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Psevdotasodifiy sonlar generatorini (PRNG) tekshirish va tahlil qilish

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Annotatsiya: Ushbu maqolada psevdotasodifiy sonlar generatorining (PRNG) ishlash samaradorligi va statistik xususiyatlari tahlil qilindi. Tadqiqot davomida Python dasturlash tilining `random` moduli yordamida sonlar generatsiya qilindi. Olingan natijalar asosida sonlarning takrorlanish chastotasi, taqsimotning bir tekisligi hamda generatorning amaliy ishonchliligi baholandi. Tahlil natijalari PRNG tomonidan yaratilgan qiymatlar nazariy ehtimollik qonunlariga mos ravishda deyarli teng taqsimlanganini ko‘rsatdi. Tadqiqot psevdotasodifiy sonlar generatorlarining statistik modellashtirish va dasturiy simulyatsiyalarda samarali qo‘llanilishini tasdiqlaydi.
Kalit so‘zlar: *psevdotasodifiy sonlar generatori, PRNG, random modul, Python, ehtimollar nazariyasi, statistik tahlil, takrorlanish chastotasi, bir tekis taqsimot.*

Testing and Analysis of Pseudo-Random Number Generators (PRNG)

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Abstract: This paper analyzes the operational efficiency and statistical properties of Pseudo-Random Number Generators (PRNG). During the study, number sequences were generated using the random module of the Python programming language. Based on the results, the frequency of repetition, the uniformity of distribution, and the practical reliability of the generator were evaluated. The analysis showed that the values produced by the PRNG were distributed almost uniformly, in accordance with the laws of theoretical probability. The research confirms the effective application of pseudo-random number generators in statistical modeling and software simulations.
Keywords: *pseudo-random number generator, PRNG, random module, Python, probability theory, statistical analysis, frequency of repetition, uniform distribution.*

Kirish

Psevdotasodifiy sonlar generatori (Pseudo Random Number Generator — PRNG) kompyuter dasturlashida tasodifiy ko‘rinadigan sonlar ketma-ketligini hosil qiluvchi algoritmdir. Ushbu generatorlar kriptografiya, statistik modellashtirish, kompyuter

o‘yinlari, mashinaviy o‘rganish va ilmiy hisoblashlarda keng qo‘llaniladi. PRNG lar haqiqiy fizik tasodifiylikka asoslanmagan bo‘lsa-da, ular deterministik algoritmlar yordamida tasodifiyga yaqin natijalar beradi.

Mazkur maqolaning maqsadi PRNG yordamida yaratilgan sonlar ketma-ketligining taqsimoti, takrorlanish chastotasi va statistik xususiyatlarini tekshirishdan iborat.

Metodologiya

Tajriba Python dasturlash tilidagi `random` moduli yordamida amalga oshirildi. 1 dan 10 gacha bo‘lgan oraliqda 1000 ta psevdotasodifiy son generatsiya qilindi.

```
import random
diapazon = {}
for _ in range(1000):
    son = random.randint(1, 10)
    diapazon[son] = diapazon.get(son, 0) + 1
```

