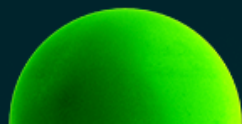
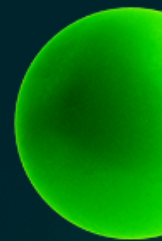


Axborotning o'lchov birliklari. Sanoq tizimlari

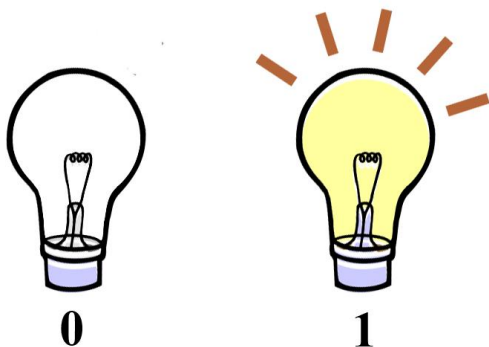


Reja:

- Axborot o'lchov birliklari
- Sanoq sistemasi haqida tushuncha
- Sonlarni bir sanoq sistemasidan ikkinchi sanoq sistemasiga o'tkazish
- Ikkilik sanoq sistemasida arifmetik amallarni bajarish

Axborotni o'lchash

Axborot o'lchov birliklari



Binary Digit (bit)

1 bit = 0 or 1

1 bayt (1 B) = 8 bit

1 Kilobayt (1 KB) = 1024 B

1 Megabayt (1 MB) = 1024 KB

1 Gigabayt (1 GB) = 1024 MB

1 Terabayt (1 TB) = 1024 GB

1 Pettabayt (1 PB) = 1024 TB

1 Ekzabayt (1 EB) = 1024 PB

1 Zettabayt (1 ZB) = 1024 EB

1 Yottabayt (1 YB) = 1024 ZB

1 Bronobayt = 1024 YB

1 Geopbayt = 1024 Bronobayt

Axborot o'lchov birliklari

Amaliyotda baytdan katta axborot hajmining o'lchov birliklari qo'llaniladi. Ularni quyidagicha tasvirlaymiz:

1 kilobayt = 1 Kb = 1024 bayt = 2^{10} bayt;

1 megabayt = 1 Mb = 1024 Kb = 2^{10} Kb = 2^{20} bayt = 1048576 bayt;

1 gigabayt = 1 Gb = 1024 Mb = 2^{10} Mb = 2^{30} bayt = 1073741824 bayt;

1 terabayt = 1 Tb = 1024 Gb = 2^{10} Gb = 2^{40} bayt = 1099511627776 bayt;

1 petabayt = 1 Pb = 1024 Tb = 2^{10} Tb = 2^{50} bayt = 1125899906842624 bayt.

Axborot hajmi o'lchov birliklari orasidagi bog'lanishni quyidagi sxema orqali ifodalash mumkin:

| | | | | | | | | |
|-----|-----|------|--------|----------|--------|----------|--------|----------|
| | :8→ | | :1024→ | | :1024→ | | :1024→ | |
| bit | | bayt | | kilobayt | | megabayt | | gigabayt |
| | ·8← | | ·1024← | | ·1024← | | ·1024← | |

Sanoq sistemasi nima?

Sanoq sistemalari








Odamlar o'rtasida muomala vositasi bo'lmish til kabi sonlarning ham o'z tili mavjud bo'lib, u o'z alifbosiga ega. Bu alifbo raqamlar va sonlarni ifodalash uchun qo'llaniladigan belgilardan iboratdir.

Arab raqamlari: 0, 1, 2, . . ., 9;

Rim raqamlari: I, V, X, L, C, D, M **sonlar alifbosining elementlari** hisoblanadi.

