COM2108: Functional Programming
Assignment 3

Test Results

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Functions

Variable Names: **seed**   : An integer to initialise the random number generator

1. **kingResToEmptyCol:** Moves a king from the reserves to an empty column
   - **Test Cases**
     1. Move a King when **no columns available**
     2. Move one King when **1 column available**
     3. Move one King when **more than 1 columns are available**
     4. **No kings** to move but there is **one empty column**

Test Case	eOBoard	Result	Status
1	([],[[(Five,Hearts),(Queen,Hearts),(Eight,Diamonds),(Queen,Clubs),(Three,Hearts),(Eight,Hearts)],[(Ace,Clubs),(King,Hearts),(Queen,Spades),(Three,Clubs),(Seven,Clubs),(Nine,Spades)],[(Six,Diamonds),(Five,Diamonds),(Five,Clubs),(Four,Spades),(Six,Clubs),(Two,Hearts)],[(Seven,Hearts),(Four,Clubs),(Two,Clubs),(King,Spades),(Six,Hearts),(Ace,Spades)],[(Jack,Spades),(Queen,Diamonds),(Two,Spades),(Five,Spades),(Jack,Diamonds),(King,Clubs)],[(Eight,Spades),(Nine,Clubs),(Three,Spades),(Nine,Diamonds),(Jack,Hearts),(Ten,Hearts)],[(Seven,Diamonds),(Six,Spades),(Eight,Clubs),(Four,Diamonds),(Ten,Clubs),(Jack,Clubs)],[(Four,Hearts),(Ace,Hearts),(Ten,Diamonds),(Seven,Spades),(Ten,Spades),(Two,Diamonds)]],[(King,Diamonds),(Three,Diamonds),(Nine,Hearts),(Ace,Diamonds)])	([],[[(Five,Hearts),(Queen,Hearts),(Eight,Diamonds),(Queen,Clubs),(Three,Hearts),(Eight,Hearts)],[(Ace,Clubs),(King,Hearts),(Queen,Spades),(Three,Clubs),(Seven,Clubs),(Nine,Spades)],[(Six,Diamonds),(Five,Clubs),(Four,Spades),(Six,Clubs),(Two,Hearts),(Four,Clubs)],[(Two,Clubs),(King,Spades),(Six,Hearts),(Ace,Spades)],[(Jack,Spades),(Queen,Diamonds),(Two,Spades),(Five,Spades),(Jack,Diamonds),(King,Clubs)],[(Eight,Spades),(Nine,Clubs),(Three,Spades),(Nine,Diamonds),(Jack,Hearts),(Ten,Hearts)],[(Seven,Diamonds),(Six,Spades),(Eight,Clubs),(Four,Diamonds),(Ten,Clubs),(Jack,Clubs)],[(Four,Hearts),(Ace,Hearts),(Ten,Diamonds),(Seven,Spades),(Ten,Spades),(Two,Diamonds)]],[(King,Diamonds),(Three,Diamonds),(Nine,Hearts),(Ace,Diamonds)])	**Pass**
2	([],[[(Five,Hearts),(Seven,Clubs),(Ten,Hearts),(Six,Diamonds),(Four,Clubs),(Three,Clubs)],[(Four,Spades),(Ace,Hearts),(Three,Hearts),(Ace,Clubs),(King,Diamonds),(Four,Diamonds)],[(Three,Diamonds),(Two,Hearts),(Jack,Spades),(Nine,Hearts),(Five,Clubs),(Two,Spades)],[(Six,Clubs),(Four,Hearts),(Five,Spades),(Seven,Spades),(King,Spades),(Ace,Spades)],[(Eight,Hearts),(Five,Diamonds),(Ten,Spades),(Jack,Diamonds),(Eight,Spades),(Jack,Clubs)],[(Seven,Hearts),(Three,Spades),(Ten,Diamonds),(Queen,Hearts),(Queen,Clubs),(Nine,Diamonds)],[(Ace,Diamonds),(Two,Clubs),(King,Hearts),(Six,Spades),(Queen,Diamonds),(Queen,Spades)]],[(Nine,Clubs),(King,Clubs),(Two,Diamonds),(Eight,Diamonds)])	([],[[(King,Clubs)],[(Five,Hearts),(Seven,Clubs),(Ten,Hearts),(Six,Diamonds),(Four,Clubs),(Three,Clubs)],[(Four,Spades),(Ace,Hearts),(Three,Hearts),(Ace,Clubs),(King,Diamonds),(Four,Diamonds)],[(Three,Diamonds),(Two,Hearts),(Jack,Spades),(Nine,Hearts),(Five,Clubs),(Two,Spades)],[(Six,Clubs),(Four,Hearts),(Five,Spades),(Seven,Spades),(King,Spades),(Ace,Spades)],[(Eight,Hearts),(Five,Diamonds),(Ten,Spades),(Jack,Diamonds),(Eight,Spades),(Jack,Clubs)],[(Seven,Hearts),(Three,Spades),(Ten,Diamonds),(Queen,Hearts),(Queen,Clubs),(Nine,Diamonds)],[(Ace,Diamonds),(Two,Clubs),(King,Hearts),(Six,Spades),(Queen,Diamonds),(Queen,Spades)]],[(Nine,Clubs),(Two,Diamonds),(Eight,Diamonds)])	**Pass**
3	([],[[(Eight,Hearts),(Nine,Clubs),(Eight,Spades),(Two,Diamonds),(Ace,Clubs),(Nine,Diamonds)],[(Six,Hearts),(Ten,Clubs),(Ten,Spades),(Ace,Hearts),(King	([],[[(King,Diamonds)],[(Eight,Hearts),(Nine,Clubs),(Eight,Spades),(Two,Diamonds),(Ace,Clubs),(Nine,Diamonds)],[(Six,Hearts),(Ten,Clubs),(Ten,Spade	**Pass**

	,Clubs),(King,Spades)],[(Nine,Hearts),(Queen,Diamonds),(King,Hearts),(Nine,Spades),(Two,Spades),(Five,Spades)],[(Four,Clubs),(Seven,Clubs),(Three,Spades),(Six,Spades),(Eight,Clubs),(Ten,Hearts)],[(Jack,Hearts),(Queen,Hearts),(Two,Hearts),(Four,Hearts),(Four,Diamonds),(Ace,Spades)],[(Five,Diamonds),(Three,Hearts),(Five,Clubs),(Two,Clubs),(Ace,Diamonds),(Jack,Diamonds)]],[==(King,Diamonds),==(Seven,Hearts),(Four,Spades),(Six,Clubs)])	s),(Ace,Hearts),(King,Clubs),(King,Spades)],[(Nine,Hearts),(Queen,Diamonds),(King,Hearts),(Nine,Spades),(Two,Spades),(Five,Spades)],[(Four,Clubs),(Seven,Clubs),(Three,Spades),(Six,Spades),(Eight,Clubs),(Ten,Hearts)],[(Jack,Hearts),(Queen,Hearts),(Two,Hearts),(Four,Hearts),(Four,Diamonds),(Ace,Spades)],[(Five,Diamonds),(Three,Hearts),(Five,Clubs),(Two,Clubs),(Ace,Diamonds),(Jack,Diamonds)],[(Seven,Hearts),(Four,Spades),(Six,Clubs)])	
4	([],[[(Six,Hearts),(Ten,Clubs),(Ten,Spades),(Ace,Hearts),(King,Clubs),(King,Spades)],[(Nine,Hearts),(Queen,Diamonds),(King,Hearts),(Nine,Spades),(Two,Spades),(Five,Spades)],[(Four,Clubs),(Seven,Clubs),(Three,Spades),(Six,Spades),(Eight,Clubs),(Ten,Hearts)],[(Jack,Hearts),(Queen,Hearts),(Two,Hearts),(Four,Hearts),(Four,Diamonds),(Ace,Spades)],[(Five,Diamonds),(Three,Hearts),(Five,Clubs),(Two,Clubs),(Ace,Diamonds),(Jack,Diamonds)]],[(Ten,Diamonds),(Seven,Diamonds),(Four,Spades),(Six,Clubs)])	([],[[(Six,Hearts),(Ten,Clubs),(Ten,Spades),(Ace,Hearts),(King,Clubs),(King,Spades)],[(Nine,Hearts),(Queen,Diamonds),(King,Hearts),(Nine,Spades),(Two,Spades),(Five,Spades)],[(Four,Clubs),(Seven,Clubs),(Three,Spades),(Six,Spades),(Eight,Clubs),(Ten,Hearts)],[(Jack,Hearts),(Queen,Hearts),(Two,Hearts),(Four,Hearts),(Four,Diamonds),(Ace,Spades)],[(Five,Diamonds),(Three,Hearts),(Five,Clubs),(Two,Clubs),(Ace,Diamonds),(Jack,Diamonds)]],[==(Ten,Diamonds),(Seven,Diamonds),(Four,Spades),(Six,Clubs)==])	

2. **resToCols:** Moves a non-king card from the reserves to a column
   - **Test Cases**
     1. Move a reserve to a column with a successor
     2. Move a reserve to a column *in the middle* with a successor
     3. Move a reserve to a column with no successor