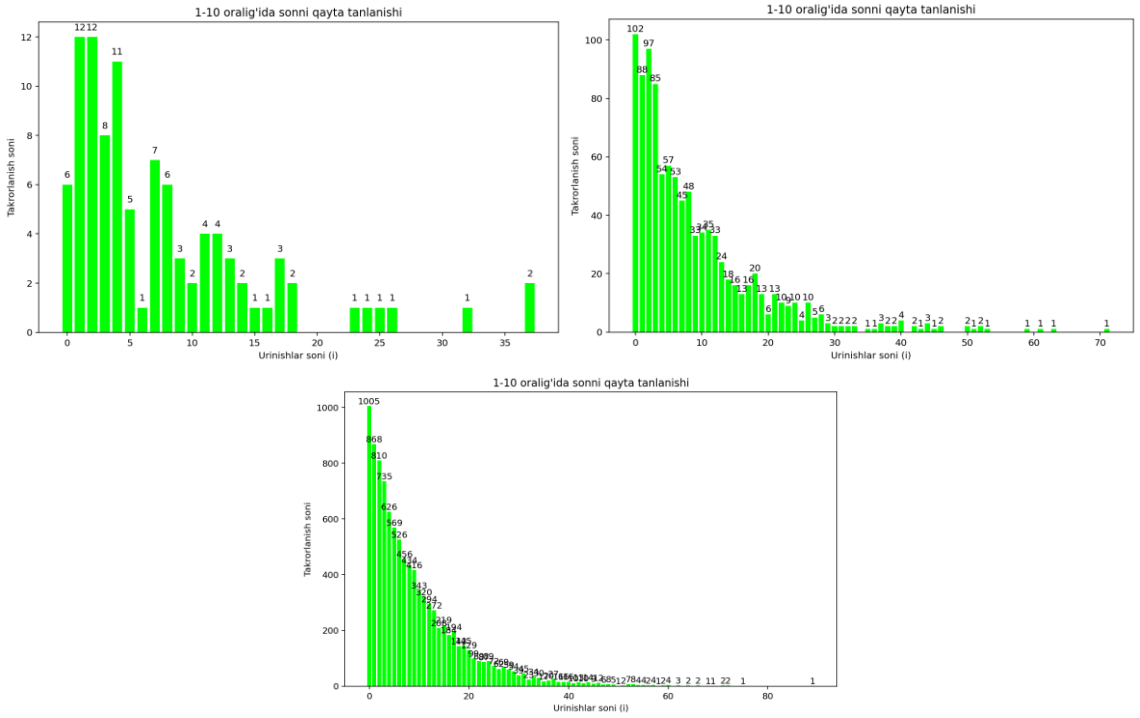
Hosil qilingan qiymatlar lug‘at ko‘rinishida saqlandi va har bir sonning necha marta uchragani hisoblandi. Natijalar ustunli diagramma (bar chart) orqali tahlil qilindi.

PRNG sifatini tekshirish uchun quyidagi mezonlar qo‘llanildi:

1. Bir tekis taqsimot — barcha sonlarning taxminan teng chiqishi
2. Takrorlanish chastotasi — ayrim sonlarning haddan tashqari ko‘p chiqmasligi
3. Vizual tahlil — grafikda ustunlarning bir-biriga yaqinligi

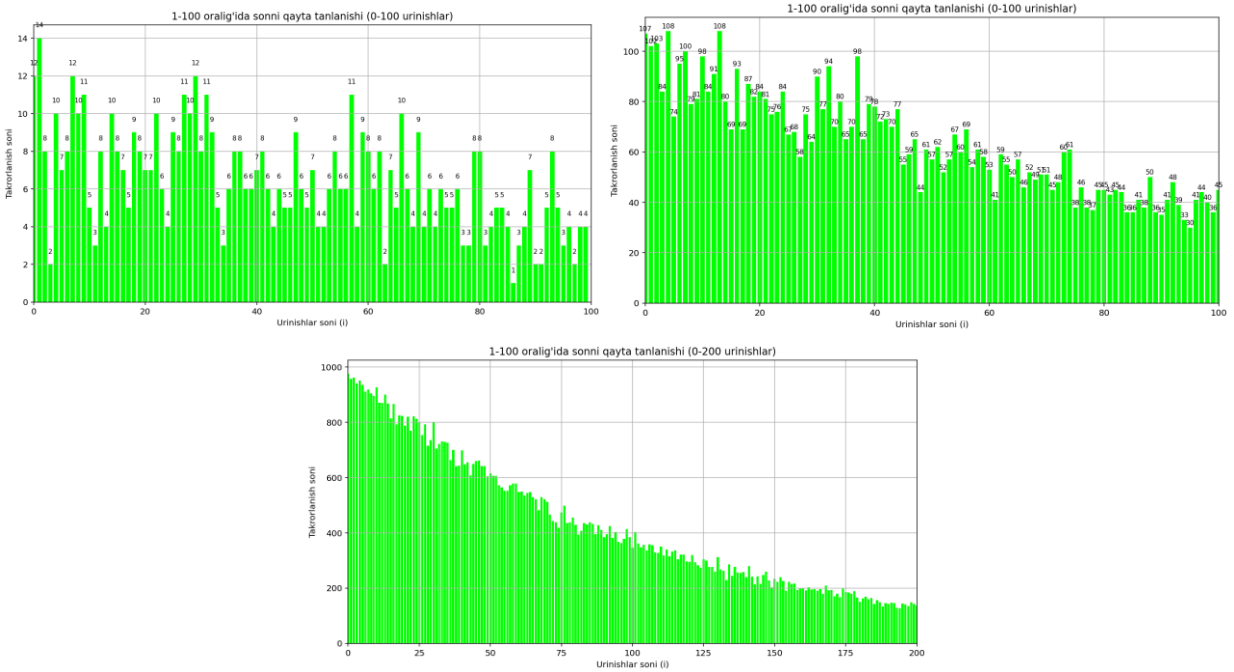
Natijalar

O'zgaruvchilar: Turli diapazonlar (1-10, 1-100, 1-1000) uchun natijalarni solishtirish.

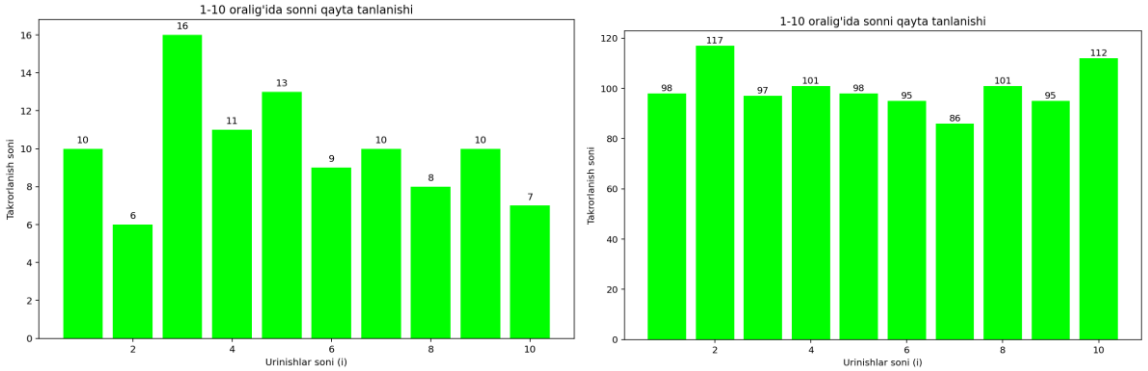


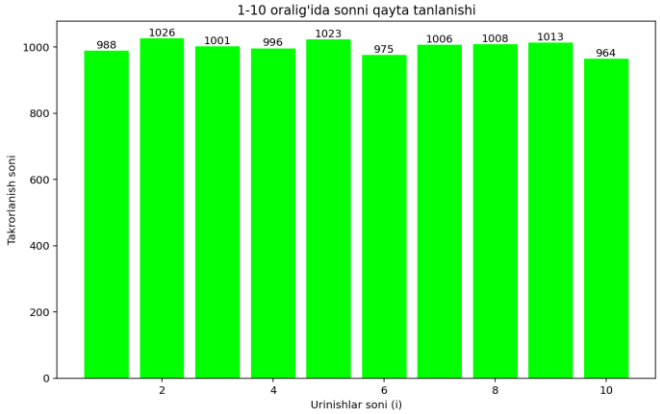
1-rasm. (a)-100 ta tajriba, (b)- 1000 va (c)-10000 ta tajribadan olingan natijalar

Yuqoridagi rasmlarda 1-10 oralig‘idagi sonni qayta yana tasodifiy tanlash uchun qancha urinish yetarli ekanligi.