Sanoq sistemalari

Qadimgi Misr oʻnlik sanoq sistemasida sonlar raqamlarning birlashmasi koʻrinishida yozilgan boʻlib, har bir raqam ketma-ket 9 martadan ortiq takrorlanmagan:

| 1 | 10 | 100 | 1000 | 10000 | 100000 | 1000000 |
|---|---|---|--|---|---|---|
|  |  |  |  |  |  |  |

Masalan, Misr oʻnlik sanoq sistemasida 632107 soni quyidagicha yozilgan:



Sanoq sistemalari

Mayya sanoq sistemasida 0 raqami va yana 19 ta raqam kiritilgan. Mayya sanoq sistemasi gorizontaal yoʻnalishda emas, balki vertikal yoʻnalishda yozilgan. Masalan: $20 = 1 \cdot 20 + 0$; $32 = 1 \cdot 20 + 12$; $429 = 1 \cdot 20^2 + 1 \cdot 20 + 9$; $4805 = 12 \cdot 20^2 + 0 \cdot 20 + 5$.

| Sonlar | 20 | 32 | 429 | 4805 |
|--------|------------|-------------|---------------|-------------|
| 3-xona | | | • | •• ===== |
| 2-xona | • | • | • | • ===== |
| 1-xona | • ===== | •• ===== | •••• ===== | — |

| | | | | |
|------------|----|-----|------|-------|
| 0 | 1 | 2 | 3 | 4 |
| • ===== | • | •• | ••• | •••• |
| 5 | 6 | 7 | 8 | 9 |
| • ===== | •• | ••• | •••• | ••••• |
| 10 | 11 | 12 | 13 | 14 |
| • ===== | •• | ••• | •••• | ••••• |
| 15 | 16 | 17 | 18 | 19 |
| • ===== | •• | ••• | •••• | ••••• |

**Biz kundalik hayotimizda qaysi
sanoq sistemasi ishlatamiz?**

10 s.s.

Eng ko'p tarqalgan 10 lik sanoq sistemasidir. O'nlik sanoq sistemasida 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 raqamlari ishlatiladi. Ularni birlashtirgan holda yangi son hosil qilish mumkin.

Agarda sizda:

-1 ta yacheyka bo'lsa 0 dan 9 gacha

-2 ta yacheka bo'lsa 0 dan 99 gacha

-3 ta yacheka bo'lsa 0 dan 999 gacha

7

7 8

5 7 8

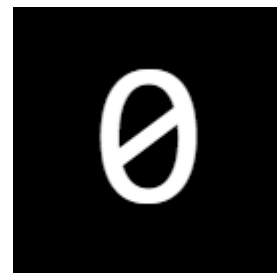
Yacheykalar o'ngdan chapga qarab ketma-ketlikda koeffisientga ega
 10^0 , 10^1 , 10^2 , ...

| 10^3 | 10^2 | 10^1 | 10^0 |
|--------|--------|--------|--------|
| 1 | 8 | 5 | 3 |

| | | | | |
|---|---|------|---|-------|
| 1 | x | 1000 | = | 1000 |
| 8 | x | 100 | = | 800 |
| 5 | x | 10 | = | 50 |
| 3 | x | 1 | = | 3 |
| | | | | <hr/> |
| | | | | 1853 |

**Kompyuter qaysi sanoq
sistemasini ishlatadi?**

Kompyuter millionlab tranzistorlardan (yoqib-o'chirgich, electronic switches) foydalangan holda ishlaydi. Har bir tranzistor ikkita holatga ega: **yoqilgan** yoki **o'chirilgan**. Yoqib-o'chirish holati binar (ikkilik) ma'lumotni ifodalashi mumkin, ha yoki yo'q, to'g'ri yoki noto'g'ri, 1 yoki 0. Kompyuterda axborotning asosiy o'lchov birligi ikkilik belgidir (binary digit). Kompyuter o'zida juda ko'p turli xil ma'lumotlarni ifodalay olishi mumkin bo'lishiga qaramasdan barcha ifodalar tranzistorning ON/OFF holatiga keltiriladi (mos holda 1 va 0).

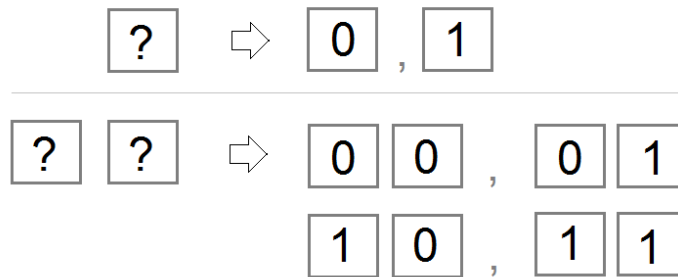


Ikkilik sanoq sistemasida 0 va 1 raqamlari ishlatiladi. Ularni birlashtirgan holda yangi son hosil qilish mumkin.