Test Case	eOBoard	Result	Status
1	([],[[==(Six,Spades)==,(Seven,Hearts),(Seven,Spades),(Four,Hearts),(Eight,Clubs),(Six,Clubs)],[(Ace,Diamonds),(Nine,Clubs),(Queen,Diamonds),(Two,Hearts),(Nine,Diamonds)],[(Four,Diamonds),(Ace,Spades),(Jack,Spades),(Queen,Hearts),(Six,Hearts),(King,Spades)],[(Five,Clubs),(Ten,Hearts),(Three,Spades),(Two,Spades),(Ten,Clubs),(King,Diamonds)],[(Seven,Clubs),(Two,Clubs),(Three,Hearts),(Five,Hearts),(Nine,Spades),(Four,Clubs)],[(Ace,Hearts),(Four,Spades),(Six,Diamonds),(Three,Clubs),(Five,Diamonds),(Three,Diamonds)],[(Ten,Diamonds),(Jack,Diamonds),(Nine,Hearts),(Eight,Diamonds),(Seven,Diamonds),(King,Clubs)],[(Eight,Hearts),(Ace,Clubs),(Jack,Hearts),(Queen,Spades),(Ten,Spades),(Eight,Spades)]],[==(Five,Spades),==(Queen,Clubs),(King,Hearts)])	([(Ace,Diamonds),(Ace,Hearts)],[[==(Five,Spades),(S== ==ix,Spades)==,(Seven,Hearts),(Seven,Spades),(Four,Hearts),(Eight,Clubs),(Six,Clubs)],[(Nine,Clubs),(Queen,Diamonds),(Two,Hearts),(Nine,Diamonds)],[(Four,Diamonds),(Ace,Spades),(Jack,Spades),(Queen,Hearts),(Six,Hearts),(King,Spades)],[(Five,Clubs),(Ten,Hearts),(Three,Spades),(Two,Spades),(Ten,Clubs),(King,Diamonds)],[(Seven,Clubs),(Two,Clubs),(Three,Hearts),(Five,Hearts),(Nine,Spades),(Four,Clubs)],[(Four,Spades),(Six,Diamonds),(Three,Clubs),(Five,Diamonds),(Three,Diamonds)],[(Ten,Diamonds),(Jack,Diamonds),(Nine,Hearts),(Eight,Diamonds),(Seven,Diamonds),(King,Clubs)],[(Eight,Hearts),(Ace,Clubs),(Jack,Hearts),(Queen,Spades),(Ten,Spades),(Eight,Spades)]],[(Queen,Clubs),(King,Hearts)])	**Pass**
2	([],[[(Four,Diamonds),(Ace,Spades),(Seven,Clubs),(Nine,Spades),(Nine,Clubs),(Queen,Diamonds)],[(Seven,Hearts),(Eight,Hearts),(Eight,Spades),(Three,Clubs),(King,Spades),(Two,Spades)],[(Three,Diamonds),(Queen,Spades),(Three,Spades),(King,Clubs),(Ten,Hearts),(Two,Diamonds)],[(Ten,Clubs),(Six,Spades),(Four,Clubs),(Two,Clubs),(Ten,Diamonds),(Five,Clubs)],[(Queen,Hearts),(Six,Clubs),(Four,Spades),(Six,Diamonds),(Three,Hearts),(Five,Diamonds)],[==(Queen,Clubs)==,(Nine,Diamonds),(Ace,Clubs),(Nine,Hearts),(Eight,Clubs),(Ten,Spades)],[(Four,Hearts),(Jack,Hearts),(Jack,Diamonds),(Ace,Hearts),(Seven,Spades)],[(Seven,Diamonds),(Eight,Diamond	([],[[(Four,Diamonds),(Ace,Spades),(Seven,Clubs),(Nine,Spades),(Nine,Clubs),(Queen,Diamonds)],[(Seven,Hearts),(Eight,Hearts),(Eight,Spades),(Three,Clubs),(King,Spades),(Two,Spades)],[(Three,Diamonds),(Queen,Spades),(Three,Spades),(King,Clubs),(Ten,Hearts),(Two,Diamonds)],[(Ten,Clubs),(Six,Spades),(Four,Clubs),(Two,Clubs),(Ten,Diamonds),(Five,Clubs)],[(Queen,Hearts),(Six,Clubs),(Four,Spades),(Six,Diamonds),(Three,Hearts),(Five,Diamonds)],[==(Jack,Clubs),(Queen,Clubs)==,(Nine,Diamonds),(Ace,Clubs),(Nine,Hearts),(Eight,Clubs),(Ten,Spades)],[(Four,Hearts),(Jack,Hearts),(Jack,Diamonds),(Ace,Hearts),(Seven,Spades)],[(Seven,D	**Pass**

	s),(King,Diamonds),(Jack,Spades),(Six,Hearts)]],[(King,Hearts),(Jack,Clubs),(Five,Hearts),(Five,Spades),(Two,Hearts)])	iamonds),(Eight,Diamonds),(King,Diamonds),(Jack,Spades),(Six,Hearts)]],[(King,Hearts),(Five,Hearts),(Five,Spades),(Two,Hearts)]])	
3	([],[[(Queen,Spades),(Two,Diamonds),(Eight,Hearts),(Jack,Clubs),(Three,Hearts),(King,Clubs)],[(Six,Clubs),(Jack,Hearts),(Nine,Clubs),(Six,Diamonds),(Seven,Diamonds),(Seven,Clubs)],[(Queen,Diamonds),(Four,Diamonds),(Four,Spades),(Ten,Clubs),(Jack,Diamonds),(Two,Spades)],[(Three,Diamonds),(King,Hearts),(Four,Clubs),(Ten,Diamonds),(Six,Spades),(Four,Hearts)],[(Two,Clubs),(Five,Clubs),(Ten,Spades),(Nine,Hearts),(King,Spades),(Nine,Spades)],[(Ace,Spades),(Eight,Clubs),(Ace,Diamonds),(Seven,Spades),(Eight,Spades),(Five,Hearts)],[(Six,Hearts),(Three,Spades),(Ten,Hearts),(Three,Clubs),(Five,Spades),(Seven,Hearts)],[(Jack,Spades),(Ace,Hearts),(Two,Hearts),(Nine,Diamonds),(Queen,Clubs),(Eight,Diamonds)]],[(Ace,Clubs),(Queen,Hearts),(King,Diamonds),(Five,Diamonds)]])	([(Two,Clubs),(Ace,Spades)],[[(Queen,Spades),(Two,Diamonds),(Eight,Hearts),(Jack,Clubs),(Three,Hearts),(King,Clubs)],[(Six,Clubs),(Jack,Hearts),(Nine,Clubs),(Six,Diamonds),(Seven,Diamonds),(Seven,Clubs)],[(Queen,Diamonds),(Four,Diamonds),(Four,Spades),(Ten,Clubs),(Jack,Diamonds),(Two,Spades)],[(Three,Diamonds),(King,Hearts),(Four,Clubs),(Ten,Diamonds),(Six,Spades),(Four,Hearts)],[(Five,Clubs),(Ten,Spades),(Nine,Hearts),(King,Spades),(Nine,Spades)],[(Eight,Clubs),(Ace,Diamonds),(Seven,Spades),(Eight,Spades),(Five,Hearts)],[(Six,Hearts),(Three,Spades),(Ten,Hearts),(Three,Clubs),(Five,Spades),(Seven,Hearts)],[(Jack,Spades),(Ace,Hearts),(Two,Hearts),(Nine,Diamonds),(Queen,Clubs),(Eight,Diamonds)]],[(Queen,Hearts),(King,Diamonds),(Five,Diamonds)]])	

3. **kingColToEmptyCol:** Moves a king card from the a column to another column
   ● **Test Cases**
      1. Move **one King** when there is *no empty columns*
      2. Move **one King** *from the first column*
      3. Move **one King** *from the last column*
      4. Move **one King** from a column *other than the first and last*
      5. Move King when **no columns available**

Test Case	eOBoard	Result	Status
1	([],[[(Queen,Diamonds),(Four,Diamonds),(Two,Clubs),(Queen,Hearts),(Ten,Diamonds),(Eight,Diamonds)],[(King,Spades),(Ace,Spades),(Three,Spades),(Queen,Clubs),(Ten,Clubs),(Nine,Diamonds)],[(Ten,Spades),(Ace,Clubs),(Three,Hearts),(Five,Spades),(Seven,Hearts),(Ace,Hearts)],[(Five,Clubs),(Ten,Hearts),(Six,Clubs),(Six,Hearts),(Jack,Clubs),(Six,Diamonds)],[(Four,Clubs),(King,Clubs),(Jack,Spades),(Five,Hearts),(Nine,Clubs),(Six,Spades)],[(Nine,Hearts),(Seven,Clubs),(Two,Spades),(Three,Diamonds),(Eight,Hearts),(Eight,Spades)],[(Queen,Spades),(Ace,Diamonds),(King,Diamonds),(Eight,Clubs),(Three,Clubs),(King,Hearts)],[(Seven,Diamonds),(Seven,Spades),(Jack,Diamonds),(Jack,Hearts),(Four,Hearts),(Two,Hearts)]],[(Nine,Spades),(Four,Spades),(Five,Diamonds),(Two,Diamonds)])	([],[[(Queen,Diamonds),(Four,Diamonds),(Two,Clubs),(Queen,Hearts),(Ten,Diamonds),(Eight,Diamonds)],[(King,Spades),(Ace,Spades),(Three,Spades),(Queen,Clubs),(Ten,Clubs),(Nine,Diamonds)],[(Ten,Spades),(Ace,Clubs),(Three,Hearts),(Five,Spades),(Seven,Hearts),(Ace,Hearts)],[(Five,Clubs),(Ten,Hearts),(Six,Clubs),(Six,Hearts),(Jack,Clubs),(Six,Diamonds)],[(Four,Clubs),(King,Clubs),(Jack,Spades),(Five,Hearts),(Nine,Clubs),(Six,Spades)],[(Nine,Hearts),(Seven,Clubs),(Two,Spades),(Three,Diamonds),(Eight,Hearts),(Eight,Spades)],[(Queen,Spades),(Ace,Diamonds),(King,Diamonds),(Eight,Clubs),(Three,Clubs),(King,Hearts)],[(Seven,Diamonds),(Seven,Spades),(Jack,Diamonds),(Jack,Hearts),(Four,Hearts),(Two,Hearts)]],[(Nine,Spades),(Four,Spades),(Five,Diamonds),(Two,Diamonds)])	
2	([],[[(King,Hearts),(Queen,Clubs),(Queen,Diamonds),(Ten,Hearts),(King,Spades),(Two,Clubs)],[(Six,Spades),(Ace,Hearts),(Two,Hearts),(Jack,Spades),(Seven,Spades),(Three,Hearts)],[(Ten,Spades),(Seven,Diamonds),(Ace,Diamonds),(Five,Spades),(Four,Clubs),(Jack,Hearts)],[(Five,Hearts),(Three,Diamonds),(Three,Clubs),(Eight,Diamonds),(Jack,Diamonds),(Jack,Clubs)],[(Eight,Clubs),(Two,Diamonds),(Nine,Diamonds),(Four,Spades),(Four,Diamonds),(Six,Clubs)],[(Ace,Clubs),(Four,Hearts),(Queen,Spades),(	([],[[(Queen,Clubs),(Queen,Diamonds),(Ten,Hearts),(King,Spades),(Two,Clubs)],[(King,Hearts)],[(Six,Spades),(Ace,Hearts),(Two,Hearts),(Jack,Spades),(Seven,Spades),(Three,Hearts)],[(Ten,Spades),(Seven,Diamonds),(Ace,Diamonds),(Five,Spades),(Four,Clubs),(Jack,Hearts)],[(Five,Hearts),(Three,Diamonds),(Three,Clubs),(Eight,Diamonds),(Jack,Diamonds),(Jack,Clubs)],[(Eight,Clubs),(Two,Diamonds),(Nine,Diamonds),(Four,Spades),(Four,Diamonds),(Six,Clubs)],[(Ace,Clubs),(Four,Hearts),(Qu	**Pass**

