A Brief History of the IEEE/CS Technical Committee on Mathematical Foundations of Computing and its Annual Symposium on Foundations of Computer Science (FOCS)

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The technical committee and its annual symposium, respectively, started out as the "AIEE Subcommittee on Logic and Switching Circuit Theory" of the AIEE Computing Devices Committee" and as the "Annual Symposium on Switching Circuit Theory and Logical Design". The first symposium was held in Chicago Illinois October 9-14, 1960 with the second held in Detroit Michigan October 17-20, 1961. Both of these symposia were included as part of the "National Electronics Conference". The second conference proceedings was published in September 1961 and it included some papers from the first symposium that, at that time, had not been published elsewhere. In 1963, due to the merger of the AIEE and IRE into the IEEE, the sponsorship became the IEEE Subcommittee on Logic and Switching Circuit Theory of the IEEE Computing Devices Committee. By 1964, however, this changed to the Switching Circuit Theory and Logical Design Committee of the IEEE Computer Group. During these initial years the name of the symposium remained the same and was held in either October or November of each year. In 1966 the name of the sponsoring committee and the symposium changed to "Switching and Automata Theory" under the IEEE Computer Group. Then in 1971, for the 12th symposium, the sponsoring committee was a Technical Committee of the IEEE Computer Society. The Switching and Automata Theory symposium name (SWAT) persisted through 1975 after which, for the 16th year it became the IEEE Annual Symposium on Foundations of Computer Science under the sponsorship of the Computer Society Technical Committee on Mathematical Foundations of Computing, with the symposium and technical committee names remaining the same to this day.

These organizational and name changes during these times speak somewhat to the evolving nature of the theoretical studies of computing as well as computing in general, but more was occurring as well. The symposium was becoming a leading place for computing theory researchers to present their latest results and meet others working in the field, so it became increasingly competitive to get papers accepted for the symposium. This was somewhat alleviated when ACM initiated a spring symposium in 1969 called the ACM Symposium on Theory of Computing (STOC) under the newly formed ACM Special Interest Group on Automata and Computability Theory. This provided two theory conferences with this late entry by ACM into the theory conference area, really serving the same community of researchers and also with a large overlap of committee members. FOCS and STOC continue as premier symposia, but many other theory conferences have arisen as the theory area expanded and evolved. Many of these newer conferences specialize in specific areas of theory. FOCS celebrated its 50th anniversary at its 50th symposium held in Atlanta Georgia October 24-27 2009. It may surprise some readers that the theory area symposia were led by the IEEE Computer Society and its predecessors rather than the ACM, since it is a common perception that ACM dominates the theory area in computing. This perception may arise due to other factors, however,

since it is clear that the FOCS symposia were held for ten years before STOC was initiated.

Beyond the organizational and name issues let's look at some of the theory area itself and some of its evolution and contributions over these times. In the early 1960's the emphasis for FOCS, actually called SWAT at that time, was on two areas: the minimization of Boolean functions aimed at trying to find representations that led to minimizing combinatorial switching circuit designs since circuits were relatively expensive. There were other issues and formulations also studied including threshold functions, neuron-like functions, multilevel logic, various canonical forms, as well as fault detection and diagnostic test methods that played a role in FOCS content. The second area was in finite state machines, also called finite automata. This area was being studied to help in the design of sequential machines such as appeared in the control sections of computers. Here as well minimization played an important role. Also timing issues, circuit delay, fault tolerance and diagnosis were important.

As time passed and the costs of the circuits decreased these minimization techniques became less crucial. However, then the time and memory space needed to perform the computations themselves became a dominant factor as more and more large and complex computations became possible. Thus the efficiency of the computations, both in time and space, became a growing area for theory research. Also by the late 1960's parallelism became an important issue with various papers in parallel models and algorithms appearing in FOCS. Parallelism somewhat died out for awhile, but found renewed interest in the 1980's, however no parallelism papers have appeared in FOCS over the last ten years. Thus other models of automata, and complexity of computations became growing topics for the FOCS conference. Lower bounds and efficient algorithms in the time and space to solve various problems were then studied, where some problems were shown to grow polynomially in terms for the number of variables in the problem, but other problems appeared to have no polynomial-like solutions. Was this really the case or not? An important paper on this P=NP question by Stephen Cook appeared in 1971 and papers in FOCS followed with new results. But the P=NP problem, is still unsolved. However many results about practical problems being shown as polynomially solvable have been developed with algorithms for minimum or near minimum time or space developed. FOCS has played a significant outlet for theory researchers to present such results. Beyond this online algorithms played a major role between 1980 and 2000, and algorithms that give very good approximate solutions, where exact solutions are intractable, have been developed. These algorithmic studies continue to be presented at FOCS conferences in many practical areas on problems formulated in terms of graphs, randomization and game theory.. Some of these areas include pattern matching, networking, distributed computing, social networks, cryptography, quantum computing, learning theory, etc. Thus, FOCS continues to flourish and as an important conference for researchers in theory to present their papers and meet with others in the area.