Transcomputation

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Transcomputation

- Deals with total systems that have no exceptions
- Transmathematics: total functions
- Computing: exception free
- Applications: best efforts within total paradigm

Assessment

- Individual portfolio: 30%
- Examination: 70%

Transcomputation

- Google+ Community Transmathematica
- Bi-annual conference started 2017
- New journal starting January 1st 2018

Course agenda

- Transreal arithmetic
- Relational operators & sketching graphs
- Trans-two’s-complement & transfloat
- Equations, functions, gradient
- Rotation, angle, polar-transcomplex numbers

Course agenda

- Transvectors, polar-transcomplex arithmetic
- Physics & modelling
- Logic, sets & antinomies, knowledge
- Hardware & software
- Revision

Transreal arithmetic

- Totalises real arithmetic to the extent that it makes the operation of division closed
- Every real number is a finite, transreal number
- There are three non-finite, transreal numbers

Division by zero

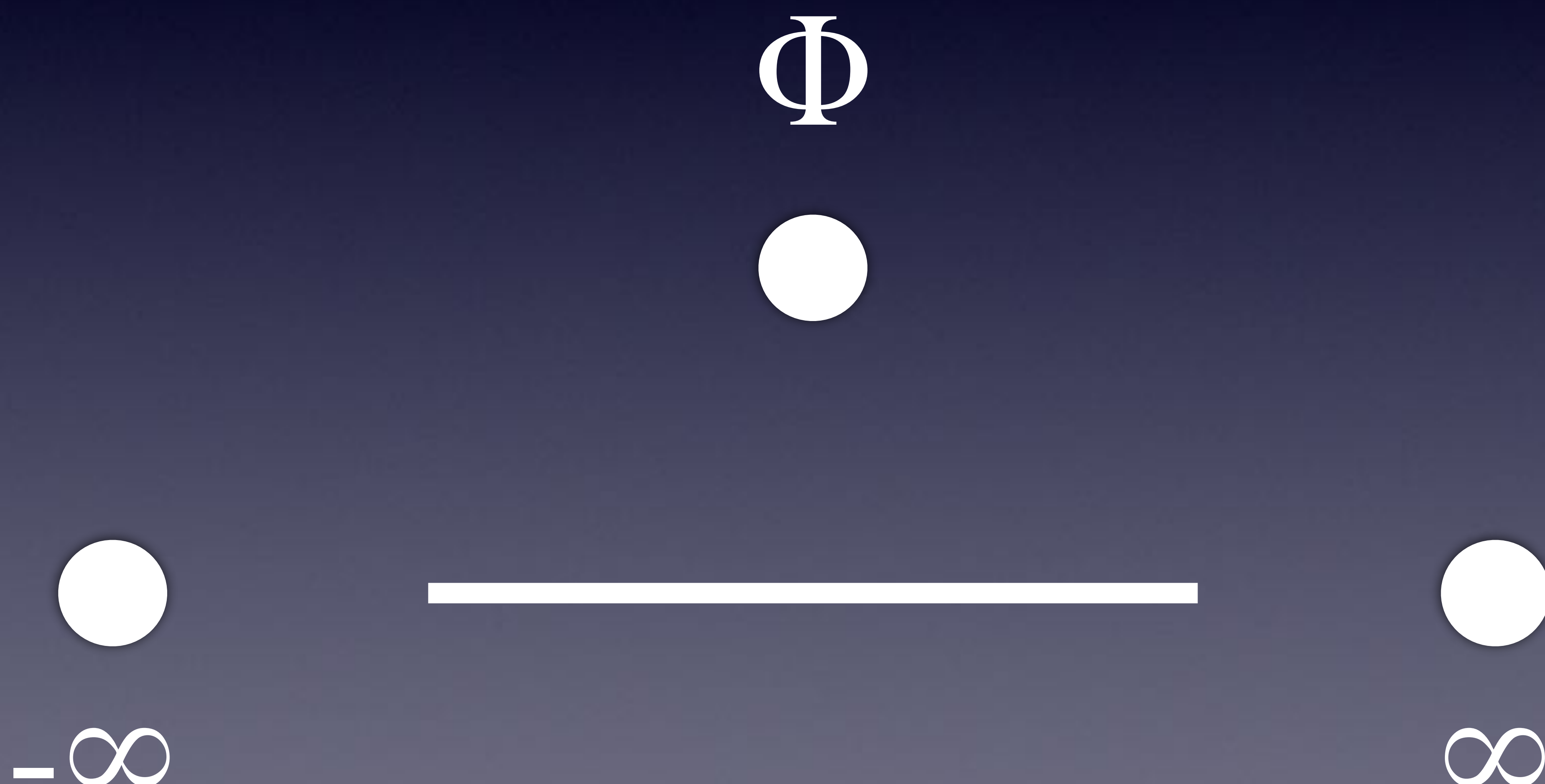
- Real arithmetic defines division in terms of the multiplicative inverse
- Real zero does not have a multiplicative inverse
- But there are other ways to define division