	Six,Diamonds),(Nine,Hearts),(King,Diamonds)],[(Three,Spades),(Five,Clubs),(Five,Diamonds),(Six,Hearts),(Seven,Hearts),(Ten,Diamonds)]],[(Eight,Spades),(Nine,Spades),(Ace,Spades),(King,Clubs)])	een,Spades),(Six,Diamonds),(Nine,Hearts),(King,Diamonds)],[(Three,Spades),(Five,Clubs),(Five,Diamonds),(Six,Hearts),(Seven,Hearts),(Ten,Diamonds)]],[(Eight,Spades),(Nine,Spades),(Ace,Spades),(King,Clubs)])	
3	([],[[(Ten,Clubs),(Seven,Clubs),(Three,Hearts),(Seven,Hearts),(Six,Hearts),(Nine,Diamonds)],[(Four,Spades),(Five,Clubs),(Jack,Spades),(Nine,Clubs),(Two,Diamonds),(Six,Spades)],[(Five,Hearts),(Eight,Spades),(Six,Clubs),(Eight,Clubs),(Eight,Hearts),(Five,Spades)],[(Six,Diamonds),(Ten,Hearts),(Two,Clubs),(Ten,Spades),(Four,Diamonds)],[(Ace,Clubs),(Nine,Hearts),(Nine,Spades),(Four,Hearts),(Three,Spades),(Two,Hearts)],[(Seven,Spades),(Jack,Clubs),(King,Spades),(Three,Clubs),(Jack,Diamonds),(Queen,Spades)],[(Jack,Hearts),(Queen,Diamonds),(King,Hearts),(Seven,Diamonds),(Two,Spades),(Ten,Diamonds)],[==(King,Clubs),(Ace,Spades),(Five,Diamonds)==,==(Eight,Diamonds),(Ace,Diamonds),(Ace,Hearts)==]],[(Four,Clubs),(Three,Diamonds),(Queen,Hearts),(Queen,Clubs)])	([],[[(Ten,Clubs),(Seven,Clubs),(Three,Hearts),(Seven,Hearts),(Six,Hearts),(Nine,Diamonds)],[(Four,Spades),(Five,Clubs),(Jack,Spades),(Nine,Clubs),(Two,Diamonds),(Six,Spades)],[(Five,Hearts),(Eight,Spades),(Six,Clubs),(Eight,Clubs),(Eight,Hearts),(Five,Spades)],[(Six,Diamonds),(Ten,Hearts),(Two,Clubs),(Ten,Spades),(Four,Diamonds)],[(Ace,Clubs),(Nine,Hearts),(Nine,Spades),(Four,Hearts),(Three,Spades),(Two,Hearts)],[(Seven,Spades),(Jack,Clubs),(King,Spades),(Three,Clubs),(Jack,Diamonds),(Queen,Spades)],[(Jack,Hearts),(Queen,Diamonds),(King,Hearts),(Seven,Diamonds),(Two,Spades),(Ten,Diamonds)],==(Ace,Spades),(Five,Diamonds),(Eight,Diamonds),(Ace,Diamonds),(Ace,Hearts)==],==[(King,Clubs)]==],[(Four,Clubs),(Three,Diamonds),(Queen,Hearts),(Queen,Clubs)])	
4	([],[[(Queen,Clubs),(Queen,Diamonds),(Ten,Hearts),(Two,Clubs)],[(Six,Spades),(Ace,Hearts),(Two,Hearts),(Jack,Spades),(Seven,Spades),(Three,Hearts)],[(Ten,Spades),(Seven,Diamonds),(Ace,Diamonds),(Five,Spades),(Four,Clubs),(Jack,Hearts)],[(Five,Hearts),(Three,Diamonds),(Three,Clubs),(Eight,Diamonds),(Jack,Diamonds),(Jack,Clubs)],[(Eight,Clubs),(Two,Diamonds),(Nine,Diamonds),(Four,Spades),(Four,Diamonds),(Six,Clubs)],[==(King,Spades)==,==(Four,Hearts),(Queen,Spades),(Six,Diamonds),(Nine,Hearts),(King,Diamonds)==],[(Three,Spades),(Five,Clubs),(Five,Diamonds),(Six,Hearts),(Seven,Hearts),(Ten,Diamonds)]],[(Eight,Spades),(Nine,Spades),(Ace,Spades),(King,Clubs)])	([],[[(Queen,Clubs),(Queen,Diamonds),(Ten,Hearts),(Two,Clubs)],[(Six,Spades),(Ace,Hearts),(Two,Hearts),(Jack,Spades),(Seven,Spades),(Three,Hearts)],[(Ten,Spades),(Seven,Diamonds),(Ace,Diamonds),(Five,Spades),(Four,Clubs),(Jack,Hearts)],[(Five,Hearts),(Three,Diamonds),(Three,Clubs),(Eight,Diamonds),(Jack,Diamonds),(Jack,Clubs)],[(Eight,Clubs),(Two,Diamonds),(Nine,Diamonds),(Four,Spades),(Four,Diamonds),(Six,Clubs)],[==(King,Spades)==,==(Four,Hearts),(Queen,Spades),(Six,Diamonds),(Nine,Hearts),(King,Diamonds)==],[(Three,Spades),(Five,Clubs),(Five,Diamonds),(Six,Hearts),(Seven,Hearts),(Ten,Diamonds)]],[(Eight,Spades),(Nine,Spades),(Ace,Spades),(King,Clubs)])	
5	([],[[==(King,Hearts)==,(Queen,Hearts),(Eight,Diamonds),(Queen,Clubs),(Three,Hearts),(Eight,Hearts)],[(Ace,Clubs),(Five,Hearts),(Queen,Spades),(Three,Clubs),(Seven,Clubs),(Nine,Spades)],[(Six,Diamonds),(Five,Diamonds),(Five,Clubs),(Four,Spades),(Six,Clubs),(Two,Hearts)],[(Seven,Hearts),(Four,Clubs),(Two,Clubs),(King,Spades),(Six,Hearts),(Ace,Spades)],[(Jack,Spades),(Queen,Diamonds),(Two,Spades),(Five,Spades),(Jack,Diamonds),(King,Clubs)],[(Eight,Spades),(Nine,Clubs),(Three,Spades),(Nine,Diamonds),(Jack,Hearts),(Ten,Hearts)],[(Seven,Diamonds),(Six,Spades),(Eight,Clubs),(Four,Diamonds),(Ten,Clubs),(Jack,Clubs)],[(Four,Hearts),(Ace,Hearts),(Ten,Diamonds),(Seven,Spades),(Ten,Spades),(Two,Diamonds)]],[(King,Diamonds),(Three,Diamonds),(Nine,Hearts),(Ace,Diamonds)])	([],[[==(King,Hearts)==,(Queen,Hearts),(Eight,Diamonds),(Queen,Clubs),(Three,Hearts),(Eight,Hearts)],[(Ace,Clubs),(Five,Hearts),(Queen,Spades),(Three,Clubs),(Seven,Clubs),(Nine,Spades)],[(Six,Diamonds),(Five,Diamonds),(Five,Clubs),(Four,Spades),(Six,Clubs),(Two,Hearts)],[(Seven,Hearts),(Four,Clubs),(Two,Clubs),(King,Spades),(Six,Hearts),(Ace,Spades)],[(Jack,Spades),(Queen,Diamonds),(Two,Spades),(Five,Spades),(Jack,Diamonds),(King,Clubs)],[(Eight,Spades),(Nine,Clubs),(Three,Spades),(Nine,Diamonds),(Jack,Hearts),(Ten,Hearts)],[(Seven,Diamonds),(Six,Spades),(Eight,Clubs),(Four,Diamonds),(Ten,Clubs),(Jack,Clubs)],[(Four,Hearts),(Ace,Hearts),(Ten,Diamonds),(Seven,Spades),(Ten,Spades),(Two,Diamonds)]],[(King,Diamonds),(Three,Diamonds),(Nine,Hearts),(Ace,Diamonds)])	**Pass**

4. **colToCols:** Moves a non-king card(s) from the one column to another
   ● **Test Cases**
     1. Move one card
     2. Move multiple cards

