

## EDOUARD ZECKENDORF

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**Dr. Edouard Zeckendorf**

Among key words associated with Fibonacci numbers are *Lucas* numbers, *Binet* form, *Pell* numbers, *Wythoff* pairs, and *Zeckendorf* sums. The term *Zeckendorf sum* entered the language some time after 1939—a surprisingly late date, as it would appear that most named mathematical entities as simple as these sums were named centuries ago!

Actually, it was not until the early 1950s that Zeckendorf sums were first discussed in a publication, and not until 1972 that the chronology was clarified, by Zeckendorf himself. In an introductory Summary [7], he writes:

Every natural number can be represented as a sum of distinct and non consecutive Fibonacci numbers or of non consecutive Lucas numbers. Using Fibonacci numbers, such a representation is always unique.

It is the unique representations that are now known as Zeckendorf sums, and their existence and uniqueness, as Zeckendorf's theorem. Shortly after the above-mentioned Summary, Zeckendorf indicates that these sums date from the year 1939.

In 1952, C. G. Lekkerkerker published an account [5] of Zeckendorf's theorem. This article, in Dutch, led to a longer work in 1960, in the prestigious *Journal of the London Mathematical Society*; there, D. E. Daykin [2] proves that the Fibonacci numbers form the *only* sequence of natural numbers for which Zeckendorf's theorem holds. Daykin's paper is cited by many later papers on Zeckendorf sums and their generalizations.

In view of the widespread currency of the terms "Zeckendorf sum" and "Zeckendorf representation," it is surprising how little is known about the life of Zeckendorf. Fortunately, Jean Godeaux [3] was able to obtain the reminiscences of P. R. Charlier, a retired engineer who knew Zeckendorf when both were prisoners of war. In the material that follows, Mr. Charlier's account is supplemented with information provided by Centre de Documentation Historique, Forces Armees Belges [6].

At the end of the nineteenth century, Dr. Abraham Zeckendorf, a dentist, and his wife, Henriette van Gelder, set up his practice in Liège, Belgium. Dr. Zeckendorf was a Dutch citizen and an active Jew. In May 1940, because of the Nazi invasion of Belgium, the Zeckendorf family fled to Nice, France.

The son, Edouard, born in Liège on May 2, 1901, was recognized early as a brilliant student. Speaking fluently both Dutch, the language of the Zeckendorf family, and French, the official language of Liège, Edouard attended the Royal Athenaeum of Liège from 1912 to 1919. There he studied Greek, Latin, English, German, mathematics, and drawing.

Soon after the end of World War I, Edouard enrolled in the University of Liège, where, in 1925, he became a medical doctor, specializing in surgery and delivery. In the same year, he became an officer in the Belgian army. Between 1927 and 1931 he obtained a License for Dental Surgery, and in 1929 he married Elsa Schwers, a nurse and member of the Reformed Church, born July 2, 1889 in Liège.

Elsa, like Edouard, was an artist. Before the marriage, Elsa had produced many fine drawings of Paris, both in pencil and charcoal. She continued to paint many oils; during his free time, Edouard continued his own drawing and mathematical investigations. The two often attended art exhibits and were friends of the best local artists. They had no children, and Elsa's sudden death in 1944 was extremely painful for Edouard.

According to Mr. Charlier, from 1930 to 1940 Dr. Zeckendorf was in charge of the military Hôpital Saint Laurent in Liège. On May 28, 1940, with the surrender of the Belgian army, Dr. Zeckendorf was taken prisoner by the Germans. As a POW, he stayed in several oflags until 1945. (An *Oflag* was an *Offizierenlager*, a camp for imprisoned officers, as contrasted to a *Stalag*.)

During his captivity Dr. Zeckendorf provided medical care to allied POWs. He also sketched soldiers representing the many various peoples of the Soviet Union. Mr. Charlier wrote that Dr. Zeckendorf escaped from a camp, and afterwards, his status as a nonpracticing Jew was ignored by the Germans. Records described in [6] confirm that Dr. Zeckendorf did attempt an escape, but no details are given in [6]. Both Mr. Charlier's account and the military records indicate that Dr. Zeckendorf chose to continue his care of POWs in Germany despite opportunities to return to his home.

After his liberation, Dr. Zeckendorf returned to Liège, where he found the family house occupied by the army. At first, the house had been deemed "abandoned" by the Germans, who occupied it and stole or destroyed the furnishings and other possessions. Later, the house had been occupied by Americans. Dr. Zeckendorf decided to go to Nice to care for his aging mother, his father having died only a few months after Elsa had died.

From March 16, 1949, to March 23, 1950, Dr. Zeckendorf headed the Belgian mission near the United Nations Commission for India and Pakistan. He was in charge of the inspection of the 500-mile long cease-fire line. When he returned from India, Dr. Zeckendorf brought with him many original sketches and photographs of the Himalayan foothills.

During his military career, Dr. Zeckendorf was honored with the following awards: Officer of the Order of the Crown (1946); Prisoner of War Medal (1946); Officer of the Order of Leopold (1949); Officer of the Order of Leopold II (1950).

Dr. Zeckendorf married Marie Jeanne Lempereur in Brussels, Belgium, on July 27, 1959. Miss Lempereur's family was Belgian but had lived in Manitoba, Canada, at the time of her birth in 1908. When she was a young girl, the family had returned to Belgium. During the eighteen years of their marriage, Dr. and Mrs. Zeckendorf enjoyed an active life, visiting exhibits and museums, traveling and visiting cities of artistic interest, and reading. After his second wife's death in July 1977, Dr. Zeckendorf continued his activities, even after the discovery of cancer. Near the end of his life, he often visited friends in Liège, and he regularly attended the monthly meetings of the Société Royale des Sciences de Liège. He died in Liège on May 16, 1983.

It appears that [8] was Dr. Zeckendorf's only publication in English, whereas some thirty others in French were published in *Mathesis* and *Bulletin de la Société Royale des Sciences de Liège*. These include several articles on each of the following subjects: Fibonacci and Lucas numbers, primes, quadratic equations, and combinatorial arrangements of letters. As citations of these publications can be downloaded easily from the MathSci database, they are not listed here.

Dr. Zeckendorf published one paper [8] in *The Fibonacci Quarterly*. In the same issue, the founding editor, V. E. Hoggatt, Jr., also published a paper [4] dedicated to Dr. E. Zeckendorf. A few of Dr. Zeckendorf's letters to Dr. Hoggatt, dating from July 1971 to February 1973, survive. They reveal a warm friendship and enthusiasm for recurrence sequences. Their tone is, of course, much less formal than other materials unearthed for this sketch. Of particular note is the distinctive signature found on all the letters and reproduced here:

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