THIS IS NOT A SAMPLE FINAL EXAM!!!

This document is not intended to imply anything about the length, format, or level of difficulty of the final exam that you will take.

It is simply a collection of some past exam questions and some other practice questions used by TAs in exam review sessions.

Consider the following algorithm to find the oldest person in the room:

1. Line up all of the people in random order.
2. Start with the person on the left end of the line.
3. If that person is older than the person to the right, they switch places; otherwise, they stay in place.
4. Move to the next person on the right and repeat step 3 until reaching the end.
5. At this point, the oldest person will be on the right end of the line.

What algorithm does this most closely represent? Why? What is the approximate running time of this algorithm (number of comparisons) as a function of the number of people in the line?

The biggest integer datatype in Java is a `long`, which is eight bytes. Imagine you are designing the next version of Java and want to include a datatype called the `superlong`, which is sixteen bytes. Assume Java uses sign-and-magnitude representation. What is the biggest positive number that can be represented with a `superlong`? What is the smallest number that can be represented with a `superlong`?
A certain microprocessor has a 2kB cache with an access time of 5ns (a nanosecond is $10^{-9}$ seconds) and an average hit rate of 70%. The main memory of the computer is 512MB and the access time is 20ns. A rival manufacturer wants to create a better microprocessor with a shorter average memory access time. It also has a 2kB cache but the access time is 8ns and the hit rate is 80%. Will the rival manufacturer’s microprocessor yield a better average memory access time? Why or why not?

You are the designer of a new microprocessor. It has the following properties:

1. 64 distinct operations (op codes)
2. A byte-addressable address space of 128MB
3. Instructions include a minimum of two addresses (aside from the op code)

What is the minimum size in bytes of an instruction for this processor?
Add the **hexadecimal** (base-sixteen) number 2A to the unsigned **binary** (base-two) number 10100001 (write your answer either in hexadecimal or binary):

In the following list of numbers, what is the average number of comparisons needed to find a number when using binary search? What is the average number when using sequential search?

3, 6, 7, 9, 12, 14, 18, 21, 22, 31, 43