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In summary, D's behavior is designed to contradict the output of H, leading to a logical inconsistency and demonstrating the impossibility of creating a Turing machine (H) that can universally determine whether any given program halts or loops.

) H12345(x) which determines whether TM 12345 halts with the argument 12345.

who is the inner and who is the outer

In this scenario:

- **Inner Turing Machine (H12345)**: This Turing machine takes another Turing machine (TM 12345) and an input (12345) as arguments and determines whether TM 12345 halts with the input 12345.
- **Outer Turing Machine**: This Turing machine encapsulates H12345 and uses its output in a way that leads to a contradiction, demonstrating the undecidability of the Halting Problem.

So, in this case, H12345 serves as the inner Turing machine, and the outer Turing machine (not explicitly named) utilizes H12345's behavior to construct a contradiction, similar to the previous explanation.

We saw in lecture that the function Halts(k, j) which determines whether TM k halts with the argument j is uncomputable. For each of the following functions, describe whether that function is computable or not and compare your reasoning with that of the solutions. Don't worry if you find these questions hard -- just read and think about the provided solutions.

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