Agarda sizda:

-1 ta yacheyka bo'lsa **0** va **1**;

-2 ta yacheka bo'lsa **00**, **01**, **10**, va **11**



















**Sonlarni 10 s.s. dan boshqasiga
o'tkazish**

Natural sonlarni o'nlik sanoq sistemasidan boshqasiga o'tkazish uchun berilgan sonni o'tkaziladigan sanoq sistemasining asosiga bo'lamiz. Agar hosil bo'lgan son bu asosdan katta bo'lsa, bo'lishni bu asosdan kichik bo'lgunga qadar davom ettiramiz. So'ngra hosil bo'lgan qoldiqlarni oxiridan boshlab yozib chiqamiz. Natijada hosil bo'lgan son o'tkaziladigan sanoq sistemasidagi son bo'ladi.

Namuna :

$$\begin{array}{r|l}
 37 & 2 \\
 \hline
 36 & \underline{18} \quad 2 \\
 \hline
 1 & \underline{18} \quad 9 \quad 2 \\
 & 0 \quad \underline{8} \quad 4 \quad 2 \\
 & 1 \quad \underline{4} \quad 2 \quad 2 \\
 & 0 \quad \underline{2} \quad 1 \\
 & 0
 \end{array}$$

$$37_{10} = 100101_2$$

$$\begin{array}{r|l}
 14217 & 7 \\
 \hline
 14217 & \underline{2031} \quad 7 \\
 \hline
 0 & \underline{2030} \quad 290 \quad 7 \\
 & 1 \quad \underline{287} \quad 41 \quad 7 \\
 & 3 \quad \underline{35} \quad 5 \\
 & 6
 \end{array}$$

$$14217_{10} = 56310_7$$

$$\begin{array}{r|l}
 628 & 3 \\
 \hline
 627 & \underline{209} \quad 3 \\
 \hline
 1 & \underline{207} \quad 69 \quad 3 \\
 & 2 \quad \underline{69} \quad 23 \quad 3 \\
 & 0 \quad \underline{21} \quad 7 \quad 3 \\
 & 2 \quad \underline{6} \quad 2 \\
 & 1
 \end{array}$$

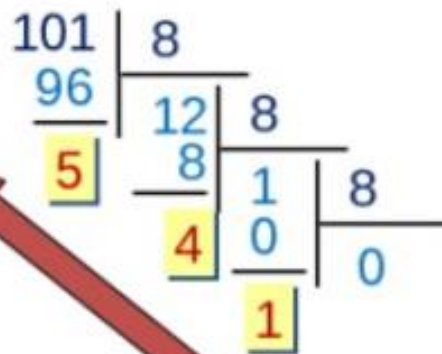
$$628_{10} = 212021_3$$

$$\begin{array}{r|l}
 23752 & 8 \\
 \hline
 23752 & \underline{2969} \quad 8 \\
 \hline
 0 & \underline{2968} \quad 371 \quad 8 \\
 & 1 \quad \underline{368} \quad 46 \quad 8 \\
 & 3 \quad \underline{40} \quad 5 \\
 & 6
 \end{array}$$

$$23752_{10} = 56310_8$$

$10 \text{ s.s.} \leftrightarrow 8 \text{ s.s.}$

10 → 8



$$101 = 145_8$$

Sanoq
sistmasi

8 → 10

² ¹ ⁰ razryadi

$$145_8 = 1 \cdot 8^2 + 4 \cdot 8^1 + 5 \cdot 8^0$$

$$= 64 + 32 + 5 = 101$$

16 lik sanoq sistemasi

16 lik sanoq sistemasida faqat 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A(10), B(11), C(12), D(13), E(14) va F(15) raqam va belgilari mavjud:

1E3, 11A8B, 125ABC, ...

