each shape is placed in a new sheet. The output of the program shows that the shapes are placed correctly.

The last list contains shapes that will be placed in a new shelf each time. The output of the program shows that the shapes are placed correctly.

The tabulated results of the overall comparisons for Task 5

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*Next Fit and First Fit algorithms performance test*
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The algorithms were run 4 times using newly generated 10000 shapes each time
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On average, the time it took to run Next Fit algorithm was: 12 | On average, 4718
sheets were used to store the shapes
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On average, the time it took to run First Fit algorithm was: 1288 | On average, 2992
sheets were used to store the shapes
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The algorithms were run 4 times using newly generated 20000 shapes each time
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On average, the time it took to run Next Fit algorithm was: 3 | On average, 9392
sheets were used to store the shapes
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On average, the time it took to run First Fit algorithm was: 5743 | On average, 5919
sheets were used to store the shapes
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The algorithms were run 4 times using newly generated 30000 shapes each time
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On average, the time it took to run Next Fit algorithm was: 4 | On average, 14102
sheets were used to store the shapes
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On average, the time it took to run First Fit algorithm was: 13272 | On average, 8882
sheets were used to store the shapes
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The algorithms were run 4 times using newly generated 40000 shapes each time
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On average, the time it took to run Next Fit algorithm was: 6 | On average, 18668
sheets were used to store the shapes
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On average, the time it took to run First Fit algorithm was: 25119 | On average,
11742 sheets were used to store the shapes
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The algorithms were run 4 times using newly generated 50000 shapes each time
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On average, the time it took to run Next Fit algorithm was: 7 | On average, 23428
sheets were used to store the shapes
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On average, the time it took to run First Fit algorithm was: 39255 | On average,
14725 sheets were used to store the shapes
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Comments on the results that you have obtained for Task 5

Time:

Looking at the results of Task 5, it can be seen that the performance of Next Fit algorithm is much better than First Fit's performance. The more shapes are being stored the bigger the difference between both algorithms' performances. It is also true that each time the number of shapes to be stored are increased the running time of Next Fit is not increasing as drastically as First Fit's.

Used sheets:

From the tabulated results it is visible that First Fit algorithm uses less sheets to store the shapes than Next Fit. The difference between used sheets using both algorithms stays more or less the same when the number of shapes to store is increased.

The tabulated results of the overall comparisons for Task 6

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*Next Fit and First Fit algorithms performance tests comparisons with sorted and
unsorted shape lists*
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The algorithms were run 4 times using newly generated 10000 shapes each time
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On average, the time it took to run Next Fit algorithm with unsorted shapes was: 7 |
On average, 4666 sheets were used to store the shapes
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On average, the time it took to run First Fit algorithm with unsorted shapes was:
1923 | On average, 2969 sheets were used to store the shapes
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On average, the time it took to run Next Fit algorithm with shapes sorted by height in increasing order was: 5 | On average, 4225 sheets were used to store the shapes
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On average, the time it took to run First Fit algorithm with shapes sorted by height in increasing order was: 1729 | On average, 3704 sheets were used to store the shapes
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On average, the time it took to run Next Fit algorithm with shapes sorted by height in decreasing order was: 4 | On average, 4347 sheets were used to store the shapes
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On average, the time it took to run First Fit algorithm with shapes sorted by height in decreasing order was: 2136 | On average, 2880 sheets were used to store the shapes
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On average, the time it took to run Next Fit algorithm with shapes sorted by width in increasing order was: 5 | On average, 4262 sheets were used to store the shapes
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On average, the time it took to run First Fit algorithm with shapes sorted by width in increasing order was: 1959 | On average, 3166 sheets were used to store the shapes
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On average, the time it took to run Next Fit algorithm with shapes sorted by width in decreasing order was: 3 | On average, 4405 sheets were used to store the shapes
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On average, the time it took to run First Fit algorithm with shapes sorted by width in decreasing order was: 2590 | On average, 2907 sheets were used to store the shapes
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On average, the time it took to run Next Fit algorithm with shapes sorted by area in increasing order was: 4 | On average, 4627 sheets were used to store the shapes
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On average, the time it took to run First Fit algorithm with shapes sorted by area in increasing order was: 2027 | On average, 4000 sheets were used to store the shapes
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On average, the time it took to run Next Fit algorithm with shapes sorted by area in decreasing order was: 2 | On average, 4502 sheets were used to store the shapes
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On average, the time it took to run First Fit algorithm with shapes sorted by area in decreasing order was: 2533 | On average, 2745 sheets were used to store the shapes
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The algorithms were run 4 times using newly generated 20000 shapes each time
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On average, the time it took to run Next Fit algorithm with unsorted shapes was: 3 |
On average, 9318 sheets were used to store the shapes

