

# R3COGNITION OF THE HALTING SOLN

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"Acme Diagnostics" <LFinezaphthis@partpostmark.net> wrote in >  
> *Thanks for the probability idea about a real-world solution to*  
> *the Halting Problem recently when you were feeling well. Of all*  
> *those who talked about that in real-world context, you had the*  
> *best idea in my opinion. I think that was a major contribution,*  
> *and I am sure I will be able to use that idea someday.*  
>  
> *Larry*

Thank you Larry, Halt() is a big nut to crack. Here is the outline of the solution for those who missed it among the heated discussion.

halt(f, a)  $\rightarrow$  pHalt2(n)  $\rightarrow$  P(UTM(n, f(a))='halt') = 0.5  
!halt(f, a)  $\rightarrow$  pHalt2(n)  $\rightarrow$  UTM(n, f(a))='don't know'

pHalt2 is an (infinite) set of functions that satisfy pHalt below, with the added constraint P(UTM(n, f(a))='halt') = 0.5. Therefore a randomly selected pHalt function has 50% odds of answering the halt program for some given input.

(different set notation)

halt(f, a)  $\rightarrow$   $\exists n, n \in \text{pHalt}, \text{UTM}(n, f(a))=\text{true}$   
!halt(f, a)  $\rightarrow$   $\exists n, n \in \text{pHalt}, \text{UTM}(n, f(a))=\text{'don't know'}$

For example, pHalt could be an infinite set of Universal Turing Machines, but they timeout after various amounts of time. If the parameter f(a) halted in that time then it outputs TRUE, otherwise it timed out and outputs DONTKNOW. Since the number of these partial Halt functions is infinite, we should come across one with enough test cycles to determine if any function halts.

By itself pHalt is still useless as it only gives one output value, HALTS. But if each pHalt function has 50% chance of being correct (something more powerful than the UTM), then determining NOTHALT is a simple probabilistic procedure.

e.g.

pHalt2() = {2, 6, 33, 655, ..}

i.e.

pHalt(2) = true  
pHalt(6) = true  
pHalt(33) = true  
..

pHalt2 is an infinite set of godel numbers whos functions can be parsed by a UTM.

each of these functions has independant probability of 50% of answering if the input function halts, otherwise it will return DONTKNOW.

As an example.

the program with godel number 999 is

10 goto 10

UTM(2, 999) = DONTKNOW (ignoring the parameter of function 999)  
UTM(6, 999) = DONTKNOW  
UTM(33, 999) = DONTKNOW  
UTM(655, 999) = DONTKNOW  
...

Since :

!halt(f, a) -> pHalt2(n) -> UTM(n, f(a))='don't know'

the program with godel number 1000 is

10 print 10

UTM(2, 1000) = HALT  
UTM(6, 1000) = DONTKNOW  
UTM(33, 1000) = HALT  
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