In [ ]:
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#Kaitlyn Kirt, CMOR 220, Spring 2024, Kaprekar Project
#Project8.ipynb
#This script uses the Kaprekar process for an arbitrary number of digits
#Last Modified: April 1, 2024
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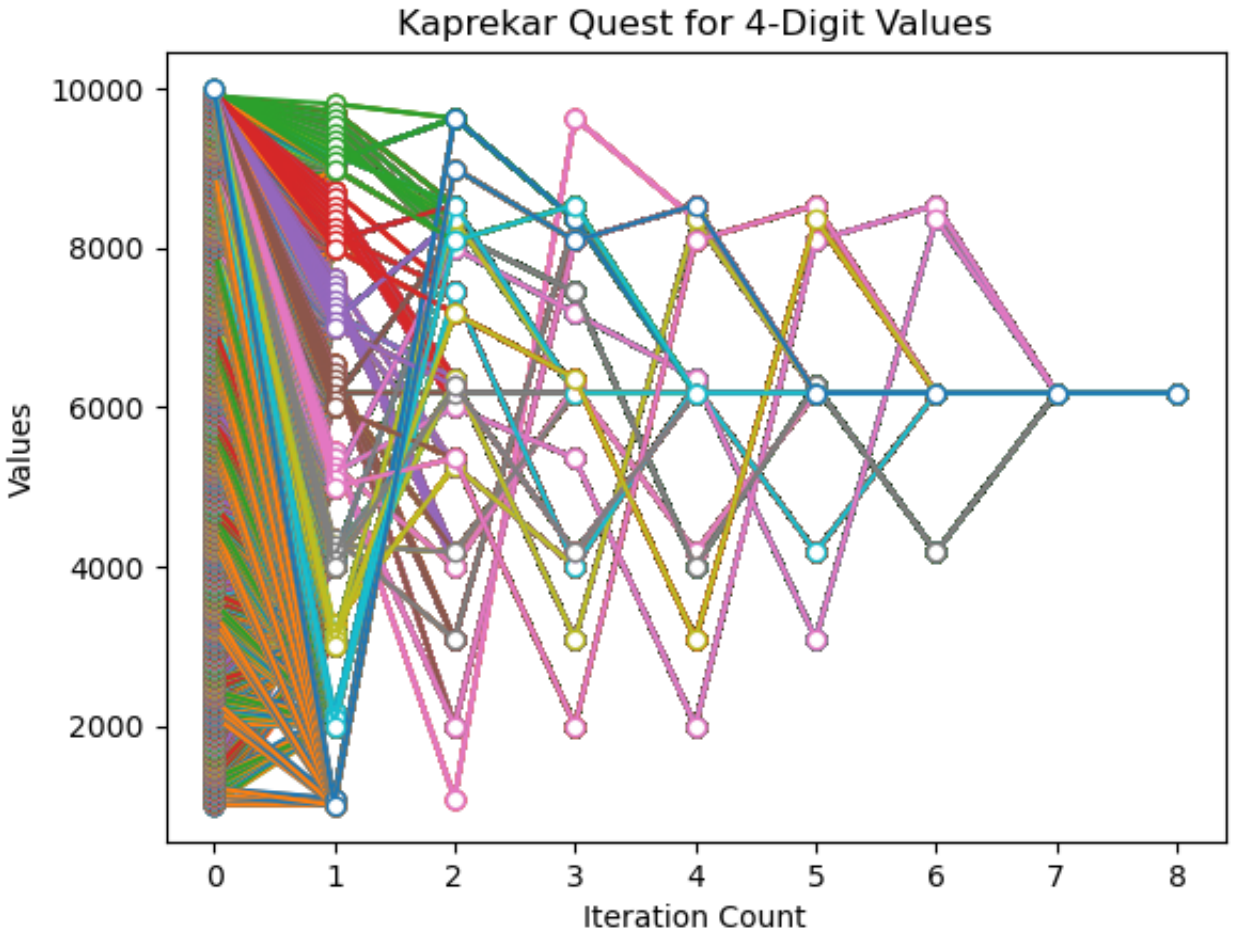
In [38]:
```
import numpy as np
import matplotlib.pyplot as plt
```