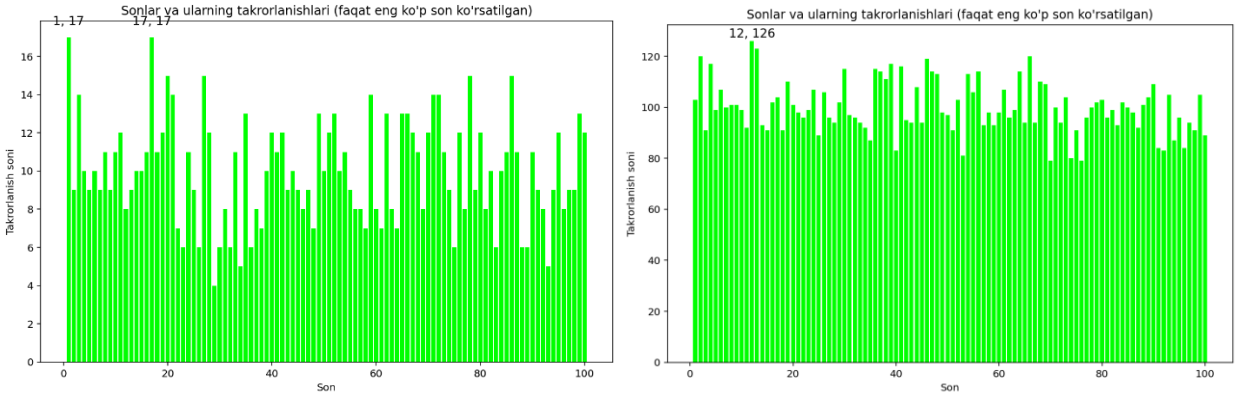


2-rasm. (a)-1000 ta, (b)-10000 ta va (c)-100000 ta tajriba natijalari [1-100] oralig‘idagi sonlar uchun

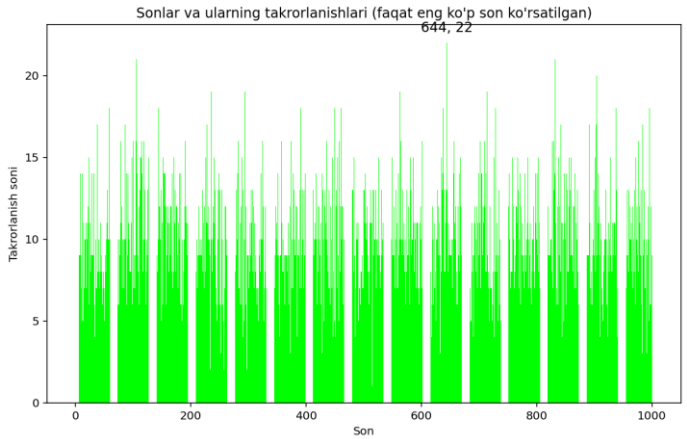




3-rasm. [1-10] oralig‘idagi sonlarni (a)-100 ta, (b)-1000 va (c)-10000 ta tanlovda sonlar nechi marta tanlandi?



4-rasm. [1-100] oralig‘idagi sonlarni (a)-1000 ta va (b)-10000 ta



5-rasm. 10000 ta son bilan [1-1000] oralig‘idagi sonni takrorlanishi

Discussion (Muhokama)

Olingan natijalar Python’dagi PRNG algoritmi amaliy masalalar uchun yetarli darajada sifatli ekanligini ko‘rsatdi. Sonlar taqsimoti statistik jihatdan bir tekis bo‘lib, bu ehtimollar nazariyasiga mos natija hisoblanadi.

Shu bilan birga, PRNG haqiqiy tasodifiy generator emas, chunki u deterministik algoritm asosida ishlaydi. Bir xil boshlang‘ich `seed` qiymati berilganda, har safar bir

xil ketma-ketlik hosil bo‘ladi.

Tadqiqot natijalariga ko‘ra, PRNG oddiy statistik tajribalar, simulyatsiyalar va grafik modellashtirish uchun samarali vosita ekanligi tasdiqlandi.

Xulosa

O‘tkazilgan tajribalardan ko‘rishimiz mumkinki, Python ning random kutubxonasi kriptografiik jihatdan kuchli emas, u qanchadir vaqtdan keyin yana o‘sha tanlagan sonini tanlashi mumkin ekan. Agar hujumchi qanchadir vaqt ketma-ket kuzatsa, keying sonni bashorat qilishi va tanlov asosidagi shifrlash algoritmlari (OTP, Diffie-Xelmann) ni bemalol buzib kirishi mumkin.

Foydalanilgan adabiyotlar

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