Verification of Systems With Non-Boolean Variables

How to find errors in computer programs

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Introduction

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- Designed by humans $\Longrightarrow$ May contain errors
- Types of errors:
  - Irritating/harmless
  - Catastrophic

Catastrophic Errors

Therac-25 radiation therapy machine [1985–1987]

- Patients receive massive overdoses of X-rays
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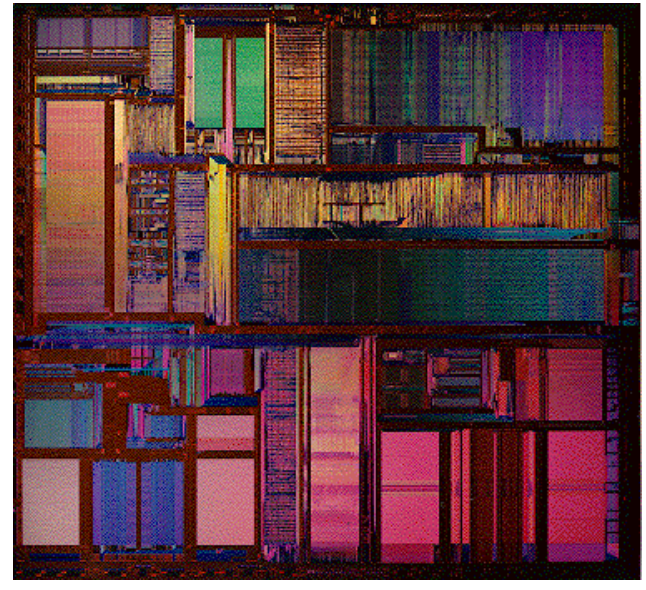
Intel's Pentium division bug [Dec. 1994]

- 4.999999/14.999999 gives 0.333329, but should be 0.3333**33**29
- Intel have to replace millions of defect processors
- Costs several 100 million $



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NASA's Mars Climate Orbiter [23 Sep. 1999]

- One team uses English units, another metric units
- Landing procedure doesn't start timely
- Spacecraft explodes in Mars's atmosphere

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- 10 years ago: Testing and simulation
- But testing only shows the presence of errors, not the absence of errors

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  - Specify the *requirements*
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- Perspective: Verification can be used to check Java programs

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It's commercial

- Collaborate with researchers from SRI International
- Co-founder of the spin-off company [www.configit-software.com] [1999]