

## Example of Numerical Algorithmic Error

Using differential debugging,

- they were able
- to find the cause of the problem.

**Any guesses?**

## Example of Numerical Algorithmic Error

On one machine, IEEE floating-point operations rounded up.

On the other machine, they rounded down.

**One part in millions (or maybe even less) became 30% error.**

The code was unstable.

That's **an example of a numerical algorithmic error.**

## Test with Corner Cases and Use a Debugger

**Test with corner cases:**

- execute loops 0 or 1 times,
- examine equality case for loop tests,
- check both directions on conditionals, and
- think about possible overflows.

**Walk through all paths for all code**

- in a debugger,
- setting state as necessary
- (required by some companies).

## Numerical Errors are Hard: Take a Class

**Numerical errors are much harder!**

**Test corners cases for small code sections.**

**Use analysis for whole programs.\***

\*Take a numerical analysis class, such as ECE491.