LEONARDO FIBONACCI

Vinit Kumar

Mathematics

ABSTRACT :-

In a rabbit problem. Rabbits obey the following law of breeding: “After every 2 months, each pair of rabbits will create a new pair as a child”. After 1 month we have a pair of rabbits because they are not mature yet. After 2 months we have 2 pairs of rabbits. Even after the month, we have 3 pairs of rabbits because born last month can not be reproduced right now but the original couple still does not pair. Today, after 4 months, we have 5 rabbits Pairs because only two of the last three couples could have created the young. After five months we have eight pairs since of the five pairs alive one month ago only the three pairs alive two months ago could breed.

We denote the no of rabbits alive each month n, F_j the nth Fibonacci number. F_j is formed by starting with the F_{j-1} last month pairs of rabbits (alive) and adding babies that can only come from the F_{j-2} pairs alive two months ago.

$$F_j = F_{j-1} + F_{j-2}$$

$F_1 = F_2 = 1$, and by convention $F_0 = 0$. The sequence looks like 1, 1, 2, 3, 5, 8, I3, 21, 34, 55, 89, 144⋯ each term is the sum of the two previous:

$$F_3 = F_2 + F_1;\ 2 = 1 + 1$$

$$F_4 = F_3 + F_2;\ 3 = 2 + 1$$

$$F_5 = F_4 + F_3;\ 5 = 3 + 2$$

$$F_6 = F_5 + F_1;\ 8 = 5 + 3$$

A formula like the one above that determines the nth number of a given sequence in terms of the previous numbers in the sequence is called a recurrence relationship. As we will see generating functions are an ideal tool for studying sequences defined by recurrence relationships.We will first examine the immediate consequences of the recurrence equation itself.

These numbers are of little use to breeders (for one thing, we have tacitly assumed that rabbits never die) but they are of great importance in mathematics. They show up in diverse studies because they have numerous interesing properties.

INTRODUCTION:-

Leonardo Fibonacci, also called Leonardo Pisano or Leonard of Pisa, was the most outstanding mathematician of the European Middle Ages. Little is known about his life except for the few facts he gives in his mathematical writings. Ironically, none of his contemporaries mention him in any document that survives.

Fig. (FIBONACCI)

Fibonacci (Fig.) was born around 1170 into the Bonacci family of Pisa, a prosperous mercantile center. ("Fibonacci" is a contraction of "Filius Bonacci," son of Bonacci.) His father Guglielmo (William) was a successful merchant, who wanted his son to follow his trade.

Around 1190, when Guglielmo was appointed collector of customs in the Algerian city of Bugia (now Bougie), he brought Leonardo there to learn the art of computation.In Bougie, Fibonacci received his early education from a Muslim schoolmaster, whointroduced him to the Indo-Arabic numeration system and Indo-Arabic computational techniques. He also introduced Fibonacci to a book on algebra, Hisâb al-jabr w'almuqabâlah, written by the Persian mathematician, al-Khowarizmi (ca. 825). (The word algebra is derived from the title of this book.)

As an adult, Fibonacci made frequent business trips to Egypt, Syria, Greece, France, and Constantinople, where he studied the various systems of arithmetic then in use, and exchanged views with native scholars. He also lived for a time at the court of the Roman Emperor, Frederick II (1194-1250), and engaged in scientific debates with the Emperor and his philosophers.

Around 1200, at the age of about 30, Fibonacci returned home to Pisa. He was convinced of the elegance and practical superiority of the Indo-Arabic system over the Roman numeration system then in use in Italy. In 1202, Fibonacci published his pioneering work, Liber Abaci {The Book of the Abacus.) (The word abaci here does not refer to the hand calculator called an abacus, but to computation in general.) Liber Abaci was devoted to arithmetic and elementary algebra; it introduced the Indo- rabic numeration system and arithmetic algorithms to Europe. In fact, Fibonacci demonstrated in this book the power of the Indo-Arabic system more vigorously than in any mathematical work up to that time. Liber Abaci's 15 chapters explain the major contributions to algebra by al-Khowarizmi and another Persian mathematician, Abu Kamil (ca. 900). Six years later, Fibonacci revised Liber Abaci and dedicated the second edition to Michael Scott, the most famous philosopher and astrologer at the court of Frederick II.

