OPERATIONAL RESEARCH IN EDUCATION

OR Society Resources

July 2026

OPERATIONAL RESEARCH IN EDUCATION

The OR Society's Teaching Resources

James Morris
OR Volunteer,
Maths Teacher
MEI Associate

July 2026

OPERATIONAL RESEARCH IN EDUCATION

Introduction

- Operational Research
- The OR Society
- OR in Education
- Overview of our teaching resources

OPERATIONAL RESEARCH IN EDUCATION

Operational Research

Operational research (OR) is the application of mathematical methods and advanced analysis to improve decision-making

Or:

‘The science of better decision-making’

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OR in detail: Supermarkets

Understanding people's buying patterns

Determining the number of staff needed on checkout and when

Calculating order quantities and delivery times

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OR in detail: Airlines

Forecasting where people want to go and when

Setting the ticket prices

Simulating boarding the plane

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OR in detail: Healthcare

Moving people through waiting lists as quickly as possible

Using hospital resources as efficiently as possible

Increasing the number of transplant operations

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OR in detail: Sports

Demonstrating large buildings are safe to use

Predicting where signs/directions should be

Keeping people moving at busy events

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The Operational Research Society

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The Operational Research Society

The OR Society is the membership body for 3,100 professionals in 53 countries.

- Publications
- Conferences & Training
- OR in Education & Pro Bono OR

THE OPERATIONAL RESEARCH SOCIETY

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OR in Education

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OR in Education

The OR in Education aim:

Every student should know what OR is

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Why?

- Invest in future OR professionals
- OR is a rapidly growing and developing field
- OR is a great career for people who enjoy maths

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How?

We…

- Run workshops & attend careers events
- Attend large scale events
- Develop resources for teachers & volunteers to use
- Deliver teacher training

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Teaching Resources

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Resources

- Hands on and interactive
- Off the shelf
- Real world examples
- Free

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School visits

- Free
- Workshops or careers talks
- May be volunteer dependent
- All we require is a member of staff present at all times

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Links to resources

Our resources can be found at:

www.tes.com/member/TheORSociety

www.theorsociety.com/resource-centre/teaching-resources/

Information/visit request forms are available at:

www.theorsociety.com/what-we-do/or-in-education/for-teachers/

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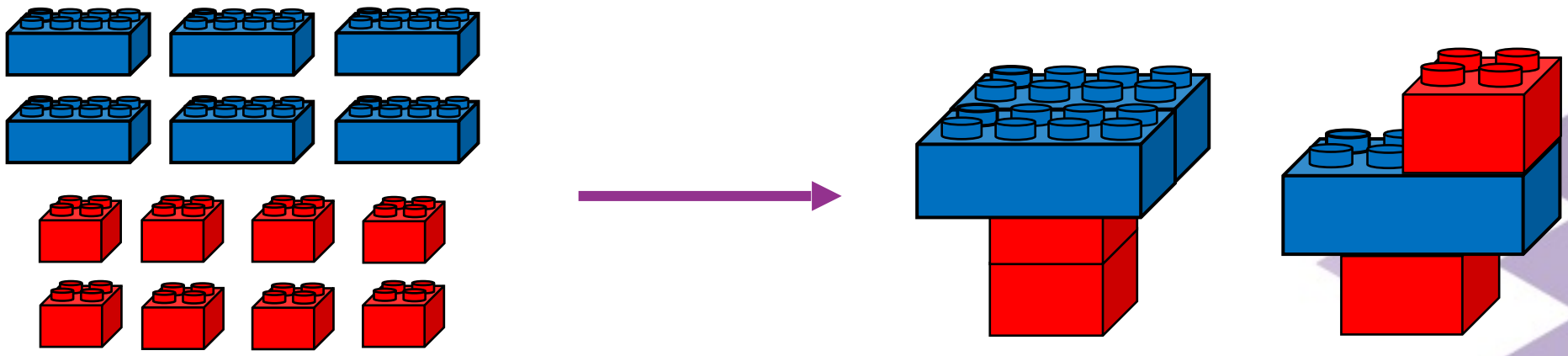
Lego Furniture Factory

