

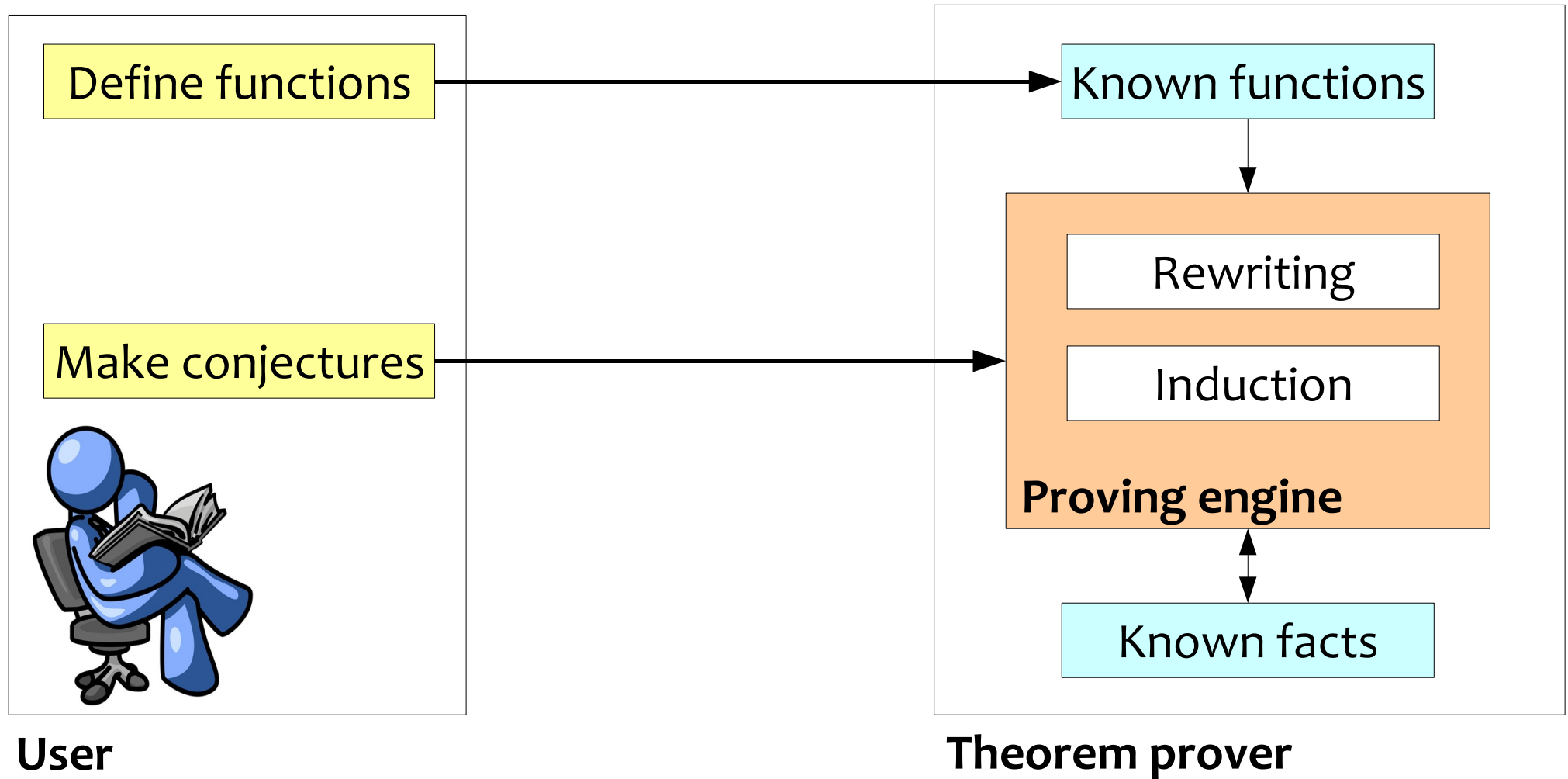
All-Termination(T)