After Liber Abaci, Fibonacci wrote three other influential books. Practica Geometriae {Practice of Geometry), written in 1220, is divided into eight chapters and is dedicated to Master Domonique, about whom little is known. This book skillfully presents geometry and trigonometry with Euclidean rigor and some originality.Fibonacci employs algebra to solve geometric problems and geometry to solve algebraic problems, a radical approach for the Europe of his day.

His next two books, the Flos (Blossom or Flower) and the Liber Quadratorum (The Book of Square Numbers) were published in 1225. Although both deal with number theory, Liber Quadratorum earned Fibonacci his reputation as a major number theorist, ranked between the Greek mathematician Diophantus (ca. 250 A.D.) and the French mathematician Pierre de Fermât (1601-1665). Flos and Liber Quadratorum exemplify Fibonacci's brilliance and originality of thought, which outshine the abilities of most scholars of his time. In 1225 Frederick II wanted to test Fibonacci's talents, so he invited him to his court for a mathematical tournament.

The contest consisted of three problems. The first was to find a rational number x such that both $x^2 - 5$ and $x^2 + 5$ are squares of rational numbers. Fibonacci gave the correct answer $41/12$: $(41/12)^2 - 5 = (31/12)^2$

and $(41/12)^2 + 5 = (49/12)^2$.

The second problem was to find a solution of the cubic equation

$x^3 + 2x^2 + 10x - 20 = 0$. Fibonacci showed geometrically that it has no solutions of the form $\sqrt{a + \sqrt{b}}$, but gave an approximate solution, 1.3688081075, which is correct to nine decimal places. This answer appears in the *Flos* without any explanation The third problem, also recorded in the *Flos*, was to solve the following:

Three people share 1/2, 1/3, and 1/6 of a pile of money. Each takes some money from the pile until nothing is left. The first person then returns one- half of what he took, the second one-third, and the third one-sixth. When the total thus returned is divided among them equally, each possesses his correct share. How much money was in the original pile? How much did each person take from thc pile?

Fibonacci established that the problem was indeterminate and gave 47 as the smallest answer. In the contest, none of Fibonacci's competitors could solve any of these problems.

The Emperor recognized Fibonacci's contributions to the city of Pisa, both as a teacher and as a citizen. Today, a statue of Fibonacci stands in a garden across the Amo River, near the Leaning Tower of Pisa.

Not long after Fibonacci's death in about 1240, Italian merchants began to appreciate the power of the Indo-Arabic system and gradually adopted it for business transactions. By the end of the sixteenth century, most of Europe had accepted it. *LiberAbaci* remained the European standard for more than two centuries and played a significant role in displacing the unwieldy Roman numeration system.

REFERENCES

- Alexanderson, G. L., 1965, Solution to Problem B-56, The Fibonacci Quarterly, 3:2 (April), 159.
- Baravalle, H. V, 1948, "The Geometry of The Pentagon and the Golden Section," Mathematics Teacher,41,22-31.
- Calendar Problems, 1993, Mathematics Teacher, 86 (Jan.), 49.
- Calendar Problems, 1999, Mathematics Teacher, 92 (Oct.), 606-611.
- Davis, B., 1972, "Fibonacci Numbers in Physics," The Fibonacci Quarterly, 10:6 (Dec), 659-660, 662.
- Deily, G. R., 1966, "A Logarithmic Formula for Fibonacci Numbers," The Fibonacci Quarterly, 4:1(Feb.), 89.
- Everman, D., et al., 1960, Problem El396, The American Mathematical Monthly, 67 (Sept.), 694.
- Eves, H., 1969, An Introduction to the History of Mathematics, 3rd ed., New York: Holt, Rinehart and Winston.
- Feinberg, M., 1963a, "Fibonacci-Tribonacci" The Fibonacci Quarterly, 1:3 (Oct.), 70-74.
- Feinberg, M., 1963b, "A Lucas Triangle," 77i<? Fibonacci Quarterly, 5:5 (Dec), 486-490.