OPERATIONAL RESEARCH IN EDUCATION

Bin Packing: Theatre Booking
Student Worksheet

Task

You are the manager of a local theatre and are responsible for the seating arrangements for the audience for an upcoming show. Your task is to find the best way to organise the audience members that have already booked online or over the phone, so that they take up the least amount of theatre space possible.

First Thoughts

Question 1
Why do you think audience members should be seated in such a way to minimise the amount of theatre space that is used?

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Question 2
Many businesses, such as cinemas and university lecture halls, allow the audience to choose where they sit. What problems can this approach cause?

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Theatre Information

To complete your task, you need to know the following information:

- The audience seating area in the theatre is arranged such that there are 12 rows, each has ten seats.
- The audience members would like to sit as close to the front of the theatre as possible.
- The audience members who have already booked to see the show must sit together in the groups they have booked in. They cannot be separated.
- The audience members who have already booked to see the show are in the following groups:

2 2 3 5 6 2 1 3 1 4 4 5 8 10 3 5 6 4 4 2

Question 3

Using the modelling packs, find a solution to seat the audience groups using the minimum amount of space as possible.

Question 4

Use this space to write down how you found your solution. Which audience groups did you seat first? How many rows does your solution use altogether?

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An algorithm is a process or set of rules which are to be followed in order to complete calculations or problem-solving operations. This process is one example of Operational research (OR), which applies appropriate, often advanced, analytical methods to real-life problems in order to help make better decisions.

First Fit Algorithm

- You must seat each audience group in the order they are booked.
- Always start from the left hand side of the rows and work from the first row, backwards.

a. Take the first group size. Place it in the first row, starting from the left hand side.
b. Take the next group size. Look to see if there is enough room for it in the first row, immediately after the previous entry. If there is, place the group in this row, starting from the left hand side. If not, put it in the next row.
c. Continue the algorithm so that every person who has already booked has been allocated a seat.

Question 5

Using this algorithm, what is the minimum number of rows required to seat the audience groups who have already booked?

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First Fit Decreasing Algorithm

- You must sort the bookings into decreasing order of audience group size first, before seating them into the appropriate rows.
- Always start from the left hand side of the rows and work from the first row, backwards.

a. Take the first group size. Place it in the first row, starting from the left hand side.
b. Take the next group size. Look to see if there is enough room for it in the first row, immediately after the previous entry. If there is, place the group in this row, starting from the left hand side. If not, put it in the next row.
c. Continue the algorithm so that every person who has already booked has been allocated a seat.

Question 6

Using this algorithm, what is the minimum number of rows required to seat the audience groups who have already booked?

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Evaluation

Question 7

Write the name of the correct algorithm on the 'pros and cons' sheet. Optional: try organising the pros and cons into groups for each algorithm.

Question 8

Which is the best algorithm for the theatre to use?

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