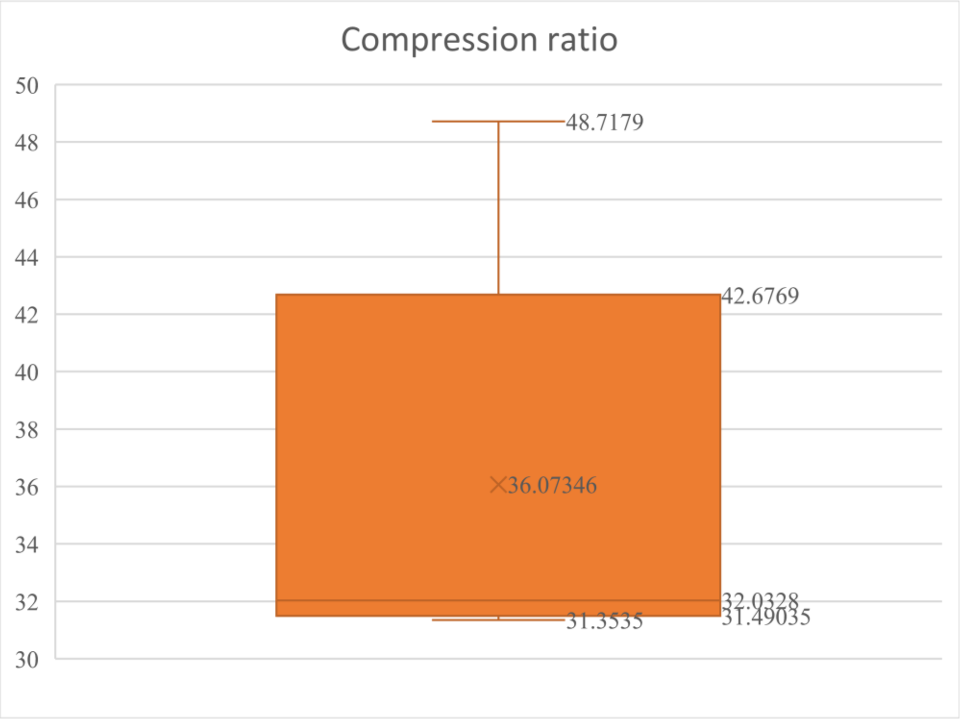
Project report

CSE 310: Project 1

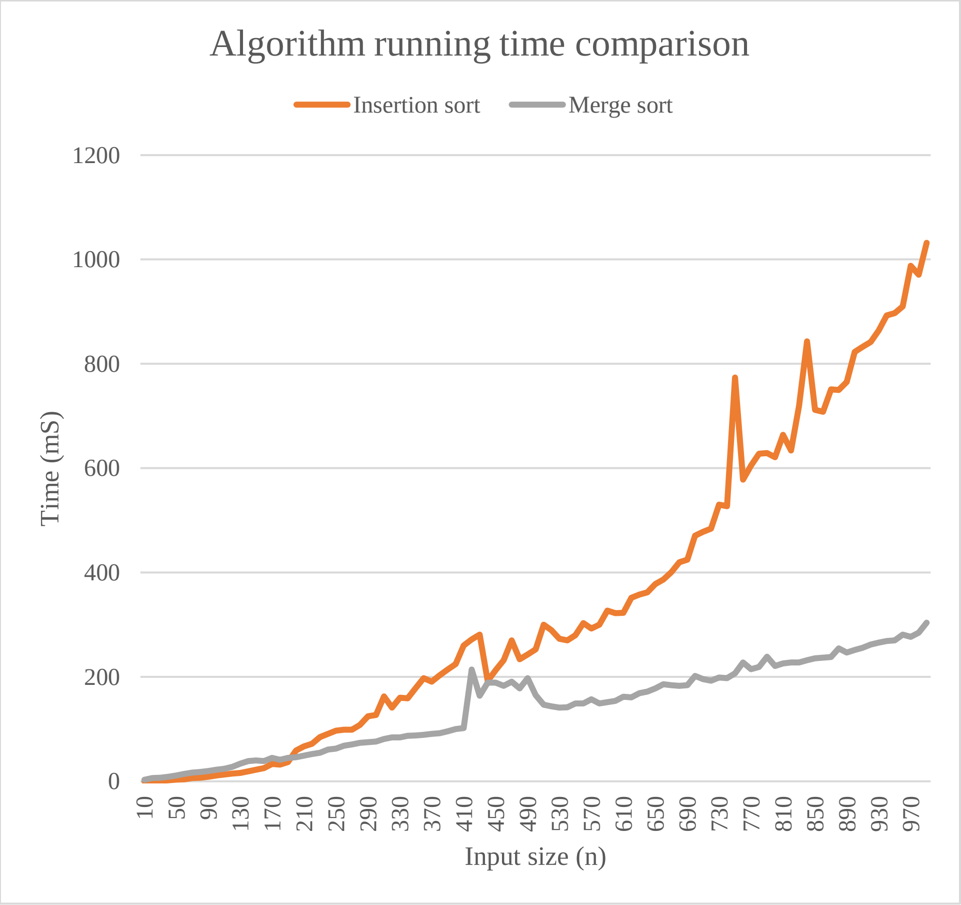
Ninad Bharat Gund
ASU ID: 1222336947

Experiments:

1. Tests of compression ratios by testing different inputs –
    - anne-of-avonlea
        - n: 491713
          sum: 2339424
          numberOfBits: 4.7577
          fixedNumberOfBits: 7
          compressionRatio: 32.0328 %
    - haiku1
        - n: 62
          sum: 275
          numberOfBits: 4.43548
          fixedNumberOfBits: 7
          compressionRatio: 36.6359 %
    - she-sells
        - n: 39
          sum: 140
          numberOfBits: 3.58974
          fixedNumberOfBits: 7
          compressionRatio: 48.7179 %
    - tale-of-two-cities ch1
        - n: 7425
          sum: 35679
          numberOfBits: 4.80525
          fixedNumberOfBits: 7
          compressionRatio: 31.3535 %
    - tongue-twisters
        - n: 374
          sum: 1790
          numberOfBits: 4.7861
          fixedNumberOfBits: 7
          compressionRatio: 31.6272 %



2. Test of running time for both algorithms, tested as a function of the input size (n) –

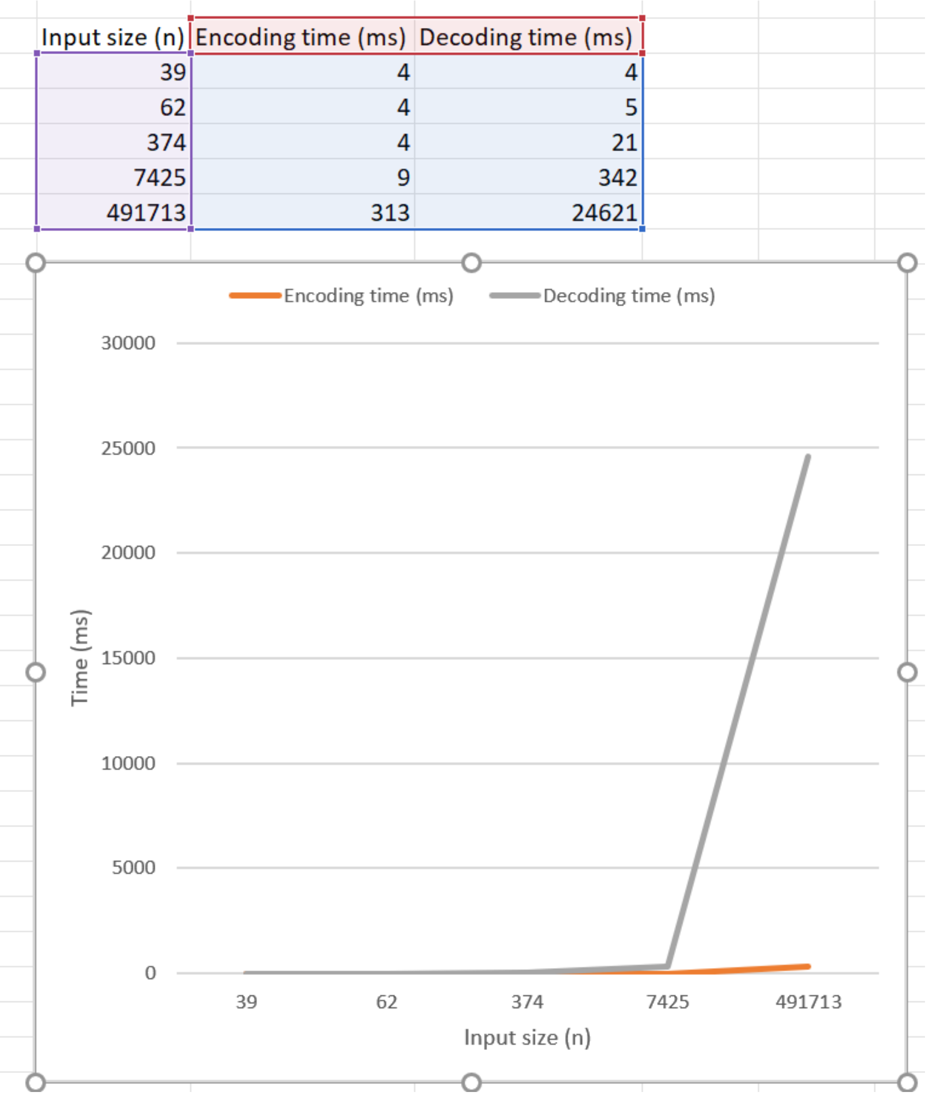


•

- (The result has some outliers because test data was created at random, based on the instance, algorithms can have best/worth running times. Insertion sort’s running time can be very different for a relatively sorted vs reverse ordered input. So we will choose to focus on the trend of the plot instead)