Consistency

- Transreal arithmetic proved consistent by machine proof
- Transreal and transcomplex arithmetic proved consistent by construction from the reals

How to Divide by Zero

Transreal-Number Line



Transreal Numbers

Transreal numbers, t, are proper fractions of real numbers, with a non-negative denominator, d, and a numerator, n, that is one of -1, 0, 1 when d = 0

$$t = \frac{n}{d}$$

With k a positive constant:

$$-\infty = \frac{-k}{0} = \frac{-1}{0} \qquad \Phi = \frac{0}{0} \qquad \infty = \frac{k}{0} = \frac{1}{0}$$

Negative Denominators

An improper fraction may have a negative denominator (-k) which must be made positive *before* any transarithmetical operator is applied

$$\frac{n}{-k} = \frac{-n}{-(-k)} = \frac{-1 \times n}{-1 \times (-k)} = \frac{-n}{k}$$

Multiplication

$$\frac{a}{b} \times \frac{c}{d} = \frac{ac}{bd}$$

Division

$$\frac{a}{b} \div \frac{c}{d} = \frac{a}{b} \times \frac{d}{c}$$

Addition of Two Infinities

$$\infty + \infty = \frac{1}{0} + \frac{1}{0} = \frac{1+1}{0} = \frac{2}{0} = \frac{1}{0} = \infty$$

$$\infty + (-\infty) = \frac{1}{0} + \frac{-1}{0} = \frac{1-1}{0} = \frac{0}{0} = \Phi$$

$$-\infty + \infty = \frac{-1}{0} + \frac{1}{0} = \frac{-1+1}{0} = \frac{0}{0} = \Phi$$

$$-\infty + (-\infty) = \frac{-1}{0} + \frac{-1}{0} = \frac{-1+(-1)}{0} = \frac{-2}{0} = \frac{-1}{0} = -\infty$$

General Addition

$$\frac{a}{b}+\frac{c}{d}=\frac{ad+bc}{bd}$$

Subtraction

$$\frac{a}{b} - \frac{c}{d} = \frac{a}{b} + \frac{-c}{d}$$

Associativity

$$a + (b + c) = (a + b) + c$$

$$a \times (b \times c) = (a \times b) \times c$$

Commutativity

$$a + b = b + a$$

$$a \times b = b \times a$$

Partial Distributivity

$$a(b+c) = ab + ac$$

When $a \neq \pm\infty$ or

$$bc > 0$$ or

$$(b+c)/0 = \Phi$$

Comparison

- Mathematics checks for division by zero and, if found, it fails
- Transmathematics checks for division by zero and always succeeds

Conclusion

- Transreal arithmetic contains real arithmetic
- Each real number is finite
- There are three non-finite, transreal numbers: negative infinity, nullity, positive infinity
- Transcomputation extends all other computation