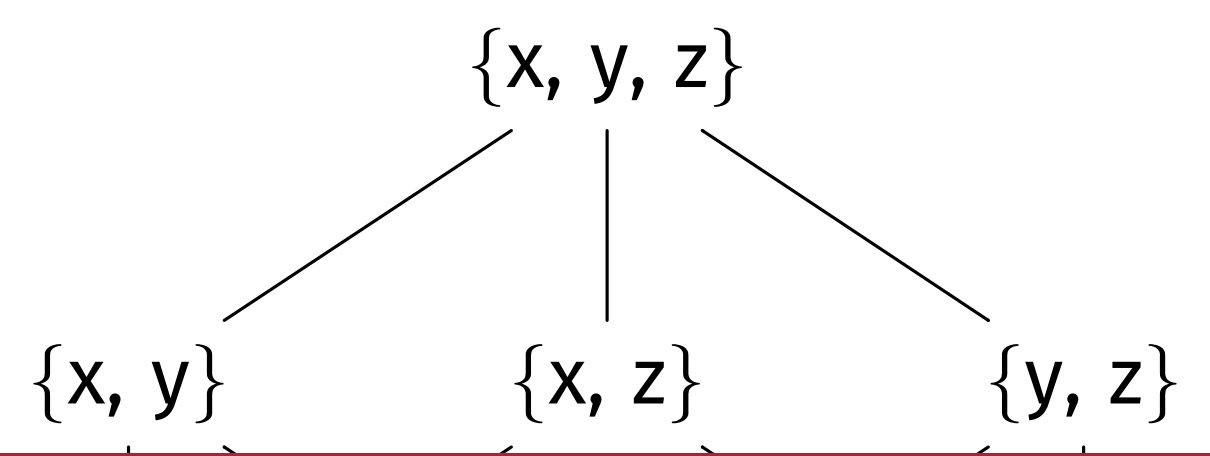

Abstract Interpretation

Software Engineering
Programming Languages

universität ulm

The Why

```
public static void main(String[] args) {
    int a = 1;
    double r = Math.random() * 10;
    if (r > 5) {
       a = 2;
    }
    System.out.println(a);
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```

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$\{a \in \{1\}\}$

The Why

```
public static void main(String[] args) {
    int a = 1;                          ⦃ a ∈ {1} ⦄
    double r = Math.random() * 10;      ⦃ r ∈ [0..10) ⦄
    if (r > 5) {
       a = 2;
    }
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}
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The Why

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public static void main(String[] args) {
    int a = 1;                          ⟅ a ∈ {1} ⟆
    double r = Math.random() * 10;      ⟅ r ∈ [0..10) ⟆
    if (r > 5) {
       a = 2;                           ⟅ a ∈ {2} ⟆
    }
    System.out.println(a);
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The Why

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public static void main(String[] args) {
    int a = 1;                          ⦃ a ∈ {1} ⦄
    double r = Math.random() * 10;      ⦃ r ∈ [0..10) ⦄
    if (r > 5) {
       a = 2;                           ⦃ a ∈ {2} ⦄
    }
    System.out.println(a);              ⦃ a ∈ {1,2} ⦄
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public static void main(String[] args) {
    int a = 1;                          ⟅ a ∈ {1} ⟆
    double r = Math.random() * 10;      ⟅ r ∈ [0..10) ⟆
    if (r > 5) {
       a = 2;                           ⟅ a ∈ {2} ⟆
    }
    System.out.println(a);              ⟅ a ∈ {1,2} ⟆ → Valid? Ok? Safe?
}
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The Why

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$⟅ a \in \{1\} ⟆$

$⟅ r \in [0..10) ⟆$

$⟅ a \in \{2\} ⟆$

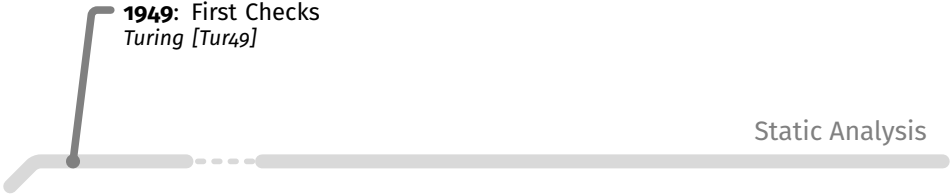
$⟅ a \in \{1, 2\} ⟆$ → Valid? Ok? Safe?

