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UNIVERSITY OF
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Car Parking

(by Martin Homer)

This is an open-ended challenge, there are no right or wrong answers, it can be used as a brainstorming exercise or carried out over a prolonged period of time, like a project.

Land in cities is in short supply, and so the value of parking spaces is very high; perhaps as much as £100,000 per space in central London. So when making a new car park, it is important to design them so as to fit in as many parking spaces as possible.

Your challenge is to find a way of fitting as many parking spaces as possible into a given area, whilst maintaining the overall usability of the car park.

Two areas to try are shown below. You can move the entrances and exits, provided they stay on the same side of the car park, as shown in the figure.
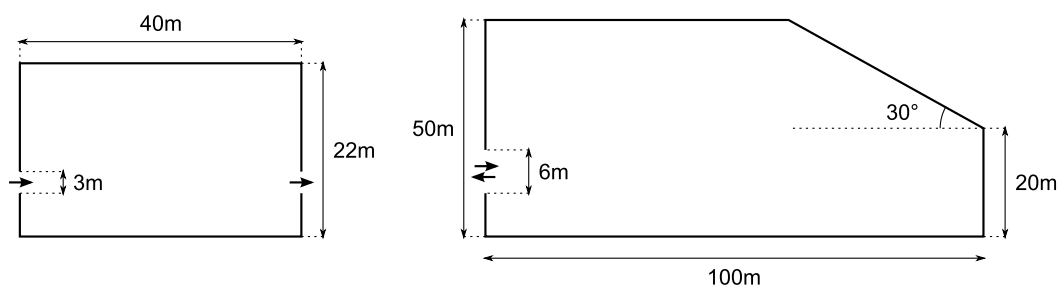
Solution

There are two constraints on how the spaces (known as bays) in a car park should be arranged: **One:** The bays must be big enough to accommodate the type of vehicles that will park in them. Some vehicles are bigger than others but in practice a design standard has been adopted which recommends that each bay is at least 4.8m×2.4m. Note 2.4m is a little wider than a typical car, but the surplus allows some room to open the doors etc. **Two:** There needs to be sufficient room for a car to manoeuvre into each bay and it must be possible to drive between the entrance / exit and each bay, even when every other bay is full. This concerns the manoeuvrability of vehicles and this is sometimes understood in terms of their turning circles, see e.g. `http://en.wikipedia.org/wiki/Turning_radius`.

Common sense suggests that a 90° arrangement requires a wider aisle to allow cars sufficient space to turn into the bays than angled bays, as the latter require less space for turning. To begin with, it is easiest to use a single, unform, size of parking bay; adding different sizes (e.g. disabled, parent and child) bays makes the problem significantly harder. Possible approaches to consider:

- What is the *maximum* number of bays you can fit into a given area (without aisles, as in)?

- Can you draw inspiration from the layout and dimensions of existing car parks?

- What are the typical dimensions of different makes of car? What are their turning circles?

- What is the area swept out by a car manoeuvering into a bay, and how is this related to the turning circle, and the width of an aisle?

- Does it help to experiment with setting the bays at different angles to the aisles? Thinking about an infinite car park, without boundaries, might help simplify this calculation.

- When designing the layout, should one begin by deciding where to put bays, or alternatively begin by placing the aisles?

- How do you demonstrate that your layouts are valid? — i.e., that it is possible to access all the bays from the entrance/exit?

- Are some shapes easier to pack than others (a lower total area per bay)?

- How do you know if you have achieved the best possible layout?