On average, the time it took to run First Fit algorithm with unsorted shapes was:
5688 | On average, 5886 sheets were used to store the shapes

On average, the time it took to run Next Fit algorithm with shapes sorted by height
in increasing order was: 1 | On average, 8430 sheets were used to store the shapes
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On average, the time it took to run First Fit algorithm with shapes sorted by height
in increasing order was: 4016 | On average, 7297 sheets were used to store the shapes
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On average, the time it took to run Next Fit algorithm with shapes sorted by height
in decreasing order was: 1 | On average, 8658 sheets were used to store the shapes
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On average, the time it took to run First Fit algorithm with shapes sorted by height
in decreasing order was: 4396 | On average, 5726 sheets were used to store the shapes
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On average, the time it took to run Next Fit algorithm with shapes sorted by width in
increasing order was: 2 | On average, 8474 sheets were used to store the shapes
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On average, the time it took to run First Fit algorithm with shapes sorted by width
in increasing order was: 3722 | On average, 6245 sheets were used to store the shapes
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On average, the time it took to run Next Fit algorithm with shapes sorted by width in
decreasing order was: 1 | On average, 8787 sheets were used to store the shapes
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On average, the time it took to run First Fit algorithm with shapes sorted by width
in decreasing order was: 4796 | On average, 5786 sheets were used to store the shapes
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On average, the time it took to run Next Fit algorithm with shapes sorted by area in
increasing order was: 1 | On average, 9126 sheets were used to store the shapes
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On average, the time it took to run First Fit algorithm with shapes sorted by area in
increasing order was: 3954 | On average, 7927 sheets were used to store the shapes
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On average, the time it took to run Next Fit algorithm with shapes sorted by area in
decreasing order was: 2 | On average, 8902 sheets were used to store the shapes
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On average, the time it took to run First Fit algorithm with shapes sorted by area in
decreasing order was: 4993 | On average, 5448 sheets were used to store the shapes

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The algorithms were run 4 times using newly generated 30000 shapes each time
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On average, the time it took to run Next Fit algorithm with unsorted shapes was: 3 |
On average, 14107 sheets were used to store the shapes
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On average, the time it took to run First Fit algorithm with unsorted shapes was:
11083 | On average, 8903 sheets were used to store the shapes
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On average, the time it took to run Next Fit algorithm with shapes sorted by height
in increasing order was: 2 | On average, 12727 sheets were used to store the shapes
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On average, the time it took to run First Fit algorithm with shapes sorted by height
in increasing order was: 9288 | On average, 10969 sheets were used to store the
shapes
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On average, the time it took to run Next Fit algorithm with shapes sorted by height
in decreasing order was: 2 | On average, 13094 sheets were used to store the shapes
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On average, the time it took to run First Fit algorithm with shapes sorted by height
in decreasing order was: 9816 | On average, 8661 sheets were used to store the shapes
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On average, the time it took to run Next Fit algorithm with shapes sorted by width in
increasing order was: 3 | On average, 12802 sheets were used to store the shapes
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On average, the time it took to run First Fit algorithm with shapes sorted by width
in increasing order was: 8992 | On average, 9425 sheets were used to store the shapes
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On average, the time it took to run Next Fit algorithm with shapes sorted by width in
decreasing order was: 2 | On average, 13227 sheets were used to store the shapes
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On average, the time it took to run First Fit algorithm with shapes sorted by width
in decreasing order was: 11968 | On average, 8744 sheets were used to store the
shapes
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On average, the time it took to run Next Fit algorithm with shapes sorted by area in
increasing order was: 4 | On average, 13654 sheets were used to store the shapes
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On average, the time it took to run First Fit algorithm with shapes sorted by area in increasing order was: 9349 | On average, 11923 sheets were used to store the shapes
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On average, the time it took to run Next Fit algorithm with shapes sorted by area in decreasing order was: 3 | On average, 13343 sheets were used to store the shapes
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On average, the time it took to run First Fit algorithm with shapes sorted by area in decreasing order was: 11793 | On average, 8248 sheets were used to store the shapes
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The algorithms were run 4 times using newly generated 40000 shapes each time
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On average, the time it took to run Next Fit algorithm with unsorted shapes was: 4 | On average, 18800 sheets were used to store the shapes
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On average, the time it took to run First Fit algorithm with unsorted shapes was: 22371 | On average, 11832 sheets were used to store the shapes
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On average, the time it took to run Next Fit algorithm with shapes sorted by height in increasing order was: 4 | On average, 16946 sheets were used to store the shapes
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On average, the time it took to run First Fit algorithm with shapes sorted by height in increasing order was: 18681 | On average, 14540 sheets were used to store the shapes
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On average, the time it took to run Next Fit algorithm with shapes sorted by height in decreasing order was: 4 | On average, 17423 sheets were used to store the shapes
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On average, the time it took to run First Fit algorithm with shapes sorted by height in decreasing order was: 18484 | On average, 11519 sheets were used to store the shapes
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On average, the time it took to run Next Fit algorithm with shapes sorted by width in increasing order was: 3 | On average, 17022 sheets were used to store the shapes
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On average, the time it took to run First Fit algorithm with shapes sorted by width in increasing order was: 17988 | On average, 12510 sheets were used to store the shapes
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On average, the time it took to run Next Fit algorithm with shapes sorted by width in decreasing order was: 6 | On average, 17552 sheets were used to store the shapes