- Focus: Optimisation



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Theatre Booking

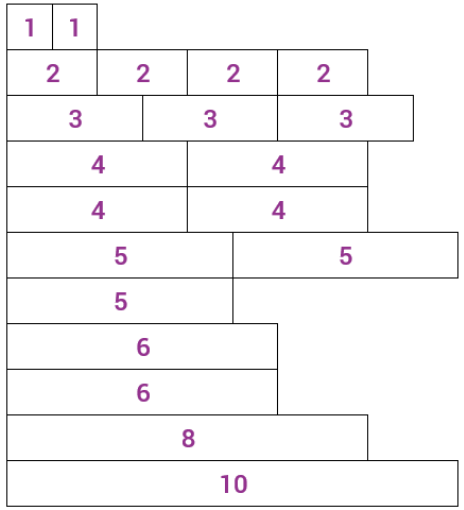
- Focus: Bin packing algorithms

Bin Packing: Theatre Booking

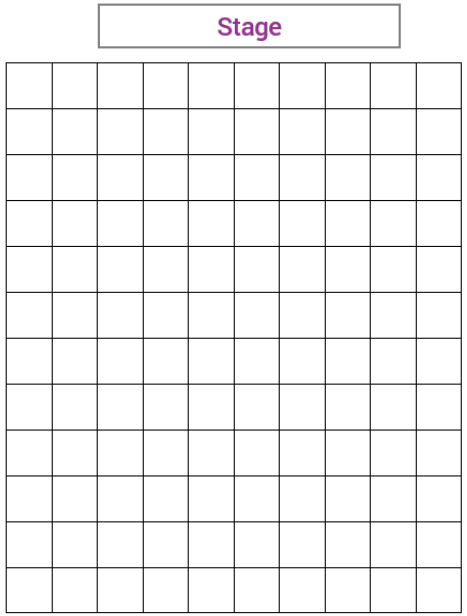
Group Bookings Template

You should have:

- 2x '1' rectangles 4x '2' rectangles 3x '3' rectangles 4x '4' rectangles
- 3x '5' rectangles 2x '6' rectangles 1x '8' rectangles 1x '10' rectangles



Theatre Seating Grid



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.

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.

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Other resources

- Travelling Salesperson Problem
- Process Improvement
- Algorithm worksheets
- And even more

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Reminder

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SWEDEBUILD – Lego Furniture Factory

Operational Research

January 2025

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Introduction

- SWEDEBUILD would like to launch a new range of dining furniture that will include some tables and chairs.

- Can you help the production manager find out how many tables and chairs should be made in order to earn the greatest profit?

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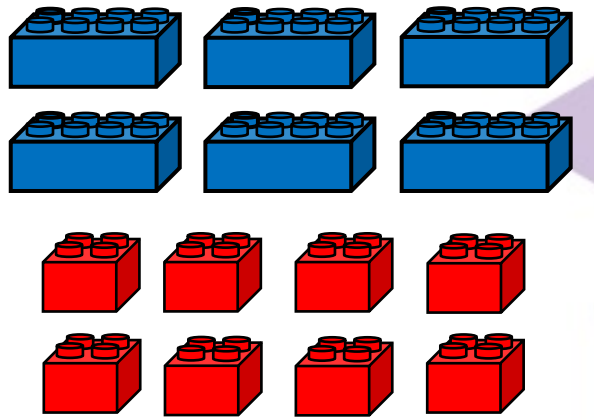
Modelling

- SWEDEBUILD has a limited amount of resources. The company has asked you to build the furniture using a limited amount of Lego bricks:

- 6 x rectangular Lego bricks

- 8 x square Lego bricks



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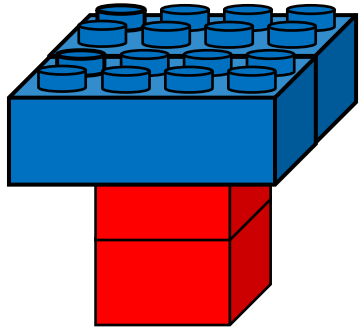
Modelling: Question 1

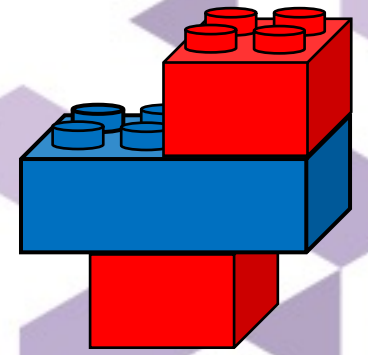
To make a table, use:

- 2 x rectangular Lego bricks
- 2 x square Lego bricks

To make a chair, use:

- 1 x rectangular Lego brick
- 2 x square Lego bricks





Q1: How many tables and chairs can you make?

