1. Prove that the incorrect sorting algorithm below runs in $O(n \lg n)$ time. (*Hint*: you may use the fact that $\sum_{i=1}^{n} \frac{1}{i} = O(\lg n)$.)

```
   Input: data: an array of integers to sort
   Input: n: the number of values in data
   Output: a permutation of data such that
                data[1] ≤ data[2] ≤ ... ≤ data[n]
1  Algorithm: BadSort
2  foreach i = n − 1 to 1 step −1 do
3  |  foreach j = 1 to n − i step i do
4  |  |  if data[j] > data[j + i] then
5  |  |  |  Swap data[j] and data[j + i]
6  |  |  end
7  |  end
8  end
9  return data
```