Honorary Doctor of Science

Professor John Forbes NASH, Jr

Citation written and delivered by Professor Roderick WONG Sue-cheun

Pro-Chancellor:

The quest for knowledge can be long and solitary, yet it can also be beautiful and fulfilling. Professor John Forbes Nash, Jr, a mathematical genius and Nobel Laureate in Economic Sciences, epitomises the beauty of such a journey through his perseverance, his discoveries, and most significantly, his landmark contributions to scholarship.

Professor Nash, now Senior Research Mathematician in the Department of Mathematics at Princeton University, was born in 1928 in Bluefield, West Virginia, US. Even as a young boy, Professor Nash stood out. While other children were playing games together, he was indulging in books and scientific experiments. While other children were calculating with small numbers, he was working with larger ones.

Professor Nash showed exceptional talent and interest in mathematics when he was in high school. Instead of using the teachers' tools, he discovered new methods for solving mathematical problems. He took advanced courses in mathematics at college and skipped grades, and was voted the most original student in school. At the age of 14, he read E T Bell's *Men of Mathematics* and became interested in the lives of mathematicians. He also worked out the proofs of some classic results in number theory.

Despite his interest and potential in mathematics, Professor Nash said he did not expect to become a mathematician. In fact, mathematics was not his major when he entered the Carnegie Institute of Technology (now known as Carnegie Mellon University) in 1945. He wanted to become an electrical engineer, just like his father. He shifted from chemical engineering to chemistry before he settled on mathematics. This was mainly inspired by professors and leading mathematicians such as John L Synge and Richard J Duffin. Professor Nash proved that he made the right move. When he graduated in 1948, he was awarded both a master's and bachelor's degree. The gifted Professor Nash received offers for graduate studies from several renowned universities:

Chicago, Harvard, Michigan and Princeton. Encouraged by the prestigious Princeton fellowship and the faculty members, especially Albert W Tucker who later became his thesis adviser, Professor Nash chose Princeton, marking his lifelong ties with the University and his glorious career in mathematics.

In 1949, at the age of 21, Professor Nash wrote a 27-page dissertation titled "Non-Cooperative Games" for his doctorate in which he presented his concept of equilibrium for non-cooperative games. The paper impacted the development of game theory and established the foundation of modern economics. Forty-five years later, it won Professor Nash the Nobel Prize in 1994, together with John Harsanyi and Reinhard Selten.

Professor Nash's concept of equilibrium introduced alternatives to the theory of two-person zero-sum games developed by the mathematician John von Neumann and the economist Oskar Morgenstern in analysing games. The von Neumann and Morgenstern theory was about games between two players, in which if one player wins, the other loses. Professor Nash focused on games involving more than two persons where mutual gain was possible. He proved the existence of an equilibrium point in n-person games which contain a mixture of conflicting and common interests.

Professor Nash's discovery, which was later known as the "Nash Equilibrium", moved game theory to a new plane. In addition to setting a new paradigm for mathematics and economics, it has influenced the military, political science, psychology, sociology, and evolutionary biology, and many other disciplines.

Professor Nash's contributions encompass more than just game theory. He has conducted ground-breaking work in many areas of mathematics, profoundly influencing differential geometry, real algebraic geometry and partial differential equations. He was internationally renowned by the late 50s. In July 1958, *Fortune* magazine described him as one of the brightest young stars of mathematics. He was only 30 years old.

His journey has not been without some sharp bends. Professor Nash's soaring career began to slow down when he was diagnosed with mental health problems in 1958. In the decades that followed, Professor Nash was lost to the mathematical community. Fortunately, he did not lose his passion for his work. Professor Nash continued with research, publishing papers that significantly developed mathematics.

Professor Nash has received numerous prizes and honours for his momentous discoveries. In addition to the John von Neumann Theory Prize by the Operations Research Society of America and the Institute for Management Science in 1978 and the Nobel Prize in 1994, he was awarded the Leroy P Steele Prize by the American Mathematical Society in 1999. He received an Honorary Doctor of Science and Technology from Carnegie Mellon University in 1999, and honorary degrees in economics from several universities afterwards. He was Fellow of the Econometric Society, Fellow of the American Academy of Arts and Sciences, and Member of the US National Academy of Sciences.

Professor Nash's enthusiasm for mathematics, his incessant quest for knowledge, and his courage to challenge difficult problems are admirable. It is good to have an element of persistence in the pursuit of knowledge, he once said. We may not solve a problem immediately or straightforwardly but if we continue to keep turning it around, we can find a solution. "I am like that myself, and at times, may be more persistent than someone else," Professor Nash said.

Professor Nash's quest for knowledge is never ending and now at the age of 83, he continues to venture forth in mathematical research. Currently, he is working on advanced game theory and ideal money.

"This man is a genius," Richard J Duffin wrote on his letter of recommendation for Professor Nash's application for graduate studies in 1948. Professor Nash has proven that he is, and always will be.

Mr Pro-Chancellor, in recognition of his discoveries and contributions, and his spirit of persistence, I respectfully present Professor John Forbes Nash, Jr, to you for the award of Honorary Doctor of Science.