1. (a) Consider the following list of English words:

     virus, covid, epidemic, house, corona, pandemic, face, mask, home, quarantine, course, fact.

   We shorten the words to at most five letters:

     virus, covid, epide, house, coron, pande, face, mask, home, quara, cours, fact.

   Illustrate the operation of radix sort on the shortened "words".

   (b) Use "epidemic" and "pandemic" in an English sentence that shows that you understand the meaning of both. (Do NOT write two sentences. Do NOT define them. Do NOT pass GO. Do NOT collect $200.)

2. Consider the rectangle with four corner points: $(3, 2)$, $(7, 2)$, $(3, 4)$, and $(7, 4)$. Assume that n points are uniformly distributed randomly inside it. (The n points can be represented by n pairs of real numbers $(x_1, y_1), (x_2, y_2), \ldots, (x_n, y_n)$.)

   (a) Show that you can sort the points by their distance to the y-axis in average-case linear time. You can assume that bucket sort works in average-case linear time.

   (b) Give the pseudo-code for your algorithm.

3. Assume that you run bucket sort using bubble sort to sort the buckets.

   (a) Assume that n/k buckets have k items (and the remaining buckets have no items). Exactly how many comparisons does bucket sort do? Show your work.

   (b) Assume that the first bucket has one item, the second bucket has two items, the third bucket has three items, etc., until there are no more items. You can assume that $n = k(k + 1)/2$ so that this works out evenly. How many comparisons does bucket sort do? Just get the exact high order term. Show your work.