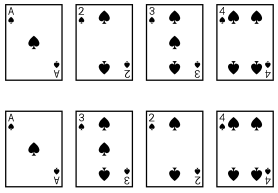
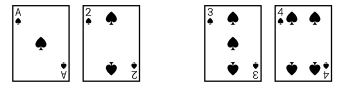
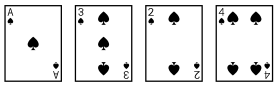
Crawfish: Taking a smaller Case

What is a perfect shuffle? Define it in your own words.

Exploring Perfect Shuffles:

There are 4 cards in a deck. A, 2, 3, and 4. Draw each iteration of a perfect shuffle until the deck returns to its original state. Use your cards to help you:

Start	Cut the deck	End
		

Test different size decks and make observations! Use your cards to perform the perfect shuffles.

a) Make a deck of 3 cards (A, 2, 3). Perform perfect shuffles until the deck returns to its original state.

b) Make a deck of 4 cards (A, 2, 3, 4). Perform perfect shuffles until the deck returns to its original state.

c) Continue making larger and larger decks. Fill in the table below.

When you get HERE take a break! Can you make a prediction about what comes next?

# of cards in deck	# perfect shuffles needed to restore deck to original state
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	

What observations can you make?

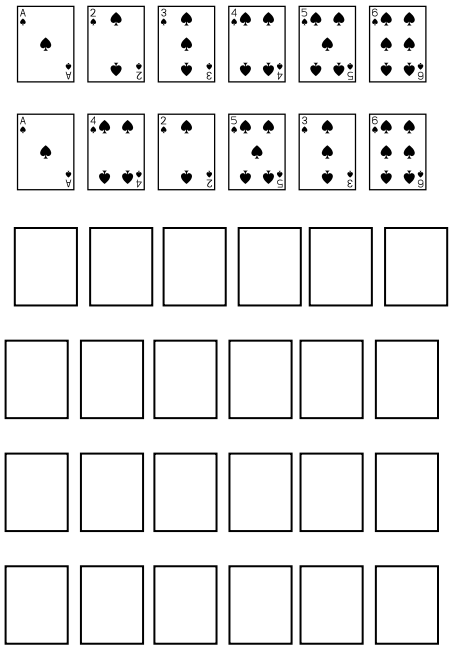
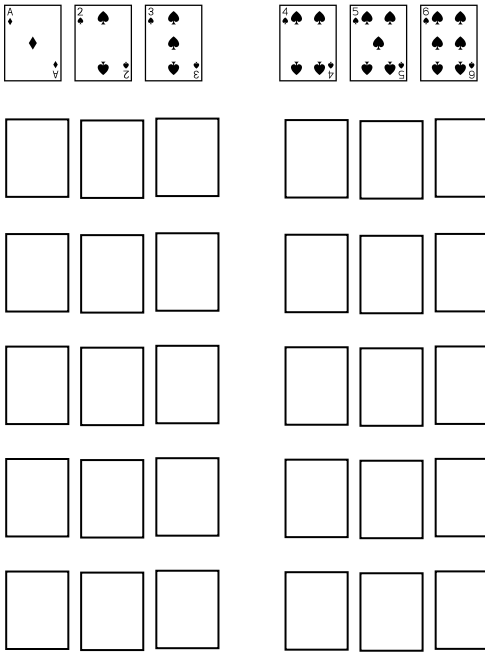
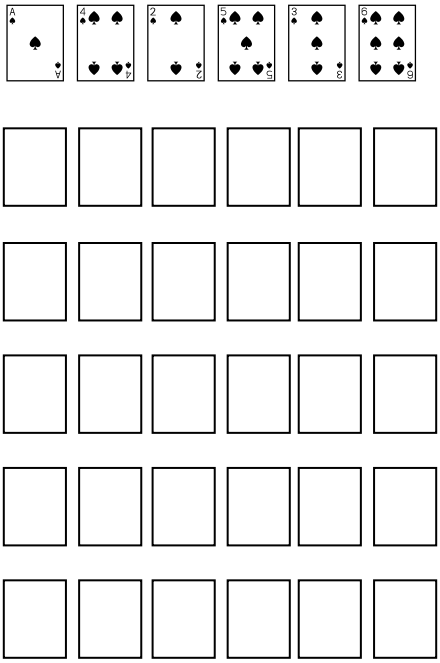
Do you notice any patterns?