- We want to proof, that a program satisfies certain properties

Origins

Based on the amazing “Tutorial on Static Inference of Numeric Invariants by Abstract Interpretation” by Miné [Min17] and https://www.di.ens.fr/ cousot/AI/

Origins



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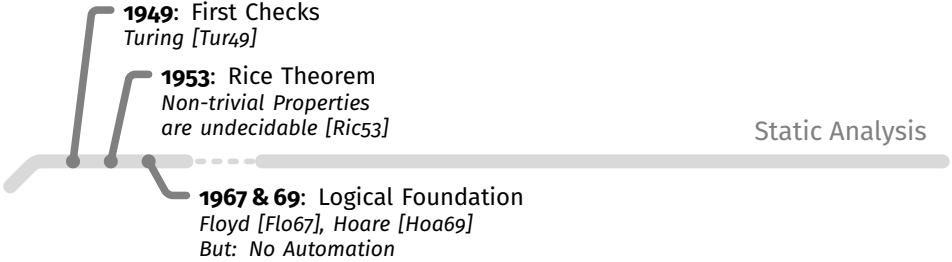

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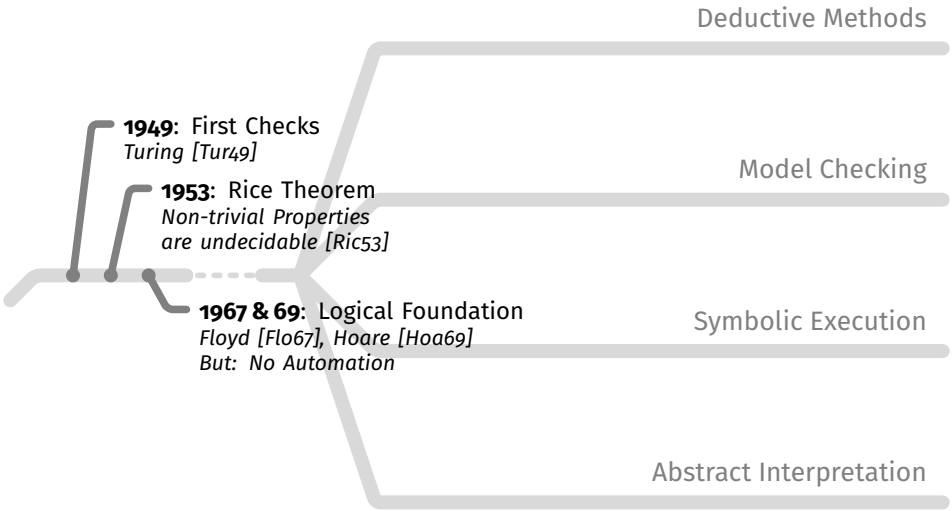

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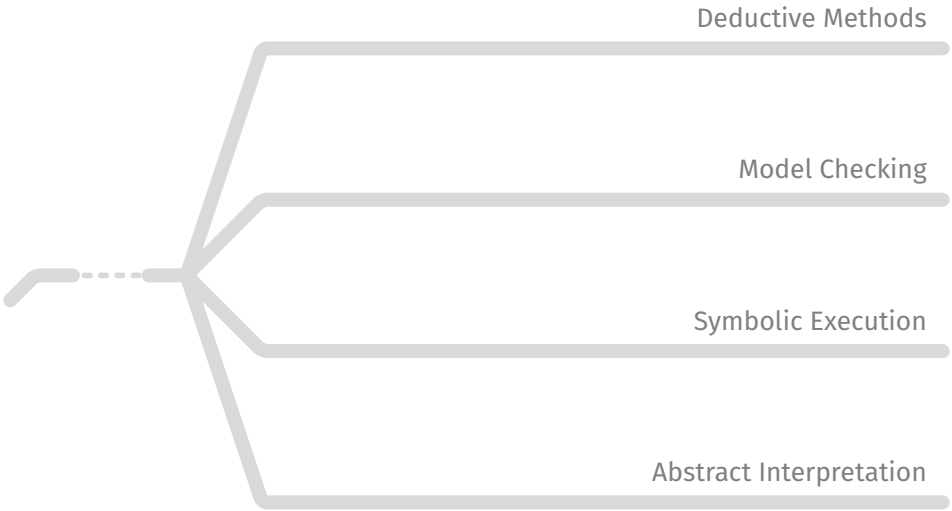

