

## COS126 Scientific Computation Questions

1. Imagine you can only store and use integers with 10 digits. What results when you add  $999999999 + 0000000001$ ?
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?

```
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?

```
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?

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

10. What will the following java fragment print?

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

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