Homework #5
Due Date: 
Reading Assignment: Chapter 5
Problems:

1. 5–14
2. 5–43
3. 5–58
4. 5–24
5. Evaluate \(\frac{1}{N} \sum_{1 \leq k \leq N} \sum_{t} \frac{t(N-k)(k-1)}{(N-1)}\)

6. The Merge Sort program sorts \(n\) numbers \(X(1), X(2), \ldots, X(n)\) by:
   
   1. If \(n = 1\), then do nothing. Otherwise, do Steps 2 through 4.
   2. Sort the \([n/2]\) numbers \(X(1), X(2), \ldots, X([n/2])\) by calling Merge Sort recursively.
   3. Sort the \([n/2]\) numbers \(X([n/2] + 1), X([n/2] + 2), \ldots, X(n)\) by calling Merge Sort recursively.
   4. Merge the two sorted lists from Steps 2 and 3. (This takes \(n - 1\) comparisons in the worst case, using the obvious algorithm.)

Let \(S(n)\) be the worst-case number of comparisons needed by Merge Sort to sort \(n\) numbers. The above description of the program shows that

\[
S(n) = S([n/2]) + S([n/2]) + n - 1, \quad n > 1;
\]

\[
S(1) = 0.
\]

Solve the recurrence for the general case, for \(n = 1, 2, 3, \ldots\)