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Modelling: Question 2

Q2: How much will it cost to produce the tables and chairs that you have just made?

- A square brick costs £3.00
- A rectangular brick costs £5.00

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Modelling: Questions 3 & 4

Q3: How much will each combination sell for?

- A table sells for £32.00
- A chair sells for £21.00

Q4: Which combination of tables and chairs will give you the greatest profit?

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Constraints

SWEDEBUILD wants to make as much profit as possible. The amount of resources available limits this possibility and is called a constraint.

What if our LEGO® bricks represented 600 / 800 bricks?

…Or 6,000,000 / 8,000,000?

Being able to formulate algebraic equations for the constraints allows them to be graphed and a solution can be identified quickly.

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Constraints: Variables

The constraints for our tables and chairs problem can be modelled using two variables:

- t = the number of tables produced
- c = the number of chairs produced

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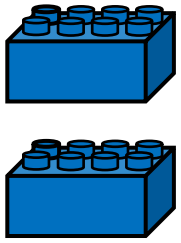
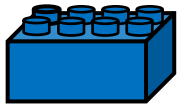
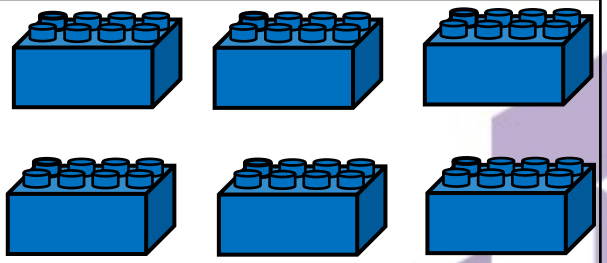
Constraints: Rectangular Bricks

- Q5: Write an inequality that links the number of tables and chairs to the number of rectangular bricks

No. rectangular bricks used		Total no. rectangular bricks available
Tables (t)	Chairs (c)	
2	1	6
		

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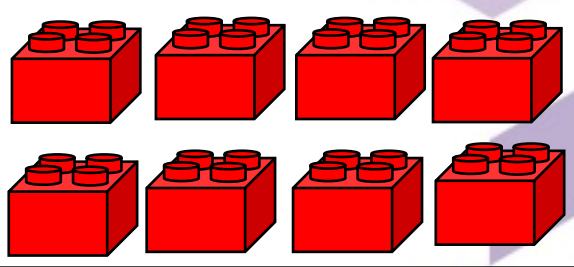
Constraints: Square Bricks

Q6: Write an inequality that links the number of tables and chairs to the number of square bricks used

No. square bricks used		Total no. square bricks available
Tables (t)	Chairs (c)	
2	2	8
		

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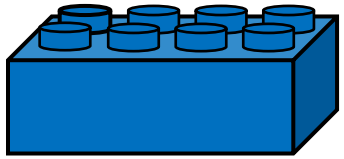
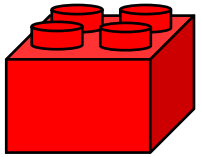
Constraints: Inequalities





The inequalities are

- Rectangular bricks: $2t + c \leq 6$
- Square bricks: $2t + 2c \leq 8$

What coordinates would you plot in order to graph them?

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Solving the inequalities: 2t+c=6

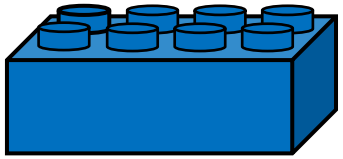
For rectangular bricks, 2t + c = 6

First, solve for c. If t = 0, what does c = ? Then solve for t when c=0

2t + c = 6

0 + ? = 6

2(?) + 0 = 6



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Solving the inequalities: 2t+c=6

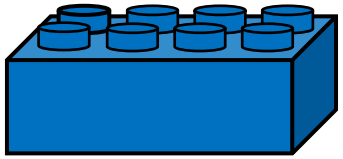
For rectangular bricks, 2t + c = 6

First, solve for c. If t = 0, what does c = ? Then solve for t when c=0

2t + c = 6

0 + 6 = 6

2(3) + 0 = 6



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Solving the Inequalities: 2t+2c=8