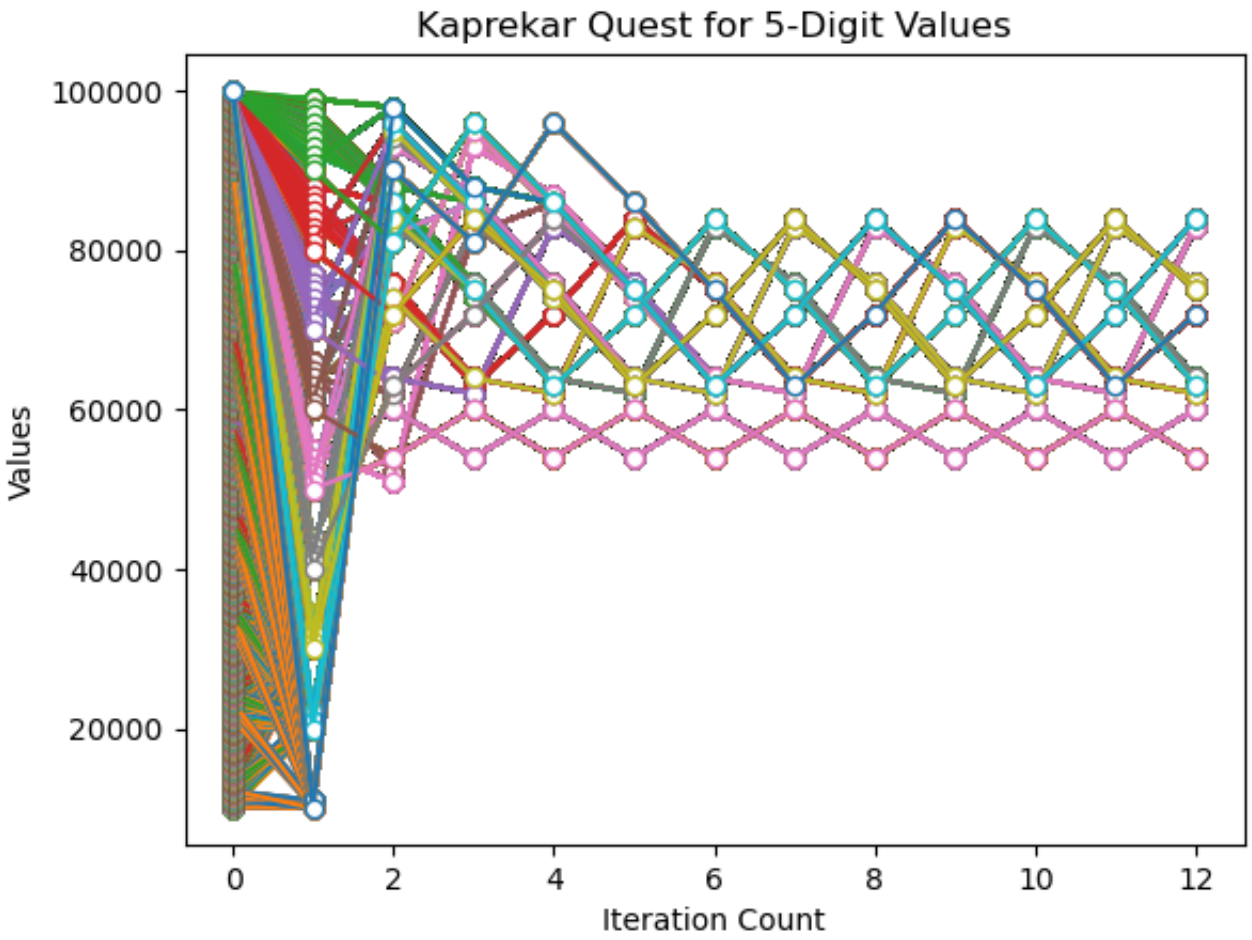
In [39]:
```
def Disallowed(n):
#inputs: n
#outputs: none
#description: this function returns the first n-digit long disallowed value
    D=0 #assigns the initial value of D
    for i in range(0,n):
        D=D+(10**i) #adds 10^i to D then reassings the variable
    return D
```

In [46]:
```
def KaprekarQuest(n,maxiter):
#inputs: n,maxiter
#outputs: none
#description: this function preforms Kaprekar's question for all of the n-le
    V=np.arange(10**(n-1),10**n) #creates a vector
    D=Disallowed(n) #gets the first disallowed value
    DR=np.where(V%D==0) #finds where the remainder is 0
    V=np.delete(V,DR) #deletes the disallowed values from V
    Data=np.zeros([len(V),maxiter+1 #preallocate Data
    Data[:,0]=V #sets first column to original values
    for c in range(0,maxiter): #runs code for maxiter times
        for r in range(0,len(V)): #uses a double nested for loop to
            Val=str(np.int64(Data[r,c]))
            if len(Val)<n: #sets a condition
                Val="0"+Val #applies the Kaprekar process to every value in
            #sorts a value to ascending and descending order
            G=sorted(Val)
            K=sorted(Val,reverse=True)
            G=int("".join(G))
            K=int("".join(K))
            Data[r,c+1]=K-G #computes the next value
    return Data
```

In [47]:
```
Data=KaprekarQuest(4,8)
plt.figure(1)
plt.plot(Data.T,"o-",markerfacecolor="white") #plots the quest with 4 digits
plt.xlabel("Iteration Count") #creates the label for the x-axis
plt.ylabel("Values") #creates the label for the y-axis
plt.title("Kaprekar Quest for 4-Digit Values") #creates the title for the fi
plt.show()
```

```
Data1=KaprekarQuest(5,12)
plt.figure(2)
plt.plot(Data1.T,"o-",markerfacecolor="white") #plots the quest with 5 digit
plt.xlabel("Iteration Count") #creates the label for the x-axis
plt.ylabel("Values") #creates the label for the y-axis
plt.title("Kaprekar Quest for 5-Digit Values") #creates the title for the fi
plt.show()
#This figure is showing the various 5-digit values through the Kaprekar proc
#There are 3 Kaprekar Holes for five-digit numbers. These holes are (teal,ye
#There are no Kaprekar Constants for the 5-digit value plot because none of
```




Kaprekar Quest for 5-Digit Values
Values
100000
80000
60000
40000
20000
0
2
4
6
8
10
12
Iteration Count

In [ ]: