

FIBONACHCHI SONLARINING XOSSALARI VA TADBIQLARI

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ANNOTATSIYA

Maqolada Fibonachchi sonlarining xossalari isbotlari va ushbu xossalardan kelib chiqadigan bir qancha natijalar keltirilgan. Fibonachchi sonlarining hayotga va qiziqarli matematika tadbirlari to‘g‘risida yozilgan.

KALIT SO‘ZLAR: *Fibonachchi sonlari, rekkurent munosabat, oltin kesim, katta kesim, kichik kesim.*

PROPERTIES AND APPLICATIONS OF FIBONACCI NUMBERS

ABSTRACT

The article presents proofs of properties of Fibonacci numbers and several results that follow from these properties. Written about real-life and interesting mathematical applications of Fibonacci numbers.

KEYWORDS: *Fibonacci numbers, recurrence relation, golden ratio, major ratio, minor ratio.*

KIRISH

Ma‘lumki, $u_1 = u_2 = 1$ bo‘lgan holda $u_n = u_{n-1} + u_{n-2}$ ($n \geq 3$) rekkurent tenglik vositasida aniqlangan ketma-ketlik Fibonachchi qatori, uning hadlari esa Fibonachchi sonlari deb ataladi. Fibonachchi sonlari iborasini XIX asrda Eduard Lyuka tomonidan qiziqarli matematikaga bag‘ishlangan asarlarda uchratish mumkin. Fibonachchi (bu so‘z italyanча “filius Bonacci” so‘zlaridan qisqartirilib tuzilgan bo‘lib, Bonachchining o‘g‘li ma‘nosini anglatadi) Italiyadagi Piza shahrida XII-XIII asrlarda yashagan Leonardo Pizan-skiyning laqabidir. Bonachchi Italiya va Jazoirda savdo-sotiq bilan shug‘ullangan. Leonardo boshlang‘ich ma‘lumotni Ja-zoirda olgan bo‘lib. u o‘zining arab o‘qituvchilaridan hind pozitsion o‘nlik sanoq tizimi va nolni o‘rgangan edi.

ADABIYOTLAR TAHLILI VA METODOLOGIYA

Quyida Fibonachchi sonlarining xossalari va metodologiyasini keltiramiz.

1-xossa. $u_1 + u_2 + u_3 + \dots + u_n = u_{n+2} - 1$

Ya'ni $u_3 - u_2 + u_4 - u_3 + \dots + u_{n+1} - u_n + u_{n+2} - u_{n+1} = u_{n+2} - 1$

2-xossa. $u_1 + u_3 + u_5 + \dots + u_{2n-1} = u_2 + (u_4 - u_2) + (u_6 - u_4) + \dots + (u_{2n} - u_{2n-2}) = u_{2n}$

3-xossa. $u_2 + u_4 + u_6 + \dots + u_{2n} = (u_1 + u_2 + u_3 + \dots + u_{2n}) - (u_1 + u_3 + u_5 + \dots + u_{2n-1}) = u_{2n+2} - 1 - u_{2n} = u_{2n+1} - 1.$

4-xossa. $u_1 - u_2 + u_3 - u_4 + \dots + (-1)^{n+1}u_n = (-1)^{n+1}u_{n-1} + 1$

5-xossa. $u_1^2 + u_2^2 + \dots + u_n^2 = u_1u_2 + u_2(u_3 - u_1) + u_3(u_4 - u_2) + \dots + u_n(u_{n+1} - u_{n-1}) = u_nu_{n+1}$

6-xossa. $u_n^2 - u_{n-1}u_{n+1} = (-1)^{n+1}$

Ya'ni matematik induksiya metodini qo'llab,

$$u_n^2 = u_{n-1}u_{n+1} + (-1)^{n+1}$$

$$u_n^2 + u_nu_{n+1} = u_nu_{n+1} + u_{n-1}u_{n+1} + (-1)^{n+1}$$

$$u_n(u_n + u_{n+1}) = u_{n+1}(u_n + u_{n-1}) + (-1)^{n+1}$$

$$u_nu_{n+2} = u_{n+1}^2 + (-1)^{n+1}$$

$$u_{n+1}^2 = u_nu_{n+2} + (-1)^n.$$

7-xossa. $u_1u_2 + u_2u_3 + u_3u_4 + \dots + u_{2n-1}u_{2n} = u_{2n}^2$

$$u_2(u_1 + u_3) + u_4(u_3 + u_5) + \dots + u_{2n-1}(u_{2n-2} + u_{2n}) =$$

$$= (u_3 - u_1)(u_1 + u_3) + (u_5 - u_3)(u_3 + u_5) + \dots$$

$$\dots + (u_{2n} - u_{2n-2})(u_{2n-2} + u_{2n}) = u_3^2 - u_1^2 + u_5^2 - u_3^2 + u_7^2 - u_5^2 +$$

$$+ \dots + u_{2n}^2 - u_{2n-2}^2 = u_{2n}^2$$

8-xossa. $u_1u_2 + u_2u_3 + u_3u_4 + \dots + u_{2n}u_{2n+1} = u_{2n+1}^2 - 1$

9-xossa. $nu_1 + (n-1)u_2 + (n-2)u_3 + \dots + 2u_{n-1} + u_n =$

$$= (u_1 + u_2 + u_3 + \dots + u_n) + (u_1 + u_2 + u_3 + \dots + u_{n-1}) + (u_1 + u_2 + u_3 +$$

