

1E Bin-packing

The process of splitting differently sized items into equally sized “bins”

Finding the Lower Bound

1. Nine boxes of a fixed cross-section have heights, in meters, as follows.

0.3 0.7 0.8 0.8 1.0 1.1 1.1 1.2 1.5

They are to be packed into bins with the same fixed cross-section and height 2m.

Determine the lower bound of bins needed.

First-Fit

- Take the items in the order given (even if not already in ascending)
- Place each item in the first available bin that can take it (starting from bin 1 each time)

First-Fit Decreasing

- Sort items into descending order
- Apply the first-fit algorithm

Full-Bin Packing

- Use observation to find combinations of items that fill a bin
- Use first-fit with any remaining items

2. Use the first-fit algorithm to pack the following items into bins of size 20 (the numbers in brackets are the size of the item). State the number of bins used and the amount of wasted space

A(8) B(7) C(14) D(9) E(6) F(9) G(5) H(15) I(6) J(7) K(8)

3. Apply the first-fit decreasing algorithm to the data in example 2.

4. The items below are packed into bins of size 25.

A(8) B(7) C(10) D(11) E(13) F(17) G(4) H(6) I(12) J(14) K(9)

a) Determine the lower bound for the number of bins

b) Apply the full-bin algorithm

c) Is your solution optimal? Give a reason for your answer.

5. A plumber needs to cut the following lengths of copper wire (lengths in metres).

A(0.8) B(0.8) C(1.4) D(1.1) E(1.3) F(0.9) G(0.8) H(0.9) I(0.8) J(0.9)

The pipe comes in lengths of 2.5m.

- a) Calculate the lower bound for the number of lengths of pipe needed.
- b) Use the first fit decreasing algorithm to determine how the required lengths may be cut from the 2.5m lengths.
- c) Use full bin packing to find an optimal solution.