Catfish: Following a Card in a smaller Case

What is a perfect shuffle? Define it in your own words.

Exploring Perfect Shuffles:

There are 6 cards in a deck. A, 2, 3, 4, 5, 6. Draw each iteration of a perfect shuffle until the deck returns to its original state. **(**You might not need to use every row)**:

Start	Cut the deck	End
		

Test different size decks and make observations! Use your cards to perform the perfect shuffles.

a) Make a deck of 7 cards (A, 2, 3, 4, 5, 6, 7). Perform perfect shuffles until the deck returns to its original state.

b) Make a deck of 8 cards (A, 2, 3, 4, 5, 6, 7, 8). Perform perfect shuffles until the deck returns to its original state.

c) Continue making larger and larger decks. Fill in the table below.

# of cards in deck	# perfect shuffles needed to restore deck to original state
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	

What observations can you make?

Do you notice any patterns?


Make a deck of 10 cards using A – 10. Fill in the table below to chart the path of the 2 card. Stop when the 2 card returns to its original position. You might not need to use every row.

Number of Perfect Shuffles	Starting position	Position after the deck is cut	End position after perfect shuffle	Notes/observations
0	2 of 10	2 of 5 (in left hand)	3 of 10	
1	3 of 10	3 of 5 (in left hand)		
2				


When the 2 card returns to its original position, what do you notice about the rest of the deck?


Will this always be the case? Why or why not?

 What do you want to do next??

a. Option J: Make a deck of 10 cards (A – 10). Make a table to chart the path of a different card.
b. Option Q: Make a deck of 12 cards (A – Q). Make a table to chart the path of the 2 card.

 In a deck of 10 cards your 2 card is in position 5 out of 10. Explain how to figure out where it will go next.

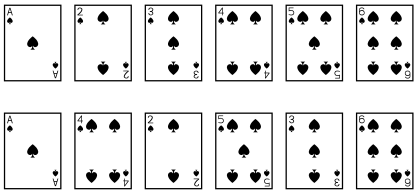
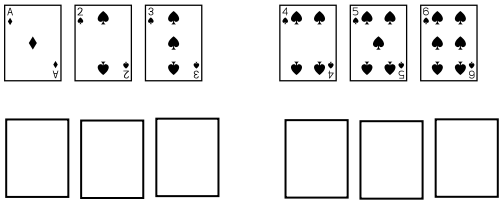
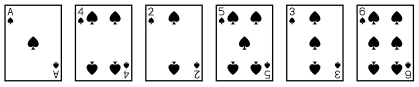
 In a deck of 10 cards your 2 card is in position 9 out of 10. Explain how to figure out where it will go next.

 How do you know when your deck is *about* to return to its original state?

Alligator: Following Cards and Non-examples

What is a perfect shuffle? Define it in your own words.

Complete the drawing of the next perfect shuffle for a deck of 6 cards:

Start	Cut the deck	End
		

Exploring Perfect Shuffles:

Make a deck of 10 cards using A – 10. Fill in the table below to chart the path of the 2 card. Stop when the 2 card returns to its original position. You might not need to use every row.

Number of Perfect Shuffles	Starting position	Position after the deck is cut	End position after perfect shuffle	Notes/observations
0	2 of 10	2 of 5 (in left hand)	3 of 10	
1	3 of 10	3 of 5 (in left hand)		
2				

 When the 2 card returns to its original position, what do you notice about the rest of the deck?

 Will this always be the case? Why or why not?

 What do you want to do next??

a. Option J: Make a deck of 10 cards (A – 10). Make a table to chart the path of a different card.
b. Option Q: Make a deck of 12 cards (A – Q). Make a table to chart the path of the 2 card.
c. Option K: Using a deck of 52 cards. Make a table to chart the path of the 2 card. (If you can do this without using physical cards, you are welcome to do so!)

 In a deck of 52 cards your 2 card is in position 9 out of 52. Explain how to figure out where it will go next.

 In a deck of 52 cards your 2 card is in position 33 out of 52. Explain how to figure out where it will go next.

 For *any* size deck, how do you know when the deck is *about* to return to its original state?

 Is there a deck that cannot return to its original state after infinite perfect shuffles? If yes, give an example.