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On average, the time it took to run First Fit algorithm with shapes sorted by width in decreasing order was: 22033 | On average, 11617 sheets were used to store the shapes
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On average, the time it took to run Next Fit algorithm with shapes sorted by area in increasing order was: 5 | On average, 18021 sheets were used to store the shapes
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On average, the time it took to run First Fit algorithm with shapes sorted by area in increasing order was: 16770 | On average, 15829 sheets were used to store the shapes
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On average, the time it took to run Next Fit algorithm with shapes sorted by area in decreasing order was: 5 | On average, 17640 sheets were used to store the shapes
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On average, the time it took to run First Fit algorithm with shapes sorted by area in decreasing order was: 21397 | On average, 10964 sheets were used to store the shapes
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The algorithms were run 4 times using newly generated 50000 shapes each time
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On average, the time it took to run Next Fit algorithm with unsorted shapes was: 5 | On average, 23428 sheets were used to store the shapes
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On average, the time it took to run First Fit algorithm with unsorted shapes was: 42461 | On average, 14736 sheets were used to store the shapes
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On average, the time it took to run Next Fit algorithm with shapes sorted by height in increasing order was: 7 | On average, 21091 sheets were used to store the shapes
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On average, the time it took to run First Fit algorithm with shapes sorted by height in increasing order was: 47520 | On average, 18042 sheets were used to store the shapes
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On average, the time it took to run Next Fit algorithm with shapes sorted by height in decreasing order was: 6 | On average, 21698 sheets were used to store the shapes
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On average, the time it took to run First Fit algorithm with shapes sorted by height in decreasing order was: 56096 | On average, 14338 sheets were used to store the shapes
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On average, the time it took to run Next Fit algorithm with shapes sorted by width in
increasing order was: 8 | On average, 21195 sheets were used to store the shapes
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On average, the time it took to run First Fit algorithm with shapes sorted by width
in increasing order was: 37427 | On average, 15524 sheets were used to store the
shapes
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On average, the time it took to run Next Fit algorithm with shapes sorted by width in
decreasing order was: 5 | On average, 21816 sheets were used to store the shapes
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On average, the time it took to run First Fit algorithm with shapes sorted by width
in decreasing order was: 595824 | On average, 14458 sheets were used to store the
shapes
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On average, the time it took to run Next Fit algorithm with shapes sorted by area in
increasing order was: 5 | On average, 22296 sheets were used to store the shapes
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On average, the time it took to run First Fit algorithm with shapes sorted by area in
increasing order was: 29130 | On average, 19673 sheets were used to store the shapes
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On average, the time it took to run Next Fit algorithm with shapes sorted by area in
decreasing order was: 6 | On average, 21858 sheets were used to store the shapes
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On average, the time it took to run First Fit algorithm with shapes sorted by area in
decreasing order was: 35745 | On average, 13631 sheets were used to store the shapes
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Comments on the results for Task 6

Time:
As in task 5, from the tabulated results it is clearly visible that the running time of Next Fit algorithm is much less than of First Fit. It is also true that the performance of both algorithms is better when the shapes are sorted. Overall it seems that most of the times the running time for the Next Fit algorithm is lowest when the shapes are sorted by width in decreasing order and for the First Fit it varies based on the parameter but it can be seen that performance is better when shapes are sorted in increasing order.

Used sheets:
As in task 5, based on the results it can be noted that the First Fit algorithm uses less sheets to store the shapes than Next Fit. It is also visible that sorting the shapes allows to save space using Next Fit algorithm. On the other hand, the space using First Fit algorithm is saved only when the shapes are sorted in decreasing order using any parameter. The most space using Next Fit is saved when shapes are sorted by height in increasing order and using First Fit when the shapes are sorted by area in decreasing order.