Test Case	eOBoard	Result	Status
1	([],[[(Three,Hearts),(Seven,Clubs),(Three,Spades),(King,Diamonds),(Ace,Diamonds),(Jack,Spades)],[(Two,Hearts),(Eight,Clubs),(Jack,Clubs),(Three,Diamonds),(Seven,Spades),(King,Spades)],[(Queen,Diamonds),(Four,Spades),(Ten,Hearts),(Queen,Hearts),(Five,Spades),(Ace,Clubs)],[(Six,Diamonds),(Eight,Diamonds),(Six,Clubs),(Two,Diamonds),(Seven,Hearts),(Nine,Clubs)],[(Nine,Spades),(Eight,Spades),(Four,Clubs),(Five,Clubs),(Nine,Hearts),(Six,Spades)],[(Eight,Hearts),(Six,Hearts),(Jack,Diamonds),(Ten,Diamonds),(Jack,Hearts),(Five,Hearts)],[(Seven,Diamonds),(Ten,Spades),(Three,Clubs),(Two,Clubs),(Ace,Hearts),(Five,Diamonds)],[(King,Clubs),(Nine,Diamonds),(Four,Hearts),(King,Hearts),(Queen,Spades),(Ace,Spades)]],[(Two,Spades),(Four,Diamonds),(Ten,Clubs),(Queen,Clubs)])	([],[[(Three,Hearts),(Seven,Clubs),(Three,Spades),(King,Diamonds),(Ace,Diamonds),(Jack,Spades)],[(Two,Hearts),(Eight,Clubs),(Jack,Clubs),(Three,Diamonds),(Seven,Spades),(King,Spades)],[(Queen,Diamonds),(Four,Spades),(Ten,Hearts),(Queen,Hearts),(Five,Spades),(Ace,Clubs)],[(Eight,Diamonds),(Six,Clubs),(Two,Diamonds),(Seven,Hearts),(Nine,Clubs)],[(Nine,Spades),(Eight,Spades),(Four,Clubs),(Five,Clubs),(Nine,Hearts),(Six,Spades)],[(Eight,Hearts),(Six,Hearts),(Jack,Diamonds),(Ten,Diamonds),(Jack,Hearts),(Five,Hearts)],[(Six,Diamonds),(Seven,Diamonds),(Ten,Spades),(Three,Clubs),(Two,Clubs),(Ace,Hearts),(Five,Diamonds)],[(King,Clubs),(Nine,Diamonds),(Four,Hearts),(King,Hearts),(Queen,Spades),(Ace,Spades)]],[(Two,Spades),(Four,Diamonds),(Ten,Clubs),(Queen,Clubs)])	**Pass**
2	([],[[(Nine,Hearts),(Ten,Hearts),(Seven,Diamonds),(King,Spades),(Jack,Diamonds),(Eight,Diamonds)],[(Queen,Hearts),(Seven,Clubs),(Two,Hearts),(Three,Clubs),(Ten,Diamonds),(Ten,Clubs)],[(Jack,Clubs),(Nine,Diamonds),(Four,Spades),(Five,Spades),(Two,Clubs),(Nine,Spades)],[(Two,Diamonds),(Two,Spades),(Nine,Clubs),(King,Hearts),(Five,Clubs),(Ace,Diamonds)],[(Jack,Hearts),(Six,Clubs),(Five,Diamonds),(King,Diamonds),(Eight,Spades),(Three,Hearts)],[(Three,Diamonds),(Queen,Spades),(Seven,Hearts),(Six,Diamonds)],[(Eight,Hearts),(Three,Spades),(Six,Hearts),(Four,Clubs),(Ace,Hearts),(Four,Diamonds)],[(Six,Spades),(Jack,Spades),(Queen,Clubs),(Eight,Clubs),(Seven,Spades),(Ten,Spades)]],[(Queen,Diamonds),(Five,Hearts),(King,Clubs),(Four,Hearts)])	([],[[(Seven,Diamonds),(King,Spades),(Jack,Diamonds),(Eight,Diamonds)],[(Queen,Hearts),(Seven,Clubs),(Two,Hearts),(Three,Clubs),(Ten,Diamonds),(Ten,Clubs)],[(Jack,Clubs),(Nine,Diamonds),(Four,Spades),(Five,Spades),(Two,Clubs),(Nine,Spades)],[(Two,Diamonds),(Two,Spades),(Nine,Clubs),(King,Hearts),(Five,Clubs),(Ace,Diamonds)],[(Nine,Hearts),(Ten,Hearts),(Jack,Hearts),(Six,Clubs),(Five,Diamonds),(King,Diamonds),(Eight,Spades),(Three,Hearts)],[(Three,Diamonds),(Queen,Spades),(Seven,Hearts),(Six,Diamonds)],[(Eight,Hearts),(Three,Spades),(Six,Hearts),(Four,Clubs),(Ace,Hearts),(Four,Diamonds)],[(Six,Spades),(Jack,Spades),(Queen,Clubs),(Eight,Clubs),(Seven,Spades),(Ten,Spades)]],[(Queen,Diamonds),(Five,Hearts),(King,Clubs),(Four,Hearts)])	**Pass**

5. **toRes:** Moves a card from a column to a reserve
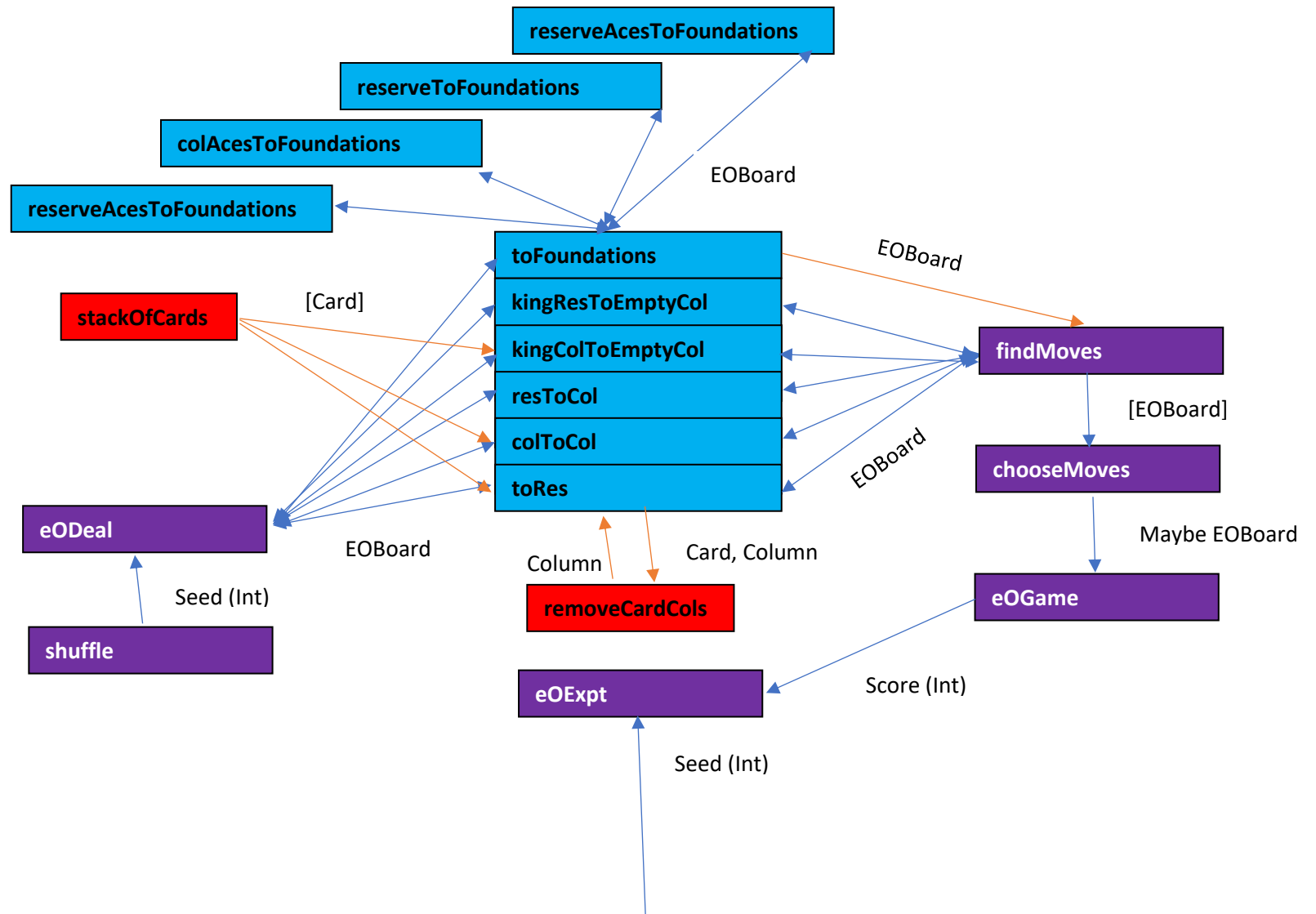   ● **Test Cases**
     1. Moves a card from reserve to columns
     2. Attempt to move the card when some column's heads are already stacked
     3. Attempt to move a card from column to reserve when all the card's first and second cards are successors/predecessors of each other

Test Case	eOBoard	Result	Status
1	([],[[(Three,Hearts),(Ace,Clubs),(King,Spades),(Six,Hearts),(Queen,Spades),(Five,Spades)],[(Nine,Hearts),(Eight,Hearts),(Nine,Clubs),(Ace,Hearts),(Six,Spades),(Queen,Clubs)],[(Eight,Clubs),(King,Clubs),(	([],[[(Ace,Clubs),(King,Spades),(Six,Hearts),(Queen,Spades),(Five,Spades)],[(Nine,Hearts),(Eight,Hearts),(Nine,Clubs),(Ace,Hearts),(Six,Spades),(Queen,Clubs)],[(Eight,Clubs),(King,Clubs),(Four,Spad	**Pass**

