Algorithms and Data Structures

Investigating A Card Shuffle App

You are provided with a Card Shuffler program. Even if you aren't familiar with coding a GUI, studying this program carefully, and amending it should make it clear how they work. Open the program Graphic_Shuffle_Investigation.sb. Make sure you have the folder Cards folder in the same directory as the program. Run the program – it should look like the window below, but nothing works!

Creating a graphics window, like that shown is straightforward. Can you see it in your code? It is shown right (lines 7 – 11). Note also the use of a FilePath variable (line 19), which will allow you later in the program to create a string pointing to the subdirectory of the card images. Line 43

```
6
7  ' Graphics Window
8  GraphicsWindow.Title = "Shuffle"
9  GraphicsWindow.Width = 1013
10 GraphicsWindow.Height = 215
11 GraphicsWindow.BackgroundColor = "#458B00"
12
13 ' Set Initial Variables
14 x = 10
15 y = 100
16 x1 = 10
17 y2 = 100
18 'The following is used to create the path to the card images
19 FilePath = Program.Directory
20
```

```
41   For i = 1 To 52
42     ' The card images must be in a sub directory of the program directory.
43     CardBack = FilePath + "\CardsSmall\53.png"
44     GraphicsWindow.DrawImage(CardBack,x,y)
45     x = x + 18
46     Program.Delay(25)
47   Endfor
```

(shown left) demonstrates how the FilePath variable is concatenated (joined) with the filename of the card back image (53.png) in the string CardBack.

Explain how 52 card back images are displayed in a row.

Which subroutine contains the commands to create the other graphic elements (titles, buttons etc.)?

The buttons are examples of control objects. These allow a GUI to be controlled via button clicks and other common features. Ours don't work, because the relevant code on Line 27 is commented out. When it is activated, a button click will 'raise an event' causing the Click subroutine to be called.

Explain how the Click subroutine works.
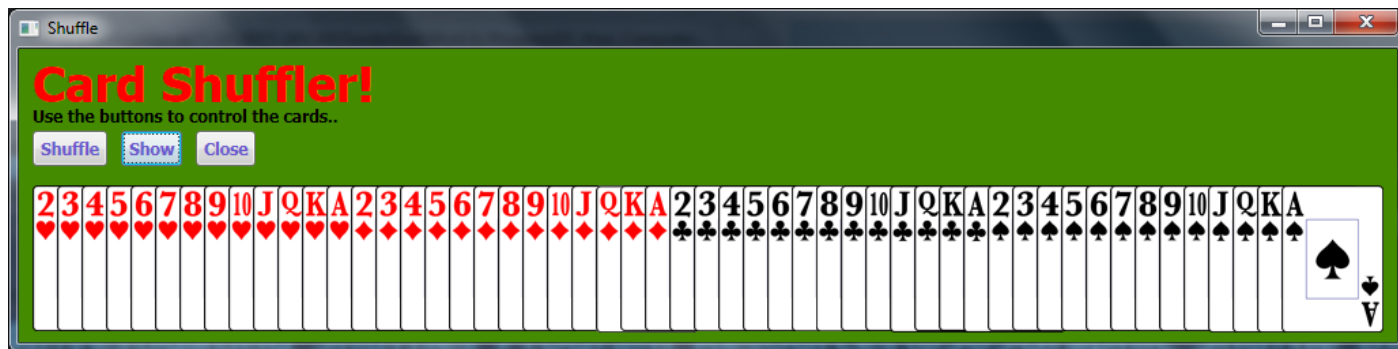
Challenge1: Displaying the deck in order

Once the buttons are activated we are able to display the cards in shuffled order. But why can't we display them in the original order when the deck is created? Each image has a number as a filename. If you look at these images, when an array of integers from 1 to 52 is created, the cards mapped to these numbers should display in order when first created (as shown above). Refactor the code, so it displays the original Deck in order, before a Shuffle takes place.

Challenge 2: Tidying the code

The shuffle subroutine uses a Knuth shuffle, which is difficult to understand. Amend the code to include your own shuffle algorithm into the subroutine. If you used a Swap subroutine you will have to include that as well.

Currently the shuffle subroutine also includes the code to display the cards face down. This has nothing to do with shuffling and should be factored out into it's own subroutine. This is a common mistake. Subroutines should always be developed for separate tasks.

Challenge 3: Sorting the deck

Implementing any sorting algorithm is a challenge, but it if you can code a bubble sort (or any other sorting method) include it so the cards can be sorted back into order.

There is a simpler way to do this, and that is to recreate the array. Calling the subroutine ManyIntegers will achieve the same result. This can be done with some simple refactoring.

Whichever method you choose, the real challenge is then to work out how to create and display a fourth button which calls a subroutine CardSort when it is clicked.

Challenge 4: Name that card

This final challenge is quite hard, so treat it as an extension. We represent a deck of cards by the numbers 1 to 52. Write the code to input a value to a variable **CardNumber**. It will then print the description of the card e.g. "King of Hearts". Encapsulate this in a subroutine **CardName.** The image provides a hint to help you achieve this.

It does not need to be incorporated in the GUI, but that could be an extra challenge!

Good luck!

Card Numbers and Values

Hearts	Diamonds	Clubs	Spades	Card
1	14	27	40	2
2	15	28	41	3
3	16	29	42	4
4	17	30	43	5
5	18	31	44	6
6	19	32	45	7
7	20	33	46	8
8	21	34	47	9
9	22	35	48	10
10	23	36	49	J
11	24	37	50	Q
12	25	38	51	K
13	26	39	52	A