COS126 Scientific Computation Questions

1. Imagine you can only store and use integers with 10 digits. What results when you add 9999999999 + 0000000001?

2. Using a factorial method which returns N! as an int, you get the following results:

   12! = 479001600
   13! = 1932053504
   14! = 1278945280
   15! = 2004310016
   16! = 2004189184
   17! = -288522240

   What happened? When did things start going wrong?

3. What will the following java fragment print?

   ```java
   double x1 = 0.3;
   double x2 = 0.1 + 0.1 + 0.1;
   StdOut.println(x1 == x2);
   double z1 = 0.5;
   double z2 = 0.1 + 0.1 + 0.1 + 0.1 + 0.1;
   StdOut.println(z1 == z2);
   ```

4. Is the previous result a consequence of Round Off Error or Catastrophic Cancellation?

5. Will the following java fragment print 0.0?

   ```java
   System.out.println( (.3 -.1 -.1-.1)*1e15);
   ```

6. Is the previous result a consequence of Round Off Error or Catastrophic Cancellation?

7. Give an example when java will give you NaN.

8. Give an example when java will give you Infinity.

9. What will the following java fragment print?

   ```java
   System.out.println( 1/0 );
   ```

10. What will the following java fragment print?

    ```java
    System.out.println( 1000000000000. + .00001);
    ```

11. Why is an ill-conditioned problem worse than an unstable algorithm?