	Four,Spades),(Jack,Spades),(Four,Diamonds),(Seven,Hearts)],[(Eight,Diamonds),(Ace,Diamonds),(Five,Diamonds),(Three,Clubs),(Six,Clubs),(Ace,Spades)],[(Three,Spades),(Six,Diamonds),(Five,Hearts),(Jack,Hearts),(Ten,Hearts),(Nine,Spades)],[(Two,Clubs),(King,Hearts),(Jack,Clubs),(Ten,Spades),(Five,Clubs),(Queen,Diamonds)],[(King,Diamonds),(Queen,Hearts),(Eight,Spades),(Seven,Spades),(Ten,Diamonds),(Four,Clubs)],[(Seven,Clubs),(Seven,Diamonds),(Two,Spades),(Nine,Diamonds),(Two,Hearts),(Three,Diamonds)]],[(Two,Diamonds),(Ten,Clubs),(Four,Hearts),(Jack,Diamonds)])	es),(Jack,Spades),(Four,Diamonds),(Seven,Hearts)],[(Eight,Diamonds),(Ace,Diamonds),(Five,Diamonds),(Three,Clubs),(Six,Clubs),(Ace,Spades)],[(Three,Spades),(Six,Diamonds),(Five,Hearts),(Jack,Hearts),(Ten,Hearts),(Nine,Spades)],[(Two,Clubs),(King,Hearts),(Jack,Clubs),(Ten,Spades),(Five,Clubs),(Queen,Diamonds)],[(King,Diamonds),(Queen,Hearts),(Eight,Spades),(Seven,Spades),(Ten,Diamonds),(Four,Clubs)],[(Seven,Clubs),(Seven,Diamonds),(Two,Spades),(Nine,Diamonds),(Two,Hearts),(Three,Diamonds)]],[**(Three,Hearts)**,(Two,Diamonds),(Ten,Clubs),(Four,Hearts),(Jack,Diamonds)])	
2	([],[[**(Two,Clubs),(Three,Clubs)**,(King,Spades),(Jack,Hearts),(Six,Diamonds),(King,Diamonds)],[**(Two,Spades),(Three,Spades)**,(Ace,Clubs),(Seven,Hearts),(Two,Diamonds)],[**(Ten,Spades),(Jack,Spades)**,(Nine,Spades),(Eight,Clubs),(Five,Clubs),(Five,Hearts)],[**(Three,Hearts)**,(Six,Spades),(Nine,Clubs),(Six,Hearts),(Eight,Spades)],[(Eight,Diamonds),(Queen,Clubs),(Ace,Spades),(Five,Diamonds),(Six,Clubs),(Jack,Clubs)],[(Nine,Diamonds),(Ten,Diamonds),(Four,Diamonds),(Eight,Hearts),(Four,Hearts)],[(Seven,Spades),(Ten,Hearts),(Queen,Spades),(Jack,Diamonds),(Five,Spades),(Nine,Hearts)],[(King,Clubs),(Ten,Spades),(Ten,Clubs),(Three,Diamonds),(Seven,Clubs)]],[(Seven,Diamonds),(Four,Spades),(Queen,Diamonds),(Queen,Hearts)])	([],[[(Two,Clubs),(Three,Clubs),(King,Spades),(Jack,Hearts),(Six,Diamonds),(King,Diamonds)],[(Two,Spades),(Three,Spades),(Ace,Clubs),(Seven,Hearts),(Two,Diamonds)],[(Ten,Spades),(Jack,Spades),(Nine,Spades),(Eight,Clubs),(Five,Clubs),(Five,Hearts)],[(Six,Spades),(Nine,Clubs),(Six,Hearts),(Eight,Spades)],[(Eight,Diamonds),(Queen,Clubs),(Ace,Spades),(Five,Diamonds),(Six,Clubs),(Jack,Clubs)],[(Nine,Diamonds),(Ten,Diamonds),(Four,Diamonds),(Eight,Hearts),(Four,Hearts)],[(Seven,Spades),(Ten,Hearts),(Queen,Spades),(Jack,Diamonds),(Five,Spades),(Nine,Hearts)],[(King,Clubs),(Ten,Spades),(Ten,Clubs),(Three,Diamonds),(Seven,Clubs)]],[**(Three,Hearts)**,(Seven,Diamonds),(Four,Spades),(Queen,Diamonds),(Queen,Hearts)])	**Pass**
3	([],[[**(Two,Clubs),(Three,Clubs)**,(King,Spades),(Jack,Hearts),(Six,Diamonds),(King,Diamonds)],[**(Two,Spades),(Three,Spades)**,(Ace,Clubs),(Seven,Hearts),(Two,Diamonds)],[**(Ten,Spades),(Jack,Spades)**,(Eight,Clubs),(Five,Clubs),(Five,Hearts)],[**(Three,Hearts),(Four,Hearts)**,(Nine,Clubs),(Six,Hearts),(Eight,Spades)],[**(Eight,Diamonds),(Nine,Diamonds)**,(Ace,Spades),(Six,Clubs),(Jack,Clubs)],[**(Four,Diamonds),(Five,Diamonds)**,(Four,Hearts)],[**(Seven,Spades),(Eight,Spades)**,(Queen,Spades),(Jack,Diamonds),(Five,Spades),(Nine,Hearts)],[**(Nine,Spades),(Ten,Spades)**,(Ten,Clubs),(Three,Diamonds),(Seven,Clubs)]],[(Seven,Diamonds),(Four,Spades),(Queen,Diamonds),(Queen,Hearts)])	([],[[**(Two,Clubs),(Three,Clubs)**,(King,Spades),(Jack,Hearts),(Six,Diamonds),(King,Diamonds)],[**(Two,Spades),(Three,Spades)**,(Ace,Clubs),(Seven,Hearts),(Two,Diamonds)],[**(Ten,Spades),(Jack,Spades)**,(Eight,Clubs),(Five,Clubs),(Five,Hearts)],[**(Three,Hearts),(Four,Hearts)**,(Nine,Clubs),(Six,Hearts),(Eight,Spades)],[**(Eight,Diamonds),(Nine,Diamonds)**,(Ace,Spades),(Six,Clubs),(Jack,Clubs)],[**(Four,Diamonds),(Five,Diamonds)**,(Four,Hearts)],[**(Seven,Spades),(Eight,Spades)**,(Queen,Spades),(Jack,Diamonds),(Five,Spades),(Nine,Hearts)],[**(Nine,Spades),(Ten,Spades)**,(Ten,Clubs),(Three,Diamonds),(Seven,Clubs)]],[(Seven,Diamonds),(Four,Spades),(Queen,Diamonds),(Queen,Hearts)])	

Data Structures
Suit
Pip
Card
Deck
EOBoard
Foundations
Columns
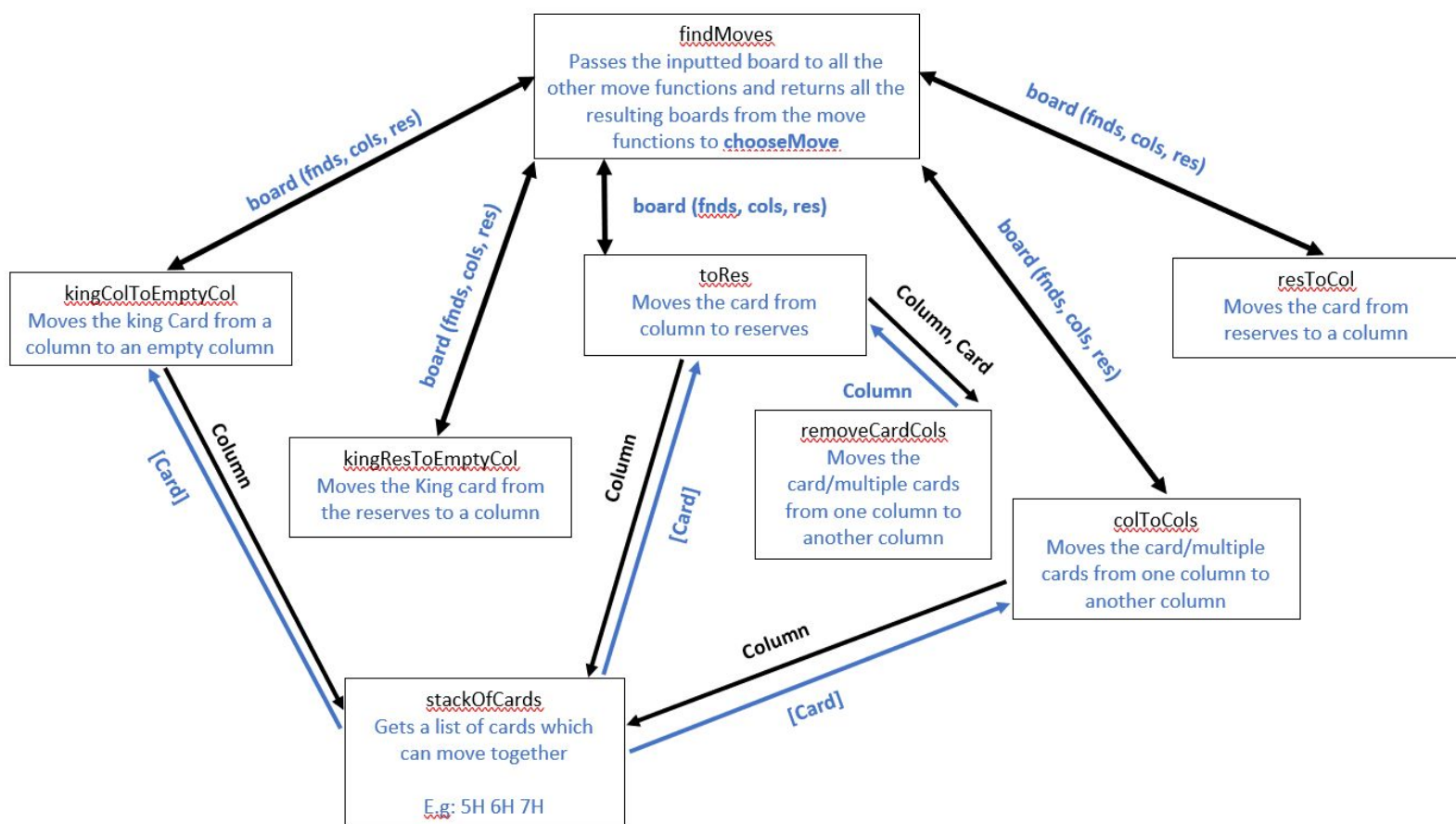Reserves