Aaron Turon

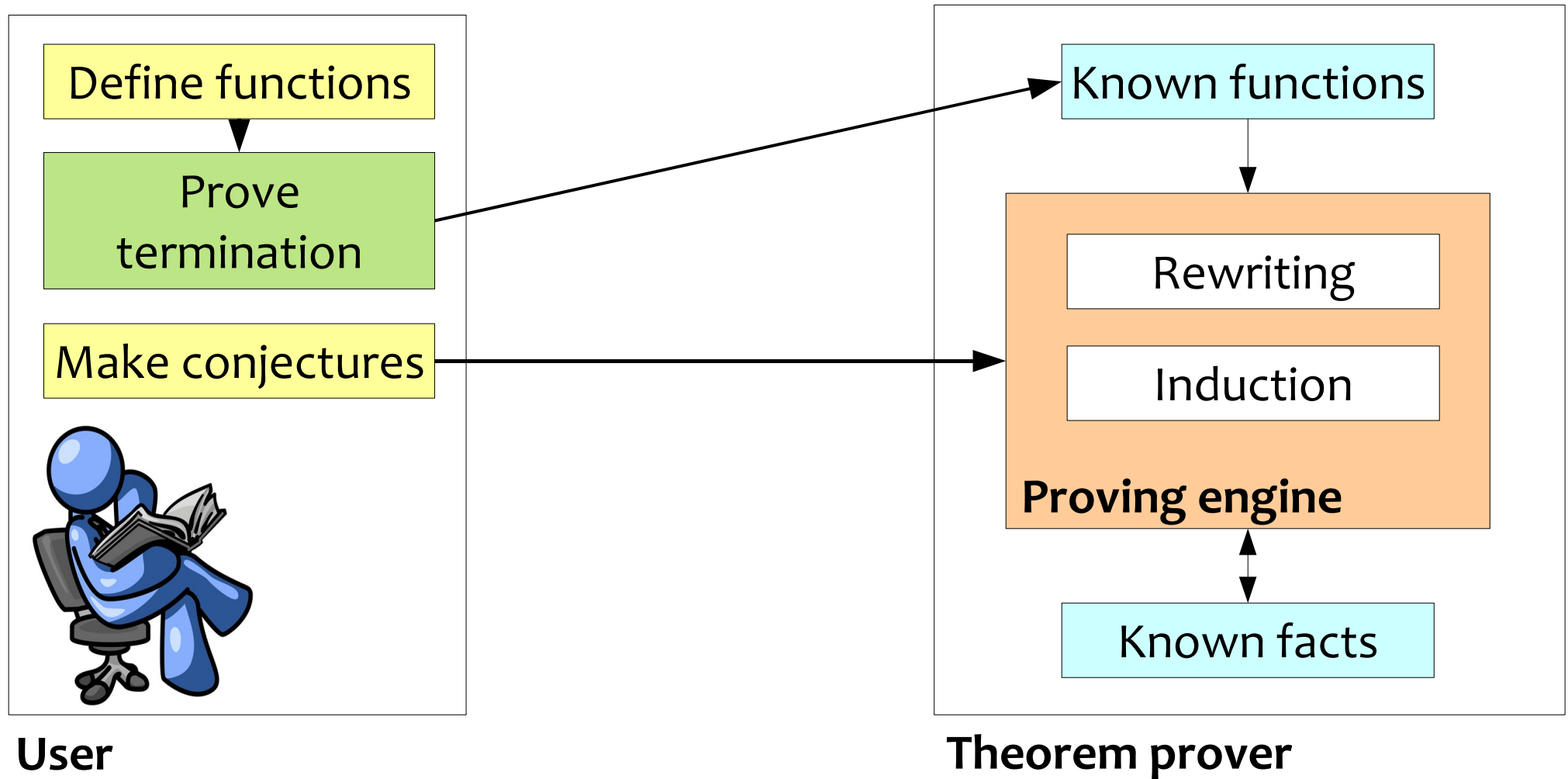
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Panagiotis Manolios, Aaron Turon. *All-Termination(T)*. TACAS 2009

