

1 Sketch

Definition 1.1. *Let X be the set of all of the states of the universe that have, do, and will exist.*

This is simply the all of the states “ever observed”.

Definition 1.2. *Time is a function S that maps from one state in the universe to the next state. Formally: $S : X \rightarrow X$.*

If time is anything, it is a function that maps from one state to another. This seems like the most general way one can speak about time.

Definition 1.3. *Define the set of states which are not the successor of any other state as A . Formally:*

$$A = \{y | \forall x \in X S(x) \neq y\} \quad (1)$$

There are then two possibilities for this set:

1. The set A contains one element.
2. The set A is empty.

1.1 A Contains One Element

If the set A contains one element, then that element is the beginning of the universe. Thus the universe began to exist.

1.2 A is Empty

Assume for the sake of contradiction A is empty. If A is empty, then there is an infinite regress into the past, and therefore no “first state”. Then we see:

$$\forall x \in X, x = S(S(S(\dots))) \quad (2)$$

However this implies:

$$\forall x \in X \forall y \in X, x = y \quad (3)$$

That is, all state in the universe are the same. However this contradicts the fact that all states in the universe are not the same. Therefore, A is not empty

1.2.1 Salvaging A is Empty

Note that one can have an infinite regress into the past if one stipulates two functions (i.e., S and S^{-1} such that $S(S^{-1}(x)) = S^{-1}(S(x)) = x$), and a starting state x_0 . In such a case, however, one would still be able to coherently say that S , S^{-1} , and x_0 began to exist, otherwise they wouldn't exist. Thus time would still be said to have “started to exist”, and thus still need a cause.

2 Conclusion

The key idea in Section 1.2 is the idea that if states of the universe are said to exist as merely an infinite regress, then all “states” would be the same, as they are all defined as an infinite regress of successors. Since they all reduce to the same infinite chain of succession, there is no difference between any two states, as they’re mathematically equivalent.

If one attempts to salvage the notion of “infinite past” by adding complexity to the model by assuming that time is reversible (which needs motivating further), then one can still ask the question of why x_0 began to exist, as every other point in time is relative to x_0 .

Thus we either have a symmetry breaker between past and future, as no “last state” exists, in the same way no “last prime” exists, or we can coherently ask why x_0 exists, as it is the basis for time in an infinite regress case. Either way, the premise “the universe began to exist” seems to hold.