Constants
Pack

Utilities
pCard
sCard
isAce
isKing

reserveAcesToFoundations

reserveToFoundations

colAcesToFoundations

reserveAcesToFoundations

EOBoard

toFoundations
kingResToEmptyCol
kingColToEmptyCol
resToCol
colToCol
toRes

EOBoard

stackOfCards

[Card]

eODeal

Seed (Int)

shuffle

EOBoard

removeCardCols

Column

Card, Column

EOBoard

findMoves

[EOBoard]

chooseMoves

Maybe EOBoard

eOGame

eOExpt

Score (Int)

Seed (Int)

Explanation of every new function

Move	Description
findMoves	Calls all the move functions, and **appends all** the functions in a **specific order** *(kingColToEmptyCol, kingResToEmptyCol, colToCols, resToCols, toRes)* and filters out the board for the ones that did not manage to make the move and returned the original board. It then **passes this list of boards to chooseMove**
chooseMove	Gets the **list of boards from findMoves** and **calls toFoundations** on that board to *move any Aces to the foundations first*. This is part of a good game strategy as well as a way to prevent 'pred' errors in the code due to pCard being used when there are still some aces in the board. It then **takes the head of the list of boards** which is also the best move and uses that move/board to **call findMoves again** *until no moves can be made anymore.*
eOGame	eOGame *takes in a board* and **passes this board to chooseMoves** to get the game rolling. The game is then 'played' by chooseMoves until there is no moves left. eOGame then **returns a score** depending on *how many cards are left in the columns and reserves.* If there are no more cards in the columns and reserves, the game has been won!
eOExpt	eOExpt conducts 100 games to be played and returns the number of wins obtained and the average score of all the games.
stackOfCards	stackofCards takes in a column and *checks for a list of cards that are 'binded'* or can move together, (Example:5H 6H 7H) This function is used in kingColToEmptyCol, toRes and colToCols to **help move multiple cards** and also to **check if the cards are attached to it's successors/predecessors**.
removeCardCols	removeCardCols takes in a card and a column and checks through all the columns and **removes that card** from the column if it is the *head of the column.*
kingResToEmptyCol	Moves a card from the reserves to an empty column if: 1) The card is a **King** 2) There is an **empty column**
kingColToEmptyCol	Moves a card from a column to an empty column if: 1) The card is a **King** 2) There is an **empty column** 3) The card being moves is **not already in an empty column**

resToCols	Moves a card from the reserves to columns if: 1) The card is one of the **column's head's predecessor**

colToCols	Move the card/multiple cards from one column to another if:
	    1) There is enough **space in the reserve**s
	    2) The **biggest card** in the stack of cards being moves is one of the **column's head's predecessor**

toRes	Moves the card from a column to a reserve if:
	    1) There is **space in the reserves**
	    2) The card is **not attached** to it's predecessor (e.g: 5H 6H)
	    3) The card is **not a King** *(as a measure of good design)*

Method to choose a move

The way the code works is to try and make a good move is as such, it tries to move the Aces to the Foundations first, then move a King to an empty column, then move a card from a column to another column or reserve to columns and lastly columns to reserves if it needs to. The idea behind this is that the algorithm tries to save up as much as possible in the reserves and try to work the cards out within the columns first.

In my code, this is exactly done in findMoves by appending all the moves in that exact order *(kingColToEmptyCol, kingResToEmptyCol, colToCols, resToCols, toRes)* and then filters out

all the boards that were the same as the original. And chooseMove gets the head of the list of moves/boards that findMoves returns which is the best move it can make.

A larger copy of the diagram above is available below.

Experimental Results

This is a set of data running 10 times of 100 games/running eOExpt 10 times. The scores returned are (number of wins, average score)

Seed	1	123	3485	999	66	22	2310	9809	1998	1234
Data	(0,3.32)	(0,3.0)	(0,3.3)	(0,4.51)	0,3.46)	(0,3.43)	(0,3.96)	(0,3.5)	(0,3.45)	(0,3.2)