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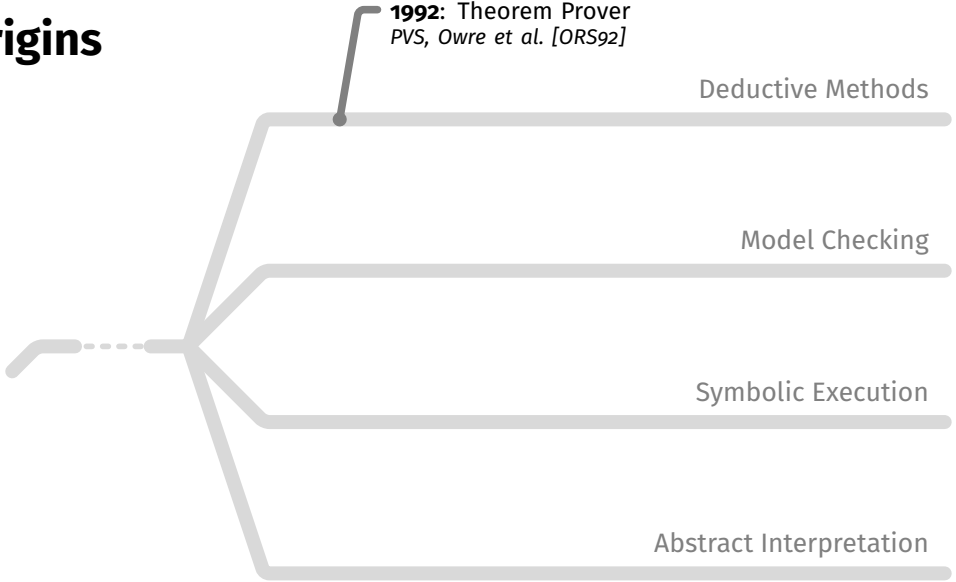

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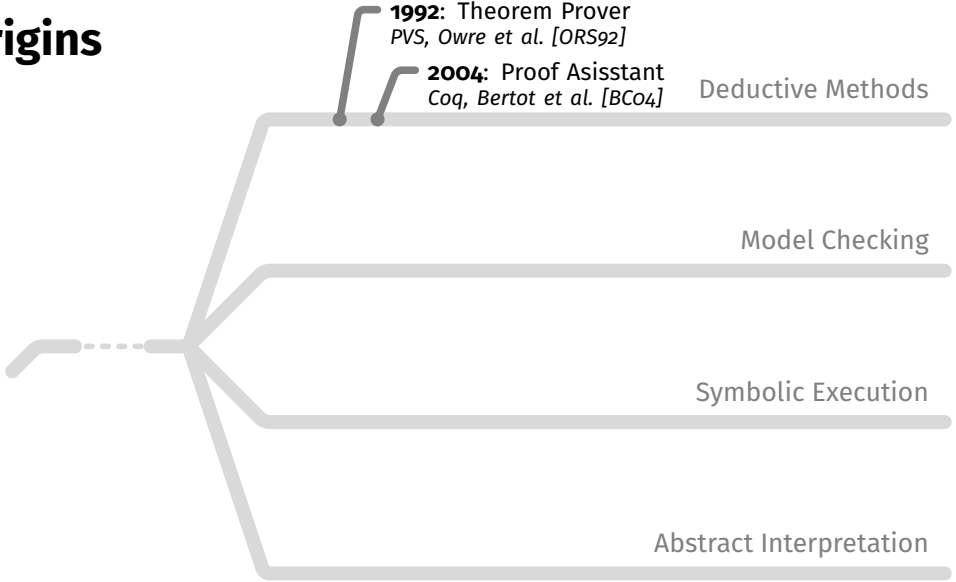

