

2D ARRAYS AND IMAGES

Learning Objectives

Understand and use a 2D array.

Understand the coordinate system for pixels and how to retrieve one.

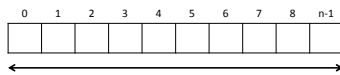
How to get a pixel at a given x and y location

2.4 Arrays and Images

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Pictures and 2-D Arrays

- an array is like a line of boxes, each storing one particular item.
 - This line only extends in one dimension (length), so it is sometimes referred to as a 1-D array.



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Pictures and 2-D Arrays

- A 2-D array on the other hand, has both a width and a height.
 - Ex: A chessboard: it is an 8 by 8 grid of squares, and each square can hold a chess piece.
- two-dimensional array (definition)
 - A way of representing a two-dimensional structure such as an image using an array of arrays. Two dimensional arrays use two indices (row and column) instead of one to access their data elements.

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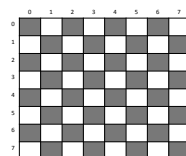
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Pictures and 2-D Arrays

- Accessing individual boxes in a 2-D array is similar to that of a 1-D array, except that now, you need to provide 2 indexes.
- One index is for the row, and the other index is for the column.

arrayname [row] [column]

- On the chessboard, to access one the top left corner, we could use `chessboard[0][0]`, and to access the diagonally opposite corner, we could use `chessboard[7][7]`.



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Pictures are 2-D Arrays

- Think of the columns as the x-axis and rows as the y-axis.
- Pictures are like 2-D arrays. They are filled with pixels in two directions (like the squares on a chessboard).
- Individual pixels can be addressed using their x and y coordinates.
- To do this with the picture object, we can use the following code:

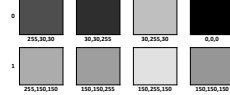
```
Pixel pixelObj = pictureObj.getPixel(x, y);
```

- This gets the pixel information at point (x,y), and stores it an object of type Pixel called pixelObj.

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learn by doing

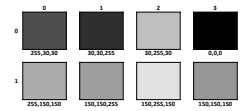


- The image above represents a 2D array named `colourMatrix`.
 - How would you access the colour indicated at (30,255,30)?
 - How would you access the colour indicated as (150,150,255)?
 - What is the red value of the colour at `colourMatrix[0][3]`?

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Our Solution



- How would you access the colour indicated at (30,255,30)?
 - The correct answer is `colourMatrix[0][2]`. You can index into a 2-D array by using column and row coordinates. In this case, you can do something like `colourMatrix[rowindex][columnindex]`.
- How would you access the colour indicated as (150,150,255)?
 - The correct answer is `colourMatrix[1][1]`.
- What is the red value of the colour at `colourMatrix[0][3]`?
 - You can index into a 2-D array by using column and row coordinates. The first number (0) is the row, and the second (3) is the column. The correct answer is the black square. The red value of the black square is the R in RGB (the first number, i.e. 0).

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Did I get this?

- If you start to look, you will see two dimensional arrays in other places besides images.
- For example, when you get theatre tickets, they may provide a row number and a seat number.

Can you think of any other real world examples of two dimensional arrays?

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Our Solution

- Another good example is a paper street map. You can look up a street on a street map, and it will have something like "D5" written next to it. This tells you to look for the area of the map labeled D (4th column) and 5 (5th row).
- Many board games also use a two dimensional grid (such as checkers and chess).

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Changing a picture

- Now that we know how to get to pixels of an image, let's try to make a visible change in an image.
- Remember that the first coordinate of a picture controls the x (horizontal) position.

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- What do we do to draw a horizontal line somewhere in the picture?
 - Load an image so that we can manipulate it.
 - Create the image object.
 - Set a sequence of pixels to a different colour: Do we change the x or the y coordinates?
 - Repaint the image.

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Summary

- A 2D array stores items in multiple rows. Those items are indexed using
`arrayName[row][column]`
- A picture can be thought of as a 2D array of pixels.
- To retrieve a pixel at a specific location, we use `getPixel(x,y)`, which specifies the horizontal (x) coordinate and the vertical (y) coordinate of the pixel to be retrieved.