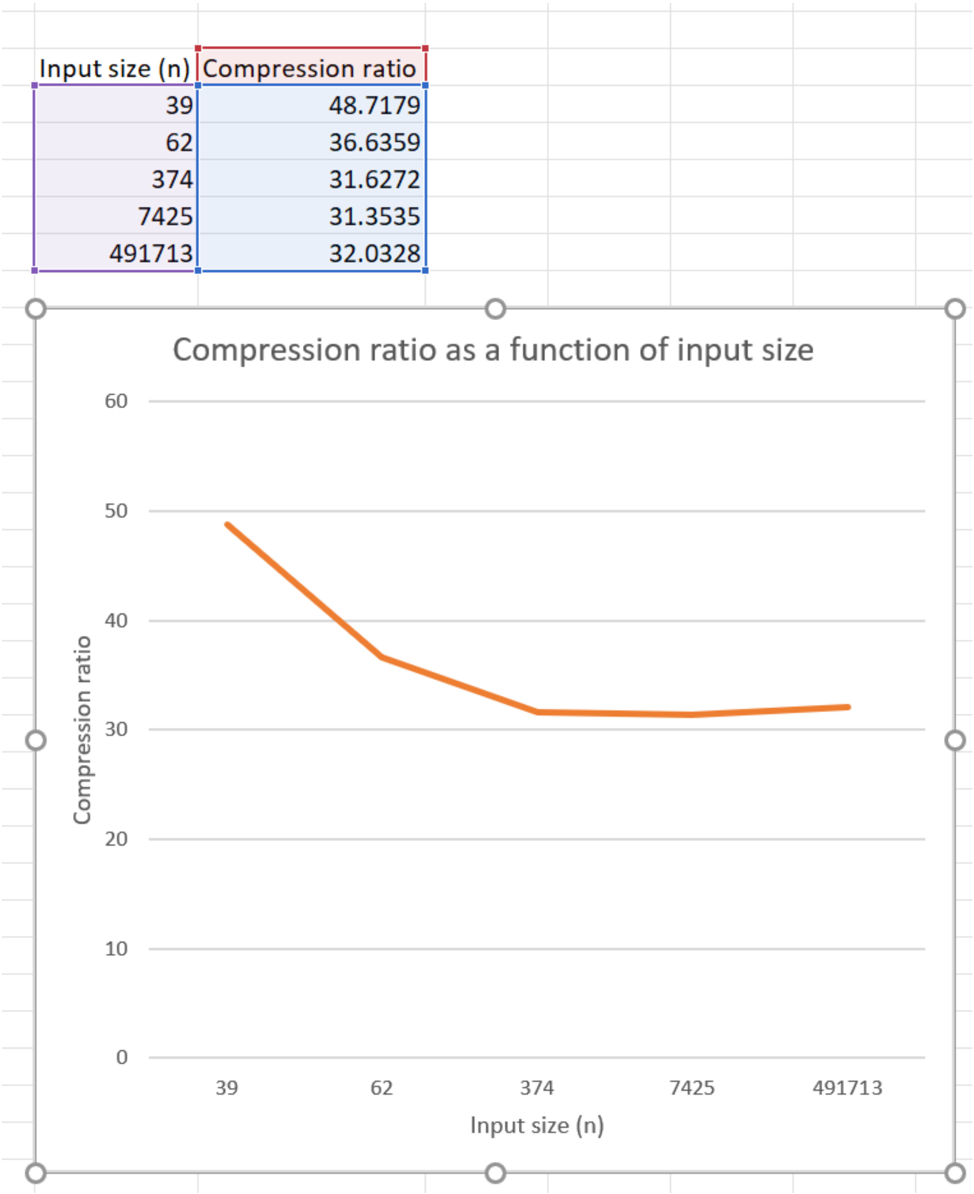
- As expected, insertion sort has a order of growth of O(n^2), while merge sort grows at O(n*logn)
- For a very small input size (below 200 in this case), insertion sort performs better, but as the input size grows, merge sort becomes significantly faster. So we can state that **insertion sort can be better for really small input instances, while merge sort is better for large input instances.**

3. Test of encoding/decoding time as a function of input size (n) –



Input size (n)	Encoding time (ms)	Decoding time (ms)
39	4	4
62	4	5
374	4	21
7425	9	342
491713	313	24621

4. Test of compression ratio as a function of input size (n) –



Input size (n)	Compression ratio
39	48.7179
62	36.6359
374	31.6272
7425	31.3535
491713	32.0328

-
- It can be observed that the compression ratio becomes worse as the size of the input increases, but this is only true for change in input size for lower range. After a point (374+ in this case), the compression ratio is barely affected by the size of the input.
- The behavior is likely because in small inputs, not all the symbols are present and thus we do not encode the symbols with 0 occurrences. After the input size grows significantly, almost all the symbols are present, and we must encode a greater number of symbols. So, we can say that compression ratio is more of a function of the number of symbols to be encoded and not the size of the input directly.