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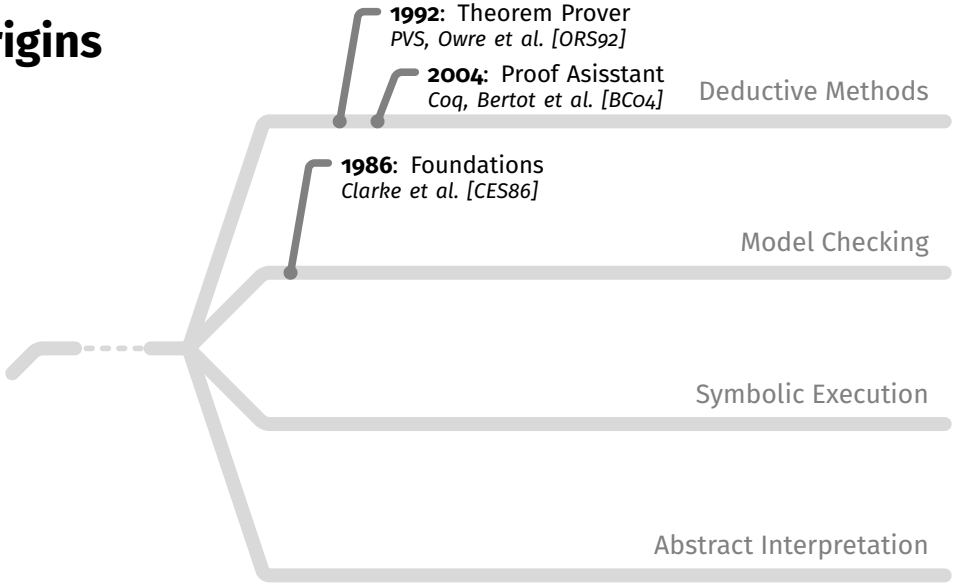

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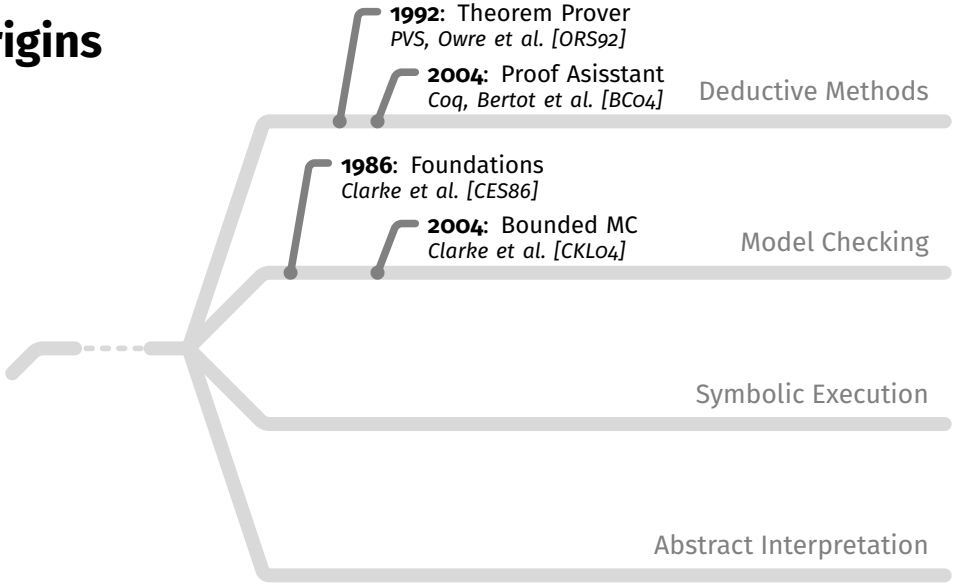

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Origins

Content of first slide [TODO: timeline]

What is a Property? Set basis Poset etc. I have to abstract! Galois, Semantics Principles of Abstract Interpretation book

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