Name: Caitlin Mooney
Course: CS 370
Assignment: Assignment 1

D1:
c
cca
D2:
ac
ba
D3:
bb
b
D4:
ac
cb

Question 1:

Question 1: A:
BFS 0:
Start State is an Empty Sequence of Dominoes
Depth=0
Count=0

BFS 1:
D1 ==>
c
cca
D2 ==>
ac
ba
D3 ==>
bb
b
D4 ==>
ac
cb
Depth=1
Count=4

BFS 2:
D1:D1 ==>
c c

cca cca
D3:D2 ==>
bb ac
b ba
D3:D3 ==>
bb bb
b b
Depth=2
Count=3

BFS 3:
D1:D1:D2 ==>
c c ac
cca cca ba
D1:D1:D4 ==>
c c ac
cca cca cb
D3:D2:D1 ==>
bb ac c
b ba cca
D3:D3:D3 ==>
bb bb bb
b b b
Depth=3
Count=4

BFS 4:
D1:D1:D2:D1 ==>
c c ac c
cca cca ba cca
D1:D1:D4:D1 ==>
c c ac c
cca cca cb cca
D3:D2:D1:D4 ==>
bb ac c ac
b ba cca cb
D3:D3:D3:D3 ==>
bb bb bb bb
b b b b
Depth=4
Count=4

BFS 5:
D1:D1:D4:D1:D2 ==>

c c ac c ac
cca cca cb cca ba
D1:D1:D4:D1:D4 ==>
c c ac c ac
cca cca cb cca cb
D3:D2:D1:D4:D3 ==>
bb ac c ac bb
b ba cca cb b
D3:D3:D3:D3:D3 ==>
bb bb bb bb bb
b b b b b
Depth=5
Count=4

Goal State Space Sequence with BFS:
D3:D2:D1:D4:D3 ==>
bb ac c ac bb
b ba cca cb b

Time = O(b^d) = O(4^5)
Space = O(b^d) = O(4^5)

Question 1: B:
DFS 0:
Start State is an Empty Sequence of Dominoes
Depth=0
Count=0

DFS 1:
D1 ==>
c
cca
D2 ==>
ac
ba
D3 ==>
bb
b
D4 ==>
ac
cb
Depth=1
Count=4

DFS 2:
D1:D1 ==>
c c
cca cca
D3:D2 ==>
bb ac
b ba
D3:D3 ==>
bb bb
b b
Depth=2
Count=3

DFS 3:
D1:D1:D2 ==>
c c ac
cca cca ba
D1:D1:D4 ==>
c c ac
cca cca cb
D3:D2:D1 ==>
bb ac c
b ba cca
D3:D3:D3 ==>
bb bb bb
b b b
Depth=3
Count=4

DFS 4:
D1:D1:D2:D1 ==>
c c ac c
cca cca ba cca
D1:D1:D4:D1 ==>
c c ac c
cca cca cb cca
D3:D2:D1:D4 ==>
bb ac c ac
b ba cca cb
D3:D3:D3:D3 ==>
bb bb bb bb
b b b b
Depth=4

Count=4

DFS 5:
D1:D1:D4:D1:D2 ==>
c c ac c ac
cca cca cb cca ba
D1:D1:D4:D1:D4 ==>
c c ac c ac
cca cca cb cca cb
D3:D2:D1:D4:D3 ==>
bb ac c ac bb
b ba cca cb b
D3:D3:D3:D3:D3 ==>
bb bb bb bb bb
b b b b b
Depth=5
Count=4

DFS 6:
D3:D2:D1:D4:D3:D1 ==>
bb ac c ac bb c
b ba cca cb b cca
D3:D2:D1:D4:D3:D3 ==>
bb ac c ac bb bb
b ba cca cb b b
D3:D3:D3:D3:D3:D3 ==>
bb bb bb bb bb bb
b b b b b b
Depth=6
Count=3