Ther average score obtained is around is 3.513 and the number of wins is 0. The reason this is so is because there was no look ahead function which looks to move a reserve to column in the next move to space space. I initially planned to do this through generating possible boards and checking if the second card in the column's predecessor is in the reserves but it ended up being in an endless loop and I was not able to fix all the errors in time.

```
*Solitare2> eOExpt 1
(0,3.32)
*Solitare2> eOExpt 123
(0,3.0)
*Solitare2> eOExpt 3485
(0,3.3)
*Solitare2> eOExpt 999
(0,4.51)
*Solitare2> eOExpt 66
(0,3.46)
```
```
*Solitare2> eOExpt 22
(0,3.43)
*Solitare2> eOExpt 2310
(0,3.96)
*Solitare2> eOExpt 9809
(0,3.5)
*Solitare2> eOExpt 1998
(0,3.45)
*Solitare2> eOExpt 1234
(0,3.2)
```

```
*Solitare2> b = ([],[[(Five,Hearts),(Queen,Hearts),(Eight,Diamonds),(Queen,Clubs),(Three,Hearts),(Eight,Hearts)],[(Ace,)
*Solitare2> kingResToEmptyCol b
([],[[(Five,Hearts),(Queen,Hearts),(Eight,Diamonds),(Queen,Clubs),(Three,Hearts),(Eight,Hearts)],[(Ace,Clubs),(King,Hearts)
,(Queen,Spades),(Three,Clubs),(Seven,Clubs),(Nine,Spades)],[(Six,Diamonds),(Five,Diamonds),(Five,Clubs),(Four,Spades)
,(Six,Clubs),(Two,Hearts)],[(Seven,Hearts),(Four,Clubs),(Two,Clubs),(King,Spades),(Six,Hearts),(Ace,Spades)],[(Jack,Spad
es),(Queen,Diamonds),(Two,Spades),(Five,Spades),(Jack,Diamonds),(King,Clubs)],[(Eight,Spades),(Nine,Clubs),(Three,Sp
ades),(Nine,Diamonds),(Jack,Hearts),(Ten,Hearts)],[(Seven,Diamonds),(Six,Spades),(Eight,Clubs),(Four,Diamonds),(Ten,Cl
ubs),(Jack,Clubs)],[(Four,Hearts),(Ace,Hearts),(Ten,Diamonds),(Seven,Spades),(Ten,Spades),(Two,Diamonds)]],[(King,Dia
monds),(Three,Diamonds),(Nine,Hearts),(Ace,Diamonds)])
*Solitare2> b1 = ([],[[(Five,Hearts),(Seven,Clubs),(Ten,Hearts),(Six,Diamonds),(Four,Clubs),(Three,Clubs)],[(Four,Spade)
*Solitare2> kingResToEmptyCol b1
([],[[(King,Clubs)],[(Five,Hearts),(Seven,Clubs),(Ten,Hearts),(Six,Diamonds),(Four,Clubs),(Three,Clubs)],[(Four,Spades),(Ac
e,Hearts),(Three,Hearts),(Ace,Clubs),(King,Diamonds),(Four,Diamonds)],[(Three,Diamonds),(Two,Hearts),(Jack,Spades),(Ni
ne,Hearts),(Five,Clubs),(Two,Spades)],[(Six,Clubs),(Four,Hearts),(Five,Spades),(Seven,Spades),(King,Spades),(Ace,Spade
s)],[(Eight,Hearts),(Five,Diamonds),(Ten,Spades),(Jack,Diamonds),(Eight,Spades),(Jack,Clubs)],[(Seven,Hearts),(Three,Sp
ades),(Ten,Diamonds),(Queen,Hearts),(Queen,Clubs),(Nine,Diamonds)],[(Ace,Diamonds),(Two,Clubs),(King,Hearts),(Six,Sp
ades),(Queen,Diamonds),(Queen,Spades)]],[(Nine,Clubs),(Two,Diamonds),(Eight,Diamonds)])
*Solitare2> b2 = ([],[[(Eight,Hearts),(Nine,Clubs),(Eight,Spades),(Two,Diamonds),(Ace,Clubs),(Nine,Diamonds)],[(Six,Hea)
*Solitare2> kingResToEmptyCol b2
([],[[(King,Diamonds)],[(Eight,Hearts),(Nine,Clubs),(Eight,Spades),(Two,Diamonds),(Ace,Clubs),(Nine,Diamonds)],[(Six,Heart
s),(Ten,Clubs),(Ten,Spades),(Ace,Hearts),(King,Clubs),(King,Spades)],[(Nine,Hearts),(Queen,Diamonds),(King,Hearts),(Nin
e,Spades),(Two,Spades),(Five,Spades)],[(Four,Clubs),(Seven,Clubs),(Three,Spades),(Six,Spades),(Eight,Clubs),(Ten,Heart
s)],[(Jack,Hearts),(Queen,Hearts),(Two,Hearts),(Four,Hearts),(Four,Diamonds),(Ace,Spades)],[(Five,Diamonds),(Three,Hear
ts),(Five,Clubs),(Two,Clubs),(Ace,Diamonds),(Jack,Diamonds)]],[(Seven,Hearts),(Four,Spades),(Six,Clubs)])
*Solitare2> b3 = ([],[[(Six,Hearts),(Ten,Clubs),(Ten,Spades),(Ace,Hearts),(King,Clubs),(King,Spades)],[(Nine,Hearts),(Q)
*Solitare2> kingResToEmptyCol b3
([],[[(Six,Hearts),(Ten,Clubs),(Ten,Spades),(Ace,Hearts),(King,Clubs),(King,Spades)],[(Nine,Hearts),(Queen,Diamonds),(Kin
g,Hearts),(Nine,Spades),(Two,Spades),(Five,Spades)],[(Four,Clubs),(Seven,Clubs),(Three,Spades),(Six,Spades),(Eight,Clu
bs),(Ten,Hearts)],[(Jack,Hearts),(Queen,Hearts),(Two,Hearts),(Four,Hearts),(Four,Diamonds),(Ace,Spades)],[(Five,Diamond
s),(Three,Hearts),(Five,Clubs),(Two,Clubs),(Ace,Diamonds),(Jack,Diamonds)]],[(Ten,Diamonds),(Seven,Diamonds),(Four,S
pades),(Six,Clubs)])




*Solitare2> b = ([],[[(Six,Spades),(Seven,Hearts),(Seven,Spades),(Four,Hearts),(Eight,Clubs),(Six,Clubs)],[(Ace,Diamond)
*Solitare2> resToCols (toFoundations b)
([[(Ace,Diamonds),(Ace,Hearts)],[[(Five,Spades),(Six,Spades),(Seven,Hearts),(Seven,Spades),(Four,Hearts),(Eight,Clubs),(S
ix,Clubs)],[(Nine,Clubs),(Queen,Diamonds),(Two,Hearts),(Nine,Diamonds)],[(Four,Diamonds),(Ace,Spades),(Jack,Spades),(
Queen,Hearts),(Six,Hearts),(King,Spades)],[(Five,Clubs),(Ten,Hearts),(Three,Spades),(Two,Spades),(Ten,Clubs),(King,Dia
monds)],[(Seven,Clubs),(Two,Clubs),(Three,Hearts),(Five,Hearts),(Nine,Spades),(Four,Clubs)],[(Four,Spades),(Six,Diamond
s),(Three,Clubs),(Five,Diamonds),(Three,Diamonds)],[(Ten,Diamonds),(Jack,Diamonds),(Nine,Hearts),(Eight,Diamonds),(Se
ven,Diamonds),(King,Clubs)],[(Eight,Hearts),(Ace,Clubs),(Jack,Hearts),(Queen,Spades),(Ten,Spades),(Eight,Spades)]],[(Qu
een,Clubs),(King,Hearts)])
*Solitare2> b1 =
([],[[(Four,Diamonds),(Ace,Spades),(Seven,Clubs),(Nine,Spades),(Nine,Clubs),(Queen,Diamonds)],[(Seven,)
*Solitare2> resToCols b1
([],[[(Four,Diamonds),(Ace,Spades),(Seven,Clubs),(Nine,Spades),(Nine,Clubs),(Queen,Diamonds)],[(Seven,Hearts),(Eight,H
earts),(Eight,Spades),(Three,Clubs),(King,Spades),(Two,Spades)],[(Three,Diamonds),(Queen,Spades),(Three,Spades),(Kin
g,Clubs),(Ten,Hearts),(Two,Diamonds)],[(Ten,Clubs),(Six,Spades),(Four,Clubs),(Two,Clubs),(Ten,Diamonds),(Five,Clubs)],[(
Queen,Hearts),(Six,Clubs),(Four,Spades),(Six,Diamonds),(Three,Hearts),(Five,Diamonds)],[(Jack,Clubs),(Queen,Clubs),(Ni
ne,Diamonds),(Ace,Clubs),(Nine,Hearts),(Eight,Clubs),(Ten,Spades)],[(Four,Hearts),(Jack,Hearts),(Jack,Diamonds),(Ace,He
arts),(Seven,Spades)],[(Seven,Diamonds),(Eight,Diamonds),(King,Diamonds),(Jack,Spades),(Six,Hearts)]],[(King,Hearts),(Fi
ve,Hearts),(Five,Spades),(Two,Hearts)])
*Solitare2> b2 = ([],[[(Queen,Spades),(Two,Diamonds),(Eight,Hearts),(Jack,Clubs),(Three,Hearts),(King,Clubs)],[(Six,Clu)
*Solitare2> resToCols (toFoundations b2)
([[(Two,Clubs),(Ace,Spades)],[[(Queen,Spades),(Two,Diamonds),(Eight,Hearts),(Jack,Clubs),(Three,Hearts),(King,Clubs)],[(S
ix,Clubs),(Jack,Hearts),(Nine,Clubs),(Six,Diamonds),(Seven,Diamonds),(Seven,Clubs)],[(Queen,Diamonds),(Four,Diamonds
),(Four,Spades),(Ten,Clubs),(Jack,Diamonds),(Two,Spades)],[(Three,Diamonds),(King,Hearts),(Four,Clubs),(Ten,Diamonds
),(Six,Spades),(Four,Hearts)],[(Five,Clubs),(Ten,Spades),(Nine,Hearts),(King,Spades),(Nine,Spades)],[(Eight,Clubs),(Ace,Di
amonds),(Seven,Spades),(Eight,Spades),(Five,Hearts)],[(Six,Hearts),(Three,Spades),(Ten,Hearts),(Three,Clubs),(Five,Spad
es),(Seven,Hearts)],[(Jack,Spades),(Ace,Hearts),(Two,Hearts),(Nine,Diamonds),(Queen,Clubs),(Eight,Diamonds)]],[(Queen,
Hearts),(King,Diamonds),(Five,Diamonds)])


*Solitare2> b =
([],[[(Queen,Diamonds),(Four,Diamonds),(Two,Clubs),(Queen,Hearts),(Ten,Diamonds),(Eight,Diamonds)],[(Ki)
```

*Solitare2> kingColToEmptyCol b
([],[[(Queen,Diamonds),(Four,Diamonds),(Two,Clubs),(Queen,Hearts),(Ten,Diamonds),(Eight,Diamonds)],[(King,Spades),(Ace,Spades),(Three,Spades),(Queen,Clubs),(Ten,Clubs),(Nine,Diamonds)],[(Ten,Spades),(Ace,Clubs),(Three,Hearts),(Five,Spades),(Seven,Hearts),(Ace,Hearts)],[(Five,Clubs),(Ten,Hearts),(Six,Clubs),(Six,Hearts),(Jack,Clubs),(Six,Diamonds)],[(Four,Clubs),(King,Clubs),(Jack,Spades),(Five,Hearts),(Nine,Clubs),(Six,Spades)],[(Nine,Hearts),(Seven,Clubs),(Two,Spades),(Three,Diamonds),(Eight,Hearts),(Eight,Spades)],[(Queen,Spades),(Ace,Diamonds),(King,Diamonds),(Eight,Clubs),(Three,Clubs),(King,Hearts)],[(Seven,Diamonds),(Seven,Spades),(Jack,Diamonds),(Jack,Hearts),(Four,Hearts),(Two,Hearts)],[(Nine,Spades),(Four,Spades),(Five,Diamonds),(Two,Diamonds)]])
*Solitare2> b1 =([],[[(King,Hearts),(Queen,Clubs),(Queen,Diamonds),(Ten,Hearts),(King,Spades),(Two,Clubs)],[(Six,Spades)
*Solitare2> kingColToEmptyCol b1
([],[[(Queen,Clubs),(Queen,Diamonds),(Ten,Hearts),(King,Spades),(Two,Clubs)],[(King,Hearts)],[(Six,Spades),(Ace,Hearts),(Two,Hearts),(Jack,Spades),(Seven,Spades),(Three,Hearts)],[(Ten,Spades),(Seven,Diamonds),(Ace,Diamonds),(Five,Spades),(Four,Clubs),(Jack,Hearts)],[(Five,Hearts),(Three,Diamonds),(Three,Clubs),(Eight,Diamonds),(Jack,Diamonds),(Jack,Clubs)],[(Eight,Clubs),(Two,Diamonds),(Nine,Diamonds),(Four,Spades),(Four,Diamonds),(Six,Clubs)],[(Ace,Clubs),(Four,Hearts),(Queen,Spades),(Six,Diamonds),(Nine,Hearts),(King,Diamonds)],[(Three,Spades),(Five,Clubs),(Five,Diamonds),(Six,Hearts),(Seven,Hearts),(Ten,Diamonds)]],[(Eight,Spades),(Nine,Spades),(Ace,Spades),(King,Clubs)])
*Solitare2> b2 = ([],[[(Ten,Clubs),(Seven,Clubs),(Three,Hearts),(Seven,Hearts),(Six,Hearts),(Nine,Diamonds)],[(Four,Spa)
*Solitare2> kingColToEmptyCol b2
([],[[(Ten,Clubs),(Seven,Clubs),(Three,Hearts),(Seven,Hearts),(Six,Hearts),(Nine,Diamonds)],[(Four,Spades),(Five,Clubs),(Jack,Spades),(Nine,Clubs),(Two,Diamonds),(Six,Spades)],[(Five,Hearts),(Eight,Spades),(Six,Clubs),(Eight,Clubs),(Eight,Hearts),(Five,Spades)],[(Six,Diamonds),(Ten,Hearts),(Two,Clubs),(Ten,Spades),(Four,Diamonds)],[(Ace,Clubs),(Nine,Hearts),(Nine,Spades),(Four,Hearts),(Three,Spades),(Two,Hearts)],[(Seven,Spades),(Jack,Clubs),(King,Spades),(Three,Clubs),(Jack,Diamonds),(Queen,Spades)],[(Jack,Hearts),(Queen,Diamonds),(King,Hearts),(Seven,Diamonds),(Two,Spades),(Ten,Diamonds)],[(King,Clubs),(Ace,Spades),(Five,Diamonds),(Eight,Diamonds),(Ace,Diamonds),(Ace,Hearts)]],[(Four,Clubs),(Three,Diamonds),(Queen,Hearts),(Queen,Clubs)])
*Solitare2> b3 = ([],[[(Queen,Clubs),(Queen,Diamonds),(Ten,Hearts),(Two,Clubs)],[(Six,Spades),(Ace,Hearts),(Two,Hearts))
*Solitare2> kingColToEmptyCol b3
([],[[(Queen,Clubs),(Queen,Diamonds),(Ten,Hearts),(Two,Clubs)],[(Six,Spades),(Ace,Hearts),(Two,Hearts),(Jack,Spades),(Seven,Spades),(Three,Hearts)],[(Ten,Spades),(Seven,Diamonds),(Ace,Diamonds),(Five,Spades),(Four,Clubs),(Jack,Hearts)],[(Five,Hearts),(Three,Diamonds),(Three,Clubs),(Eight,Diamonds),(Jack,Diamonds),(Jack,Clubs)],[(Eight,Clubs),(Two,Diamonds),(Nine,Diamonds),(Four,Spades),(Four,Diamonds),(Six,Clubs)],[(Four,Hearts),(Queen,Spades),(Six,Diamonds),(Nine,Hearts),(King,Diamonds)],[(King,Spades)],[(Three,Spades),(Five,Clubs),(Five,Diamonds),(Six,Hearts),(Seven,Hearts),(Ten,Diamonds)]],[(Eight,Spades),(Nine,Spades),(Ace,Spades),(King,Clubs)])
*Solitare2> b4 = ([],[[(King,Hearts),(Queen,Hearts),(Eight,Diamonds),(Queen,Clubs),(Three,Hearts),(Eight,Hearts)],[(Ace)
*Solitare2> kingColToEmptyCol b4
([],[[(King,Hearts),(Queen,Hearts),(Eight,Diamonds),(Queen,Clubs),(Three,Hearts),(Eight,Hearts)],[(Ace,Clubs),(Five,Hearts),(Queen,Spades),(Three,Clubs),(Seven,Clubs),(Nine,Spades)],[(Six,Diamonds),(Five,Diamonds),(Five,Clubs),(Four,Spades),(Six,Clubs),(Two,Hearts)],[(Seven,Hearts),(Four,Clubs),(Two,Clubs),(King,Spades),(Six,Hearts),(Ace,Spades)],[(Jack,Spades),(Queen,Diamonds),(Two,Spades),(Five,Spades),(Jack,Diamonds),(King,Clubs)],[(Eight,Spades),(Nine,Clubs),(Three,Spades),(Nine,Diamonds),(Jack,Hearts),(Ten,Hearts)],[(Seven,Diamonds),(Six,Spades),(Eight,Clubs),(Four,Diamonds),(Ten,Clubs),(Jack,Clubs)],[(Four,Hearts),(Ace,Hearts),(Ten,Diamonds),(Seven,Spades),(Ten,Spades),(Two,Diamonds)]],[(King,Diamonds),(Three,Diamonds),(Nine,Hearts),(Ace,Diamonds)])

*Solitare2> colToCols b
([],[[(Three,Hearts),(Seven,Clubs),(Three,Spades),(King,Diamonds),(Ace,Diamonds),(Jack,Spades)],[(Two,Hearts),(Eight,Clubs),(Jack,Clubs),(Three,Diamonds),(Seven,Spades),(King,Spades)],[(Queen,Diamonds),(Four,Spades),(Ten,Hearts),(Queen,Hearts),(Five,Spades),(Ace,Clubs)],[(Eight,Diamonds),(Six,Clubs),(Two,Diamonds),(Seven,Hearts),(Nine,Clubs)],[(Nine,Spades),(Eight,Spades),(Four,Clubs),(Five,Clubs),(Nine,Hearts),(Six,Spades)],[(Eight,Hearts),(Six,Hearts),(Jack,Diamonds),(Ten,Diamonds),(Jack,Hearts),(Five,Hearts)],[(Six,Diamonds),(Seven,Diamonds),(Ten,Spades),(Three,Clubs),(Two,Clubs),(Ace,Hearts),(Five,Diamonds)],[(King,Clubs),(Nine,Diamonds),(Four,Hearts),(King,Hearts),(Queen,Spades),(Ace,Spades)]],[(Two,Spades),(Four,Diamonds),(Ten,Clubs),(Queen,Clubs)])
*Solitare2> b1 = ([],[[(Nine,Hearts),(Ten,Hearts),(Seven,Diamonds),(King,Spades),(Jack,Diamonds),(Eight,Diamonds)],[(Qu)
*Solitare2> colToCols b1
([],[[(Seven,Diamonds),(King,Spades),(Jack,Diamonds),(Eight,Diamonds)],[(Queen,Hearts),(Seven,Clubs),(Two,Hearts),(Three,Clubs),(Ten,Diamonds),(Ten,Clubs)],[(Jack,Clubs),(Nine,Diamonds),(Four,Spades),(Five,Spades),(Two,Clubs),(Nine,Spades)],[(Two,Diamonds),(Two,Spades),(Nine,Clubs),(King,Hearts),(Five,Clubs),(Ace,Diamonds)],[(Nine,Hearts),(Ten,Hearts),(Jack,Hearts),(Six,Clubs),(Five,Diamonds),(King,Diamonds),(Eight,Spades),(Three,Hearts)],[(Three,Diamonds),(Queen,Spades),(Seven,Hearts),(Six,Diamonds)],[(Eight,Hearts),(Three,Spades),(Six,Hearts),(Four,Clubs),(Ace,Hearts),(Four,Diamonds)],[(Six,Spades),(Jack,Spades),(Queen,Clubs),(Eight,Clubs),(Seven,Spades),(Ten,Spades)]],[(Queen,Diamonds),(Five,Hearts),(King,Clubs),(Four,Hearts)])

*Solitare2> b = ([],[[(Three,Hearts),(Ace,Clubs),(King,Spades),(Six,Hearts),(Queen,Spades),(Five,Spades)],[(Nine,Hearts)
*Solitare2> toRes b
([],[[(Ace,Clubs),(King,Spades),(Six,Hearts),(Queen,Spades),(Five,Spades)],[(Nine,Hearts),(Eight,Hearts),(Nine,Clubs),(Ace,Hearts),(Six,Spades),(Queen,Clubs)],[(Eight,Clubs),(King,Clubs),(Four,Spades),(Jack,Spades),(Four,Diamonds),(Seven,Hearts)],[(Eight,Diamonds),(Ace,Diamonds),(Five,Diamonds),(Three,Clubs),(Six,Clubs),(Ace,Spades)],[(Three,Spades),(Six,Diamonds),(Five,Hearts),(Jack,Hearts),(Ten,Hearts),(Nine,Spades)],[(Two,Clubs),(King,Hearts),(Jack,Clubs),(Ten,Spades),(Five,Clubs),(Queen,Diamonds)],[(King,Diamonds),(Queen,Hearts),(Eight,Spades),(Seven,Spades),(Ten,Diamonds),(Four,Clubs)],[(Seven,Clubs),(Seven,Diamonds),(Two,Spades),(Nine,Diamonds),(Two,Hearts),(Three,Diamonds)]],[(Three,Hearts),(Two,Diamonds),(Ten,Clubs),(Four,Hearts),(Jack,Diamonds)])

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*Solitare2> b1 = ([],[[(Two,Clubs),(Three,Clubs),(King,Spades),(Jack,Hearts),(Six,Diamonds),(King,Diamonds)],[(Two,Spad)
*Solitare2> toRes b1
([],[[(Two,Clubs),(Three,Clubs),(King,Spades),(Jack,Hearts),(Six,Diamonds),(King,Diamonds)],[(Two,Spades),(Three,Spade
s),(Ace,Clubs),(Seven,Hearts),(Two,Diamonds)],[(Ten,Spades),(Jack,Spades),(Nine,Spades),(Eight,Clubs),(Five,Clubs),(Fiv
e,Hearts)],[(Six,Spades),(Nine,Clubs),(Six,Hearts),(Eight,Spades)],[(Eight,Diamonds),(Queen,Clubs),(Ace,Spades),(Five,Dia
monds),(Six,Clubs),(Jack,Clubs)],[(Nine,Diamonds),(Ten,Diamonds),(Four,Diamonds),(Eight,Hearts),(Four,Hearts)],[(Seven,
Spades),(Ten,Hearts),(Queen,Spades),(Jack,Diamonds),(Five,Spades),(Nine,Hearts)],[(King,Clubs),(Ten,Spades),(Ten,Club
s),(Three,Diamonds),(Seven,Clubs)]],[(Three,Hearts),(Seven,Diamonds),(Four,Spades),(Queen,Diamonds),(Queen,Hearts)]
)
*Solitare2> b2 = ([],[[(Two,Clubs),(Three,Clubs),(King,Spades),(Jack,Hearts),(Six,Diamonds),(King,Diamonds)],[(Two,Spad)
*Solitare2> toRes b2
([],[[(Two,Clubs),(Three,Clubs),(King,Spades),(Jack,Hearts),(Six,Diamonds),(King,Diamonds)],[(Two,Spades),(Three,Spade
s),(Ace,Clubs),(Seven,Hearts),(Two,Diamonds)],[(Ten,Spades),(Jack,Spades),(Eight,Clubs),(Five,Clubs),(Five,Hearts)],[(Thr
ee,Hearts),(Four,Hearts),(Nine,Clubs),(Six,Hearts),(Eight,Spades)],[(Eight,Diamonds),(Nine,Diamonds),(Ace,Spades),(Six,Cl
ubs),(Jack,Clubs)],[(Four,Diamonds),(Five,Diamonds),(Four,Hearts)],[(Seven,Spades),(Eight,Spades),(Queen,Spades),(Jac
k,Diamonds),(Five,Spades),(Nine,Hearts)],[(Nine,Spades),(Ten,Spades),(Ten,Clubs),(Three,Diamonds),(Seven,Clubs)]],[(Se
ven,Diamonds),(Four,Spades),(Queen,Diamonds),(Queen,Hearts)])
```