$$+ \dots + u_{n-2}) + \dots + u_1 = u_{n+2} - 1 + u_{n+1} - 1 + u_n - 1 + u_{n-1} - 1 + u_1 =$$

$$= u_{n+4} - (n + 3)$$

$$10\text{-xossa. } u_1 + 2u_2 + 3u_3 + \dots + nu_n = (n + 1)(u_1 + u_2 + u_3 + \dots + u_n) - (nu_1 + (n - 1)u_2 + (n - 2)u_3 + \dots + 2u_{n-1} + u_n) =$$

$$= (n + 1)(u_{n+2} - 1) - (u_{n+4} - (n + 3)) = nu_{n+2} - u_{n-3} + 2$$

$$11\text{-xossa. } u_n = \sum_{k=1}^n C_{n-k-1}^k$$

$$12\text{-xossa. } u_n = \frac{1}{\sqrt{5}} \left[\left(\frac{1+\sqrt{5}}{2} \right)^n - \left(\frac{1-\sqrt{5}}{2} \right)^n \right]. [1]$$

NATIJAR

$$u_{n+2}^2 - u_{n+1}^2 = u_n u_{n+3}$$

Chunki

$$u_{n+2}^2 - u_{n+1}^2 = (u_{n+2} - u_{n+1})(u_{n+2} + u_{n+1}) = u_n u_{n+3}.$$

Xuddi shunday

$$u_{n+m} = u_{n-1}u_m + u_n u_{m+1}$$

Bundan

$$u_{n+m} = u_{n+1}u_{m+1} + u_{n-1}u_{m-1}$$

XULOSA

Ko‘plab tabiiy va hayotiy masalalarni yechimida Fibonachchi sonlarining o‘rni beqiyos ekanligini ko‘rish mumkin. Bundan tashqari Fibonachchi sonlari oltin kesim bilan ham bog‘liq. Berilgan kesmaning oltin kesimi deb uni shunday ikki qismga ajratish tushuniladiki. bu yerda butun kesma uzunligining katta qism uzunligiga nisbati va katta qism uzunligining kichik qism uzunligiga nisbati o‘zaro tengdir. Bu nisbatning qiymati α_1 ga teng boiishini aniqlash qiyin emas. Qiziqarli tomoni shundaki,

$$\lim_{n \rightarrow \infty} \frac{u_{n+1}}{u_n} = \alpha_1$$

bo‘ladi.

ADABIYOTLAR

1. Н.Т.То‘rayev, I.Azizov. Matematik mmantiq va diskret matekatika. Toshkent. 2011.
2. Noriyeva A. O‘‘ QUVCHILARNING KREATIVLIK QOBILIYATLARINI RIVOJLANTIRISHDA NOSTANDART MISOL VA MASALALARNING ANAMIYATI //Журнал математики и информатики. – 2022. – Т. 2. – №. 1.
3. Meliyeva Mohira Zafar qizi, & Noriyeva Aziza. (2023). KO‘PHADLARNI NOSILA YORDAMIDA KO‘RAYTUVCHILARGA AJRATISH . *ОБРАЗОВАНИЕ НАУКА И ИННОВАЦИОННЫЕ ИДЕИ В МИРЕ*, 20(3), 117–120. Retrieved from <http://newjournal.org/index.php/01/article/view/5708>
4. Нориева А. Koshi tengsizligi va uning qiziqarli masalalarga tadbiqlari //Современные инновационные исследования актуальные проблемы и развитие тенденции: решения и перспективы. – 2022. – Т. 1. – №. 1. – С. 361-364.
5. Рабимкул А., Иброҳимов Ж. Б. ў., Пўлатов, БС and Нориева, АЖ қ. 2023. АРГУМЕНТЛАРНИ ГУРУҲЛАРГА АЖРАТИБ БАҲОЛАШ УСУЛИДА КЎП ПАРАМЕТРЛИ НОЧИЗИҚЛИ РЕГРЕССИЯ ТЕНГЛАМАЛАРИНИ ҚУРИШ МАСАЛАЛАРИ //Educational Research in Universal Sciences. – 2023. – Т. 2. – №. 2. – С. 174-178.
6. Abdunazarov R. Issues of effective organization of practical classes and clubs in mathematics in technical universities. *Mental Enlightenment Scientific-Methodological Journal*. Current Issue: Volume 2022, Issue 3 (2022) Articles.
7. Абдуназаров Р. О. численной решение обратной спектральной задачи для оператора Дирака //Журнал “Вопросы вычислительной и прикладной математики. – №. 95. – С. 10-20.
8. Отакулов С., Мусаев А. О. Применение свойства квазидифференцируемости функций типа минимума и максимума к задаче негладкой оптимизации //Colloquium-journal. – Голопристанський міськрайонний центр зайнятості, 2020. – №. 12 (64). – С. 48-53.
9. Мусаева А. О. Зарубежная система финансирования образовательных учреждений //Наука и новые технологии. – 2011. – №. 10. – С. 75-81.
10. Мусаев А. О. Интеграция образовательных систем России и Дагестана XIX века //Известия Дагестанского государственного педагогического университета. Психолого-педагогические науки. – 2010. – №. 3. – С. 21-24.