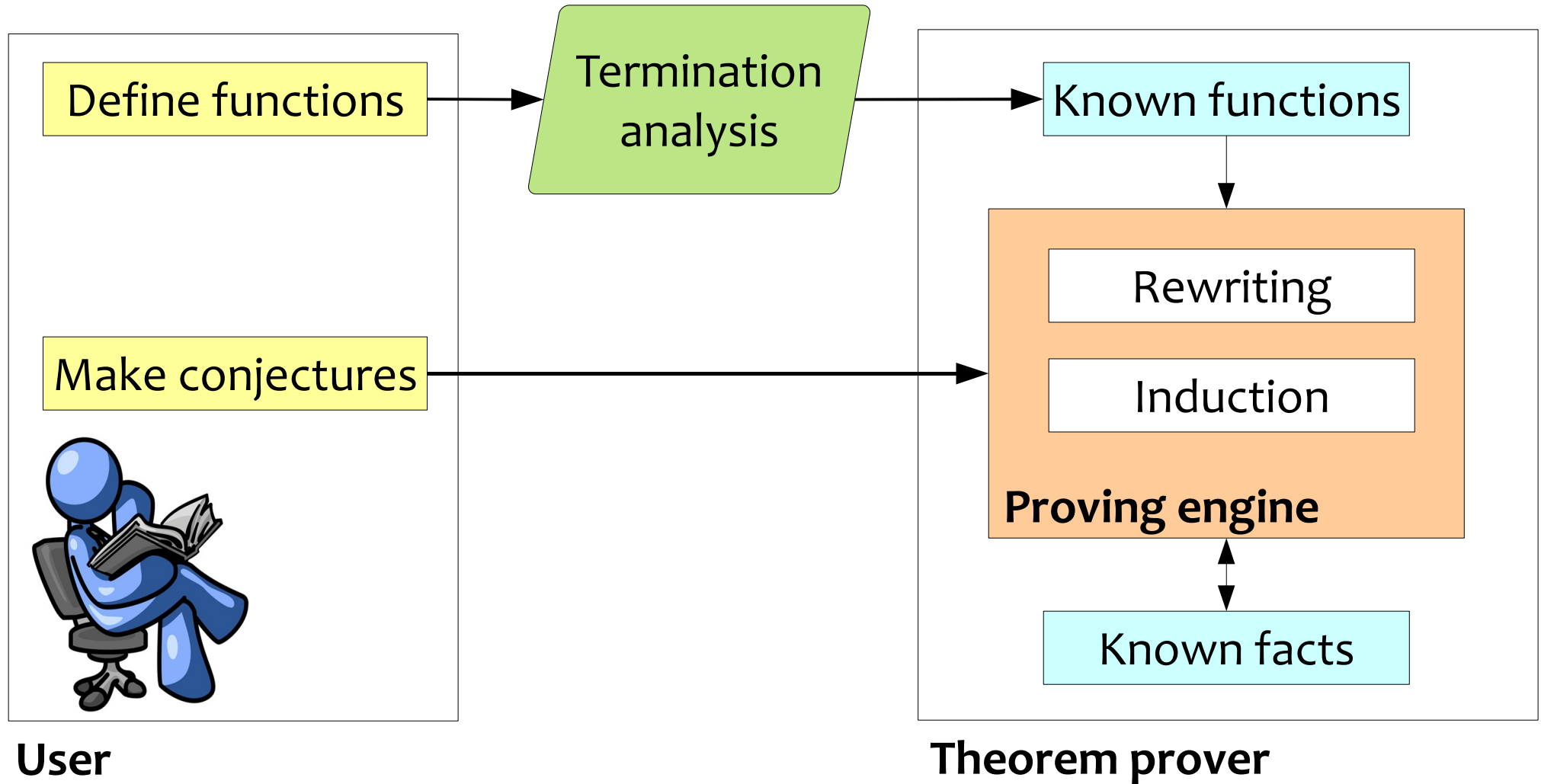
Life with a theorem prover:



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```
(defun replace-ith (i v list)  
  (if (consp list)  
    (if (zp i) (cons v (cdr list))  
      (cons (car list)  
        (replace-ith (1- i) v (cdr list))))  
    nil))
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- Measures: (acl2-count **i**), (acl2-count **list**)

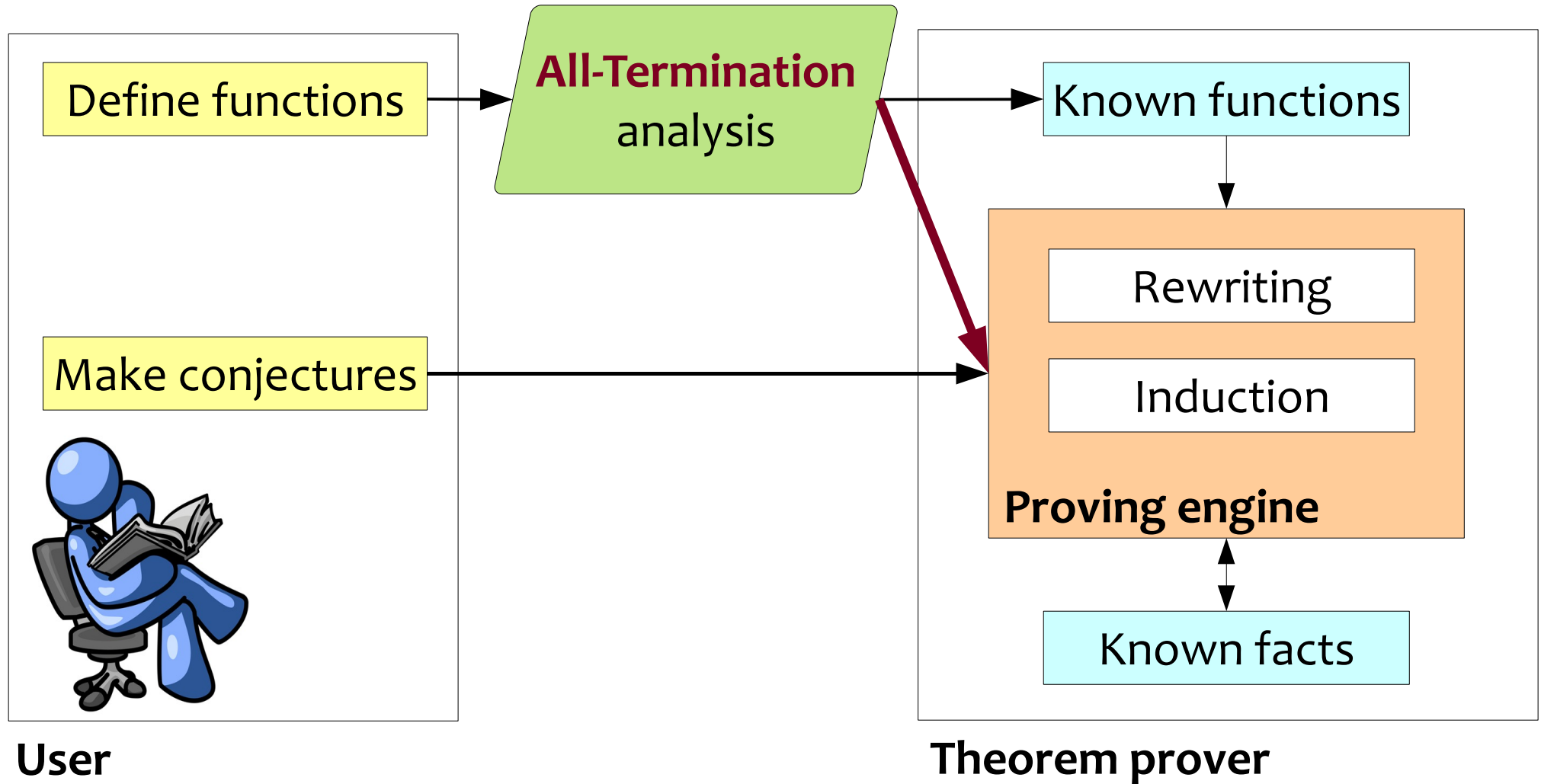
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```

