The Last Question Isaac Asimov

“The Last Question” is a short story by science-fiction author Isaac Asimov about a fictional supercomputer called Multivac. It was Isaac Asimov’s favorite short story that he wrote himself, and it is my favorite short story by him.

“The Last Question” essentially ponders the last real question that mankind would face: How can we prevent the heat death of the universe? It describes a universe in which the technological singularity has been reached, and computers are far smarter and far beyond the understanding of man. The story is told on a scale of trillions of years, with the original Multivac computer spawning a line of computers that each, over the course of a million years, constructed its successor. By the end of the short story, the universe has reached thermodynamic equilibrium, i.e. maximum entropy. The AC (analog computer) spends a timeless interval pondering the data, and the story ends with an allusion to the Bible: “Let there be light,” implying that the AC has reached a state of divinity.

Throughout the short story, Isaac Asimov references a number of scientific concepts in order to explain technological advances. While the majority of his explanations are scientifically valid, he does hold up to the claim of science *fiction* from time to time.

Let’s begin at the beginning. Multivac is a “self-adjusting and self-correcting” computer, and no single human has a firm grasp of its whole structure. This is entirely possible, and is a concept referred to in science as the “technological singularity”, a term first coined by the great von Neumann himself. Current scientists predict the technological singularity to occur at some point in the next half-century, with the median prediction at the 2012 Singularity Summit being forty years from now. One of the major characteristics of the technological singularity is reaching a point in artificial intelligence where computers have greater problem solving capacity than humans, and thus build and iterate upon themselves to construct the next generation of computers. This is how the ACs in “The Last Question” work, and is presumably a point we will reach eventually. However, general consensus is that by the very definition of a technological singularity, it is impossible for present-day humans to predict what humans lives will be like after the singularity, something that Asimov attempts to do.

Multivac solves the problem of utilizing stellar energy on May 14, 2061. At this point, all of Earth’s energy problems are solved for the next hundreds of billions of years, due to how much energy the Sun produces. This is entirely correct, as the Sun produces **5 x 1023 horsepower**, which is enough energy to melt a bridge of ice 2 miles wide, 1 mile thick, and extending the entire way from the Earth to the Sun, in one second. However, despite all this energy, the computer is unable to figure out a way to reverse entropy, which is also very realistic, as reversing the direction of entropy would violate the Second Law of Thermodynamics(which is a statistical law, and could possibly be proved incorrect some day).

An issue pops up at this point, because the story claims that the Sun will last for twenty billion years, which is incorrect. This might simply be due to current scientific theory at the time of the creation of this story, as the current estimate for the lifespan of the Sun is five billion years. As Asimov jumps the story forward into an age where Microvacs have been constructed and handed out to every family, he describes “hyperspatial jumps,” in which the family travels through hyperspace in order to reach distant locations quickly. Hyperspace is generally a science fiction concept in which humans travel at or faster than the speed of light (FTL travel). This is impossible in real life, as to accelerate to the speed of light you would need infinite energy, which the characters in the story do not have.

Asimov then explains the construction of Microvacs, and how they resulted from the Multivac. For a thousand years, Planetary ACs grew in size larger and larger, with transistors taking up more and more space. Asimov wrote this story before Moore’s law was published, which states that the number of components per integrated circuit doubles every two years. According to Moore’s law, the Planetary ACs would not need to get any larger in order to keep on increasing in power. However, in 2015, Moore’s law is beginning to be questioned. Although it has remained valid for 50 years, it is doubtful that its projections will remain valid into the future, as the rate of progress is plateauing. In 2015, Gordon Moore, the author of Moore’s law and the cofounder of Intel Corporation, stated that he sees Moore’s law dying in the next decade, which would make Asimov’s description of Planetary ACs accurate. Indeed, we will have to use new methods of computing, such as quantum computing. Asimov states that the Microvacs use molecular valves, which is consistent with current research. Recently, progress has been made into using molecular valves to create nanoscale electronics. The next generation mentioned has access to a Galactic AC, which uses sub-mesons instead of molecular valves. Mesons are subatomic particles that transmit the strong force that holds nucleons together. They are composed of a quark and an antiquark, and thus a sub-mesonic particle could be a quark/antiquark. However, I am not sure whether a quark could replace a molecular valve in a computer, as described in “The Last Question”.

At some point in time, the humans in this story become immortal, which is possible if we can ever stop telomeres from getting shorter. However, when the conscious of humans is separated from their bodies and human minds start wandering around the universe, Asimov has once again entered science-fiction. Consciousness is a physical phenomenon, and the most we could do is simulate it. A conscious physically moving around the universe, separate from its body, seems doubtful.

As the years go on, the AC starts moving entirely into hyperspace, away from “real” space. Assuming Asimov is referring to hyperspace as in a dimension beyond the third, this does not seem to be possible. While there may be four-dimensional beings, a three-dimensional being cannot ever be brought into the fourth dimension, just like a two-dimensional being could not be brought into the third. The idea that a three-dimensional computer could construct a four-dimensional computer, when it would not be able to perceive a fourth dimension itself is unlikely. In the same way, the merging of the human conscious into the AC is only possible if they are all simulated, as a physical three dimensional being could not merge with a four dimensional being, though it could be contained inside.

At the end of the story, the AC has finally discovered a way to reverse entropy, but there are no humans left to explain it to, so it decides to answer by demonstration. This ending is purposefully vague, to leave us wondering such questions as ‘Are we the result of a previous universe?’ and ‘Is the universe a cycle?’, along with questions about religion and creationism. While the reversal of entropy may or may not be possible, the philosophical implications of this story are what leave a lasting impression.

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