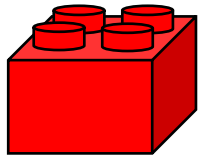
For square bricks, 2t + 2c = 8

First, solve for c. If t = 0, what does c = ? Then solve for t when c=0

2t + 2c = 8

0 + 2(?) = 8

2(?) + 0 = 8



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Solving the Inequalities: 2t+2c=8

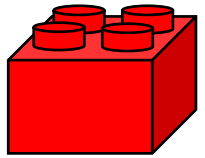
For square bricks, 2t + 2c = 8

First, solve for c. If t = 0, what does c = ? Then solve for t when c=0

2t + 2c = 8

0 + 2(4) = 8

2(4) + 0 = 8



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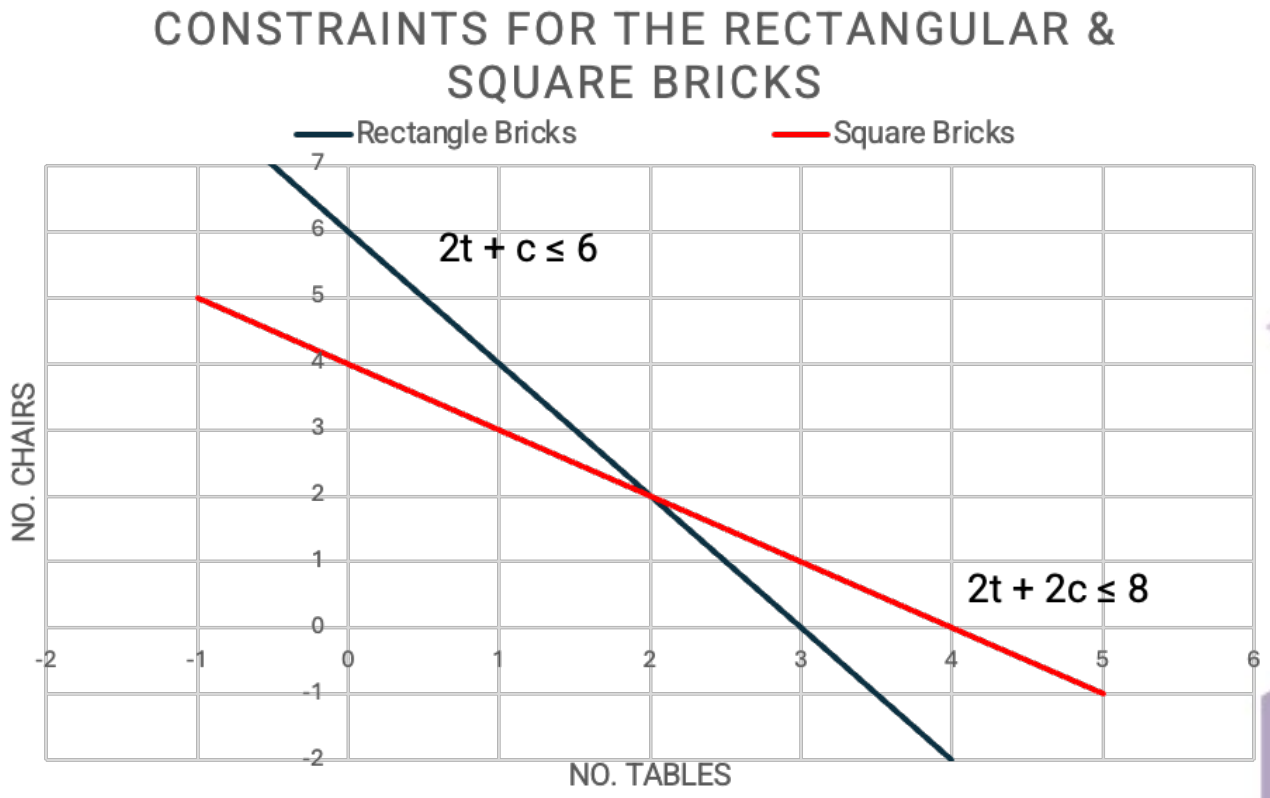
Graphing the Equation: Question 7

- Q7: Plot the constraint inequalities on the same graph



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Graphing the Equation: Questions 8-10

Q8: Can you plot the points on the graph that represent the different combinations of tables and chairs that you worked out in Question 3?

