IEEE 754-2008
Revision Process Update

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ARITH 23
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details

- http://754r.ucbtest.org
- http://754r.ucbtest.org/drafts Current 2.10
- http://754r.ucbtest.org/minutes
- In-person meeting Thursday 14 July 8:00am at Oracle Santa Clara
- 754r@ucbtest.org to attend
History

- 1985 was really a hardware standard – hoping for hardware adoption
- 2008 is a metastandard for programming languages – hardware now given, hoping for language adoption
- 2018 is a bug fix release, plus perhaps a bit more – C language now given, hoping for other languages
- 2028 ?
Example: operation

- Standard defines operations
- Programming languages define operators and functions
- Mathematics defines functions
Example: power

• Sayed and Fahmy ACM TOMS define special cases including some 754-2008 missed or wasn't explicit about. So we added them.

• What about pow( -32.0, 0.2 )? Could make sense in decimal, probably not in binary. What should happen?

• What about pow(-32.0,2/10) vs pow(-32.0,1/5)? Leave it to languages to define another powd(x,p/q) if desired.
Something new – twoSum?

- Considered but dropped from 754-2008
- Pending hardware implementations encourage us to consider for 2018
What is twoSum?

• \((h,l) = \text{twoSum}(a,b)\)
• \(h+l = a+b\) exactly
• \(l\) is as small in magnitude as possible, preferably zero
• \(h\) is as large in magnitude as possible
• \(l\) called “tail” in 754-2008 discussions
twoSum – who cares?

- Extending precision – David Bailey et al -
  “double double” for those times you need more precision than your hardware provides

- Reproducible reduction operations at reasonable cost – Demmel et al – regardless of number of threads, though not correctly rounded

- ACM TOMS now publishing Replicated Computational Results
twoSum issues

• What is \( l \) if \( h \) is exact, inf, or nan?
• How does it work in decimal?
• Overflow/underflow in twoProduct?
• Cater to hardware (fully specify) or software implementations (minimally specify)