Homework 2

1. For constants c and n_0, we get the following when $n \geq n_0$.

$$\begin{aligned} 2^{2n} &\leq c \cdot 2^n \\ \log(2^{2n}) &\leq \log(c \cdot 2^n) \\ 2n\log(2) &\leq \log(c) + n\log(2) \\ n\log(2) &\leq \log(c) \\ n &\leq \frac{\log(c)}{\log(2)} = c' \end{aligned}$$

   Since no constant c' can be bigger than every possible n, this results in a contradiction. Thus $O(2^{2n}) \neq O(2^n)$.

2. ```
   def PhysIndexReverse(A, i):
       return (A.front + A.size - i - 1) % A.cap
   ```

3. ```
   def Sum(L):
       if L is None:
           return 0
       else:
           return L.data + Sum(L.next)
   ```

4. When we pop 6 off of the stack we know that 5 has already been pushed onto the stack. It is thus impossible to pop 4 because we know that 5 is above it.

5. 3 of the 10 pop operations fail, so only 7 of them remove items. The peek operations have no effect on the size. 25 pushes - 7 pops = 18 items.

6. ```
   def Transfer(S, T):
       while not S.isEmpty():
           T.push(S.pop())
   ```

7. Transfer S to temporary stack A which now contains the items in reverse order. Transfer A to B to have the items in the original order. Transfer B back to S, which now has the items in the reverse order.

8. After enqueueing 8 items, the front is at index 0 and the back is at index 7 (first empty is index 8). Dequeueing 5 items moves the front to index 5, but leaves the back at index 7. Adding 3 items causes the back to loop around to index 0, and the remaining 3 moves it to 3. The front is thus at index 5 and the back is at index 3.

9. ```
   def Clear(Q):
       if not Q.isEmpty():
           Q.dequeue()
           Clear()
   ```