Q9: Could negative numbers form part of the solution?

Q10: Write a report for the production manager of SWEDEBUILD. This should explain your recommendations to the company and how you came to those conclusions.

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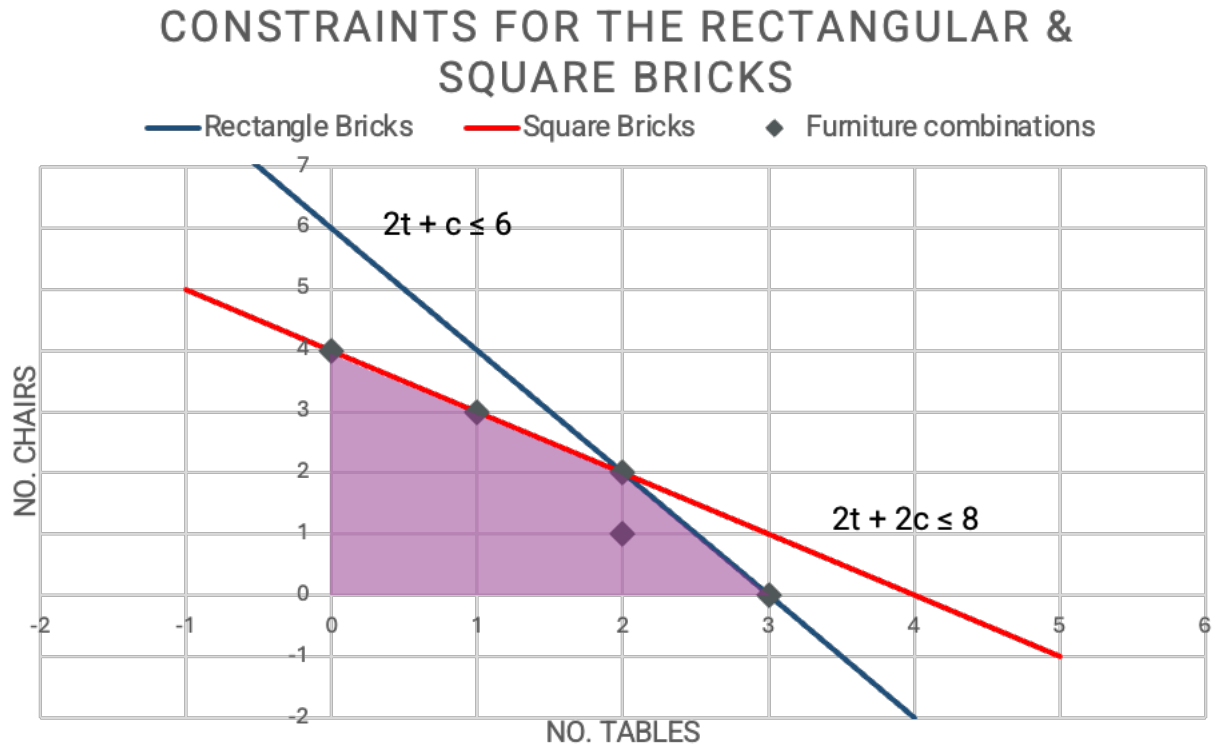
Graphing the Equation

- Purple area: feasible region



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Linear Programming

This type of maths is called linear programming.

Linear programming is concerned with finding the best solution (e.g. increase profit, reduce costs) from a set of constraints.

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Linear Programming: Examples

Linear programming can also be used to help provide low cost, healthy food packages to people in need.

What might the constraints be in this case?

Linear programming is used extensively in operational research.

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Theatre Bookings

Operational Research

March 2025

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Introduction

You are in charge of the seating arrangements for the audience of an upcoming theatre show.

You need to find the best way to organise the audience group bookings, so that when they are seated they take up the least amount of space possible.

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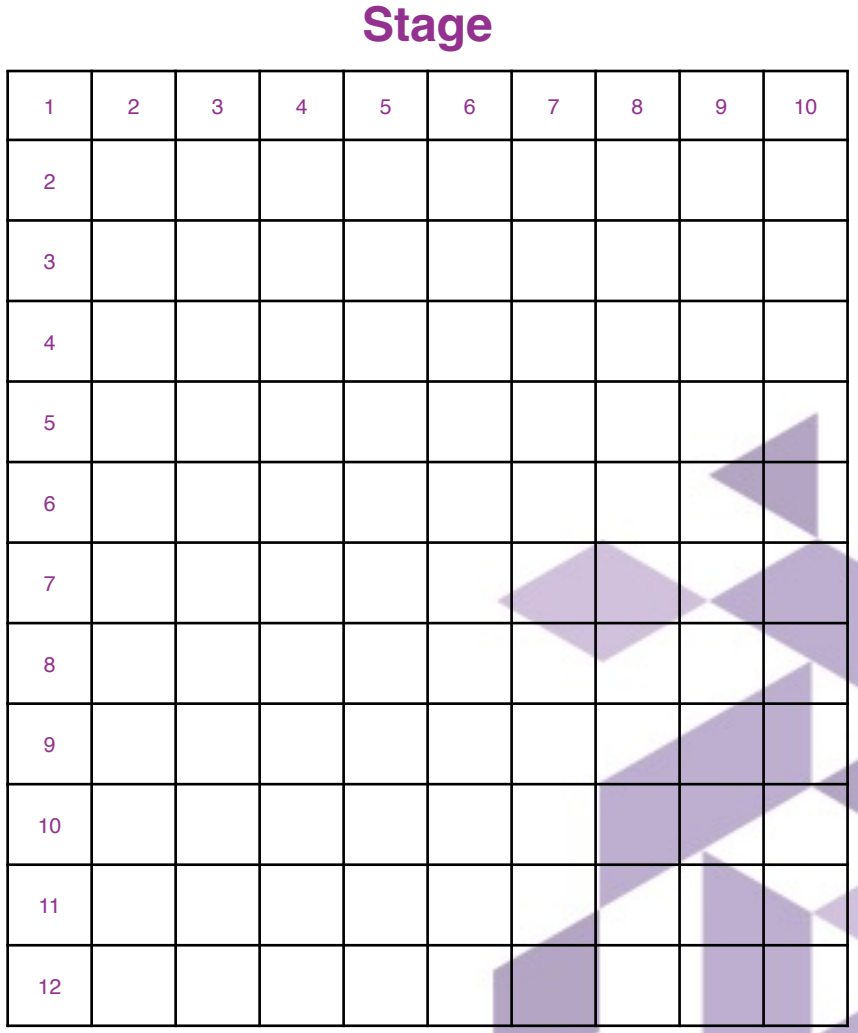
Theatre Information

The audience seating area in the theatre is arranged such that there are 12 rows, each row has ten seats.

The audience members would like to sit as close to the front of the theatre as possible.



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Theatre Information

The people who have already booked to see the show must sit together in their groups and cannot be separated.

The following groups have currently made bookings:

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

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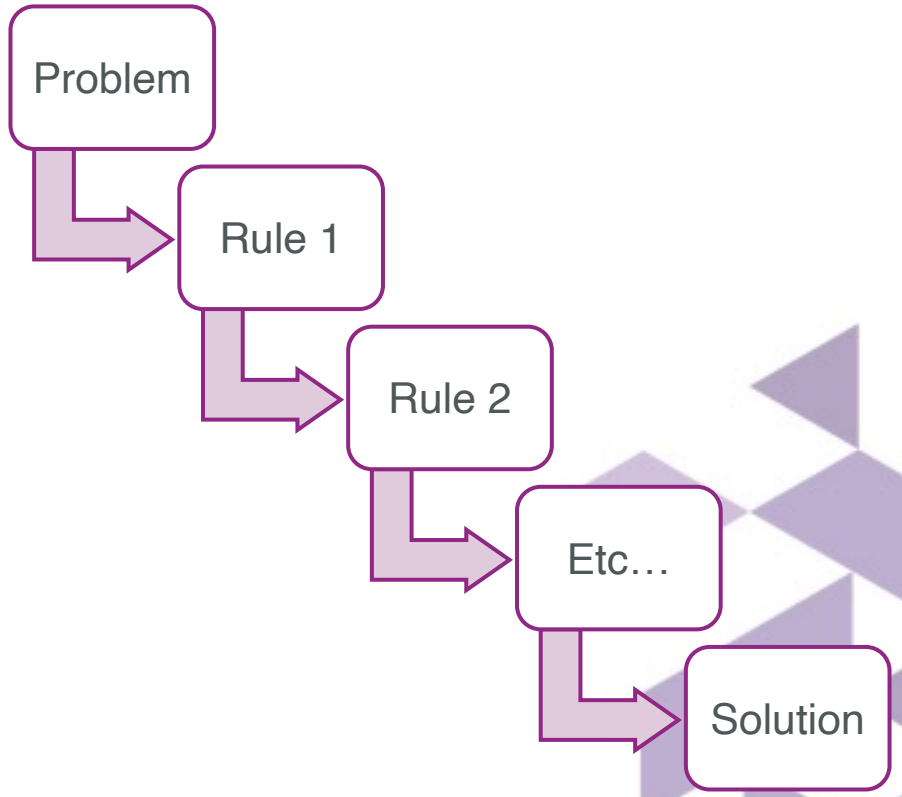
Algorithms

An algorithm is a process or set of rules which are to be followed in order to complete calculations or problem-solving operations.



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The 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 (the one nearest the stage) backwards.

1. Take the first group. Place it in the first row, starting from the left-hand side.
2. Always place the next group in the lowest numbered row which can fit the group.
3. Continue until every person who has already booked has been allocated a seat.

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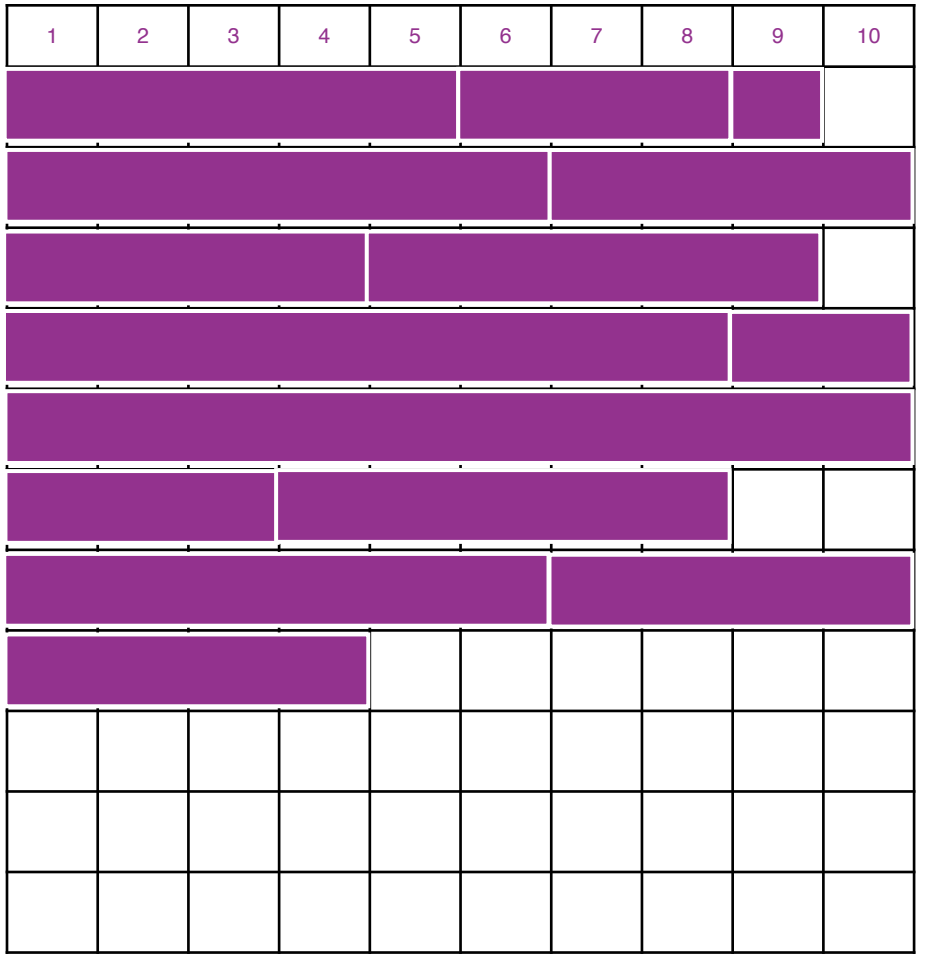
The First Fit Algorithm

Order of groups:

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



The minimum amount of rows required for this algorithm is nine.