DFS 7:
D3:D2:D1:D4:D3:D1:D1 ==>
bb ac c ac bb c c
b ba cca cb b cca cca
D3:D2:D1:D4:D3:D3:D2 ==>
bb ac c ac bb bb ac
b ba cca cb b b ba
D3:D2:D1:D4:D3:D3:D3 ==>
bb ac c ac bb bb bb
b ba cca cb b b b
D3:D3:D3:D3:D3:D3:D3 ==>
bb bb bb bb bb bb bb
b b b b b b b

Depth=7
Count=4

Goal State Space Sequence with DFS:
D3:D2:D1:D4:D3 ==>
bb ac c ac bb
b ba cca cb b

Time = O(b^m) = O(4^7)
Space = O(bm) = O(4*7)

Question 1: C:
DFS 0:
Start State is an Empty Sequence of Dominoes
Depth=0
Count=0

DFS 1:
D4 ==>
ac
cb
D3 ==>
bb
b
D2 ==>
ac
ba
D1 ==>
c
cca
Depth=1
Count=4

DFS 2:
D3:D3 ==>
bb bb
b b
D3:D2 ==>
bb ac
b ba
D1:D1 ==>
c c
cca cca
Depth=2

Count=3

DFS 3:
D3:D3:D3 ==>
bb bb bb
b b b
D3:D2:D1 ==>
bb ac c
b ba cca
D1:D1:D4 ==>
c c ac
cca cca cb
D1:D1:D2 ==>
c c ac
cca cca ba
Depth=3
Count=4

DFS 4:
D3:D3:D3:D3 ==>
bb bb bb bb
b b b b
D3:D2:D1:D4 ==>
bb ac c ac
b ba cca cb
D1:D1:D4:D1 ==>
c c ac c
cca cca cb cca
D1:D1:D2:D1 ==>
c c ac c
cca cca ba cca
Depth=4
Count=4

Goal State Space Sequence with DFS:
This inverse method of DFS Search does not achieve a solution for the state space problem.

Time = O(b^l) = Unsuccessful
Space = O(b*l) = Unsuccessful

Question 2:

Question 3:
BFS 0:
Start State is an Empty Sequence of Dominoes
Depth=0
Count=0

BFS 1:
D1 ==>
c
cca
D2 ==>
ac
ba
D3 ==>
bb
b
D4 ==>
ac
cb
Depth=1
Count=4

BFS 2:
D3:D3 ==>
bb bb
b b
D4:D3 ==>
ac bb
cb b
Depth=2
Count=2

BFS 3:
D3:D3:D3 ==>
bb bb bb
b b b
D1:D4:D3 ==>
c ac bb
cca cb b
Depth=3
Count=2

BFS 4:
D3:D3:D3:D3 ==>

bb bb bb bb
b b b b
D1:D1:D4:D3 ==>
c c ac bb
cca cca cb b
D2:D1:D4:D3 ==>
ac c ac bb
ba cca cb b
Depth=4
Count=3

BFS 5:
D3:D3:D3:D3:D3 ==>
bb bb bb bb bb
b b b b b
D3:D2:D1:D4:D3 ==>
bb ac c ac bb
b ba cca cb b
Depth=5
Count=2

Goal State Space Sequence with BFS:
D3:D2:D1:D4:D3 ==>
bb ac c ac bb
b ba cca cb b

Time = O(b^d) = O(2^5)
Space = O(b^d) = O(2^5)

Question 4:
D1:
b
c
D2:
cd
c
D3:
c
b
D4:
dc
dd

To achieve the sequence of dominoes whose state space has a D2:D4 cycle, the transition has to hit D2:D4:D1:D3.

State 0:
Empty
State 1:
D2:D4 ==>
cd dc
c dd
D2:D4:D1 ==>
cd dc b
c dd c
D2:D4:D1:D3 ==>
cd dc b c
c dd c b