



It can take a very long time to count all the organisms in a **population** in a large area. A **quadrat** is used to take **samples**. A quadrat is a square frame of a particular size, such as 50 × 50 cm.

The position of a quadrat in an area is selected randomly. This can be done by dividing the whole area into a grid and selecting grid coordinates using a random number generator. The quadrat is placed at the coordinates.

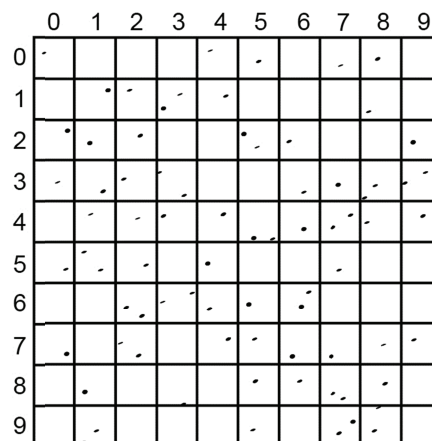
The number of individuals of the study species inside the quadrat is recorded. The quadrat is then placed at another set of random coordinates, and the number of individuals is recorded again. The number of times this process is repeated often depends on the time available. However, it is best to take at least five samples.

To estimate the total population size, you add up the total number of organisms in all the quadrats. You also calculate the total area of all the quadrats and the total area of the study area. The formula for calculating an estimate of the population size is:

$$\text{estimated population size} = \text{total number of organisms in samples} \times \frac{\text{total area of study area}}{\text{total area of quadrats}}$$

- Use the information above to write a method for an investigation to estimate the population size of daisy plants on a school field.
- Write an apparatus list for your method.
- For which of these organisms would quadrat sampling not work? Give a reason for your answer.
dandelion plants blackbirds shellfish attached to rocks ground beetles
- Give a reason why quadrats should be randomly placed when taking samples to estimate population size.
- The diagram shows the position of daisy plants on a school field. Each square is 1 m by 1 m.

- Use random numbers to select 10 pairs of coordinates. These are your 10 sample squares on the grid.
- Count and record the number of plants in each of your sample squares.
- Use your results, and the formula above, to calculate an estimate for the size of the daisy plant population on the field. Show your working.



Extra challenge

- The total number of daisies in the field above is 78.
 - Compare your value from question 5c with the actual total, suggesting a reason for any difference.
 - Using further samples, test the statement above that it is best to take at least five samples to get a reasonable estimate of population size.