- Measured subsets: $\{\mathbf{i}\}$, $\{\mathbf{list}\}$
 - Guide rewriting heuristics:

(replace-ith **3** v **list**)
vs (replace-ith **i** 3 **list**)

- Yield induction schemes

A better life with ACL2s:



CCG analysis in the ACL2 Sedan

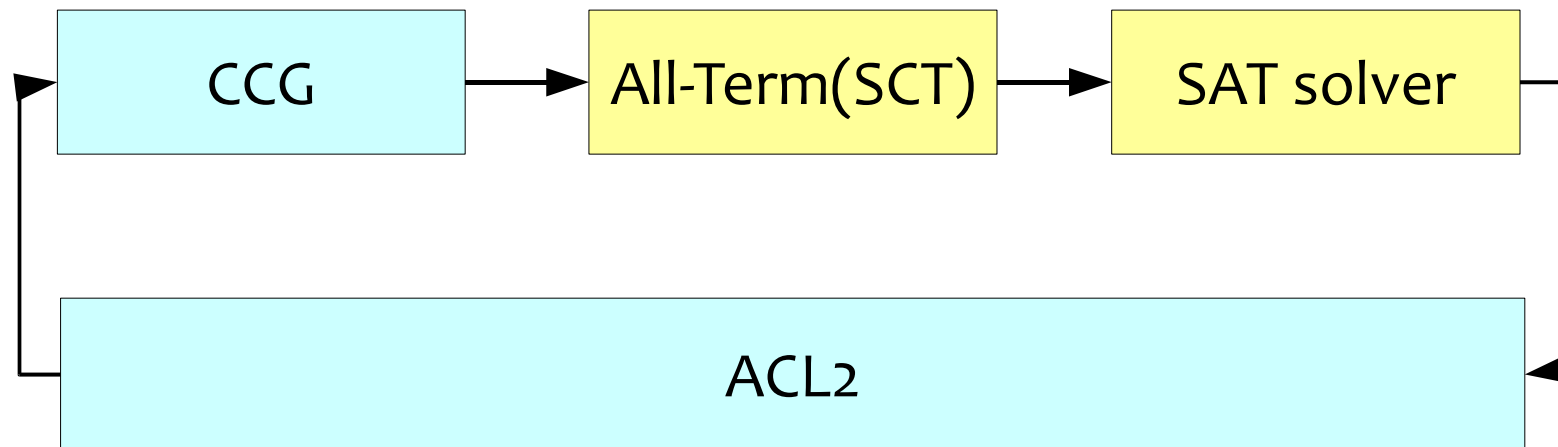
- Push-button
 - avoid teaching ordinals to freshmen
- Powerful
 - shows ~98% regression suite terminating
 - c.f. Legato's recent challenge
- Based on *size-change termination* (SCT)
- Does static analysis, including thm proving
 - Want to *extract* more information from this analysis!

Theoretical results:

All-Termination(SCT) is no harder than SCT

- Both are PSPACE-complete
- PSPACE algorithm for All-Termination is impractical

Practical algorithm:



Experimental results

CCG + All-Termination(SCT) on the regression suite

Number of functions: >11,000

Proved terminating: 98% (*note: same as CCG+SCT*)

Multiargument functions:

Proved terminating 1728

With “nontrivial” m-sets **90%**

With multiple m-sets 7%

Maximum m-set count **3**

Running time (not including CCG): **30 seconds**



Thank you

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