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The First Fit Decreasing Algorithm

This is exactly the same as the first fit algorithm, except you must sort the given data into **decreasing order** first, **before** sorting the data into rows.

Apply the ‘First Fit Decreasing’ algorithm.

What is the minimum number of rows you use?

Remember, the group sizes were:

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

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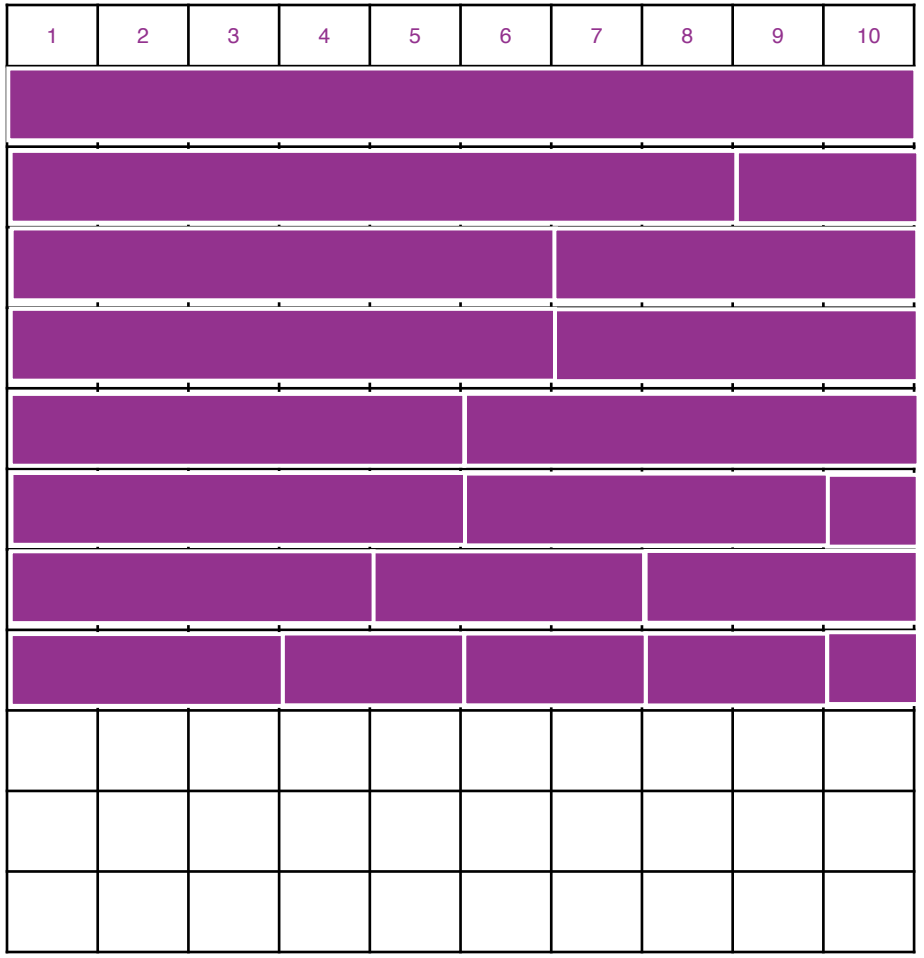
The First Fit Decreasing Algorithm

Order of groups:

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



The minimum number of rows required for this algorithm is eight.

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Evaluation

What are the pros and cons of each algorithm?

Which is the best algorithm for the theatre to use?

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Bin Packing Algorithms

Bin packing algorithms are also used for loading containers such as ferries:

Portsmouth Harbour (Google Maps Satellite View)

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Bin Packing Algorithms

Bin packing algorithms are also used for:

- Cutting cookies or pastry out of dough
- Scheduling adverts in fixed length breaks on TV or radio

There are a wide variety of algorithms with a wide variety of uses.

Algorithms are used extensively in operational research (OR).

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Get in touch

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Twitter: @ORinEducation

YouTube: OR in Education

education@theorsociety.com