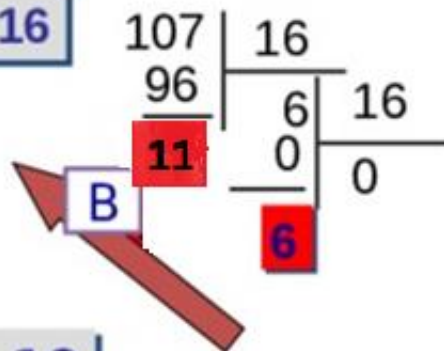
$10 \text{ s.s.} \leftrightarrow 16 \text{ s.s.}$

Asos (raqam soni): 16

Alfavit: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F

10 11 12 13 14 15

10 → 16



$$107 = 6B_{16}$$

16 → 10

2 1 0 razryadi

$$1C5_{16} = 1 \cdot 16^2 + 12 \cdot 16^1 + 5 \cdot 16^0$$

$$= 256 + 192 + 5 = 453$$

C

10 s.s. \leftrightarrow 16 s.s.

Misollar

171 =

1BC₁₆ =

206 =

22B₁₆ =

Sanoq sistemalari

| | | | | | | | | | | | | | | | | | | |
|--------|-----------------|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|-----|
| 4 lik | sanoq sistemasi | 0 | 1 | 2 | 3 | 10 | 11 | 12 | 13 | 20 | 21 | 22 | 23 | 30 | 31 | 32 | 33 | 100 |
| 5 lik | | 0 | 1 | 2 | 3 | 4 | 10 | 11 | 12 | 13 | 14 | 20 | 21 | 22 | 23 | 24 | 30 | 31 |
| 6 lik | | 0 | 1 | 2 | 3 | 4 | 5 | 10 | 11 | 12 | 13 | 14 | 15 | 20 | 21 | 22 | 23 | 24 |
| 7 lik | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 20 | 21 | 22 |
| 8 lik | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 20 |
| 9 lik | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
| 10 lik | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| 11 lik | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A | 10 | 11 | 12 | 13 | 14 | 15 |
| 12 lik | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A | B | 10 | 11 | 12 | 13 | 14 |
| 13 lik | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A | B | C | 10 | 11 | 12 | 13 |
| 14 lik | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A | B | C | D | 10 | 11 | 12 |
| 15 lik | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A | B | C | D | E | 10 | 11 |
| 16 lik | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A | B | C | D | E | F | 10 |

Sonlarni bir sanoq sistemasidan boshqa sanoq sistemasiga o'tkazish

Sonlarni ixtiyoriy p asosli sanoq sistemasidan q asosli sanoq sistemasiga o'tkazish uchun, son avval p asosli sanoq sistemasidan o'nlik sanoq sistemasiga o'tkaziladi, so'ng o'nlik sanoq sistemasidan q asosli sanoq sistemasiga yuqoridagi usullarda o'tkaziladi. Demak, o'nlik sanoq sistemasi ixtiyoriy pozitsiyali sanoq sistemalari orasida «ko'prik» vazifasini o'taydi. Masalan:

| | |
|---|---|
| $515025_6 = 41273_{10} = 15A2B_{13}$ $515025_6 = 5 \cdot 6^5 + 1 \cdot 6^4 + 5 \cdot 6^3 + 0 \cdot 6^2 + 2 \cdot 6^1 + 5 \cdot 6^0 =$ $= 5 \cdot 7776 + 1 \cdot 1296 + 5 \cdot 216 + 2 \cdot 6 + 5 \cdot 1 =$ $= 38880 + 1296 + 1080 + 17 = 41273_{10} = 15A2B_{13}$ <div style="text-align: right;"> $\begin{array}{r} 41273 \mid 13 \\ - 41262 \mid 3174 \mid 13 \\ \hline B=11 \quad 3172 \mid 244 \mid 13 \\ \hline \quad 2 \mid 234 \mid 18 \mid 13 \\ \hline \quad \quad A=10 \mid 13 \mid 1 \\ \hline \quad \quad \quad 5 \end{array}$ </div> | $114_{14} = 214_{10} = 21221_3$ $114_{14} = 1 \cdot 14^2 + 1 \cdot 14^1 + 4 \cdot 14^0 =$ $= 1 \cdot 196 + 1 \cdot 14 + 4 \cdot 1 = 196 + 14 + 4 =$ $= 214_{10} = 21221_3$ <div style="text-align: right;"> $\begin{array}{r} 214 \mid 3 \\ - 213 \mid 71 \mid 3 \\ \hline 1 \quad 69 \mid 23 \mid 3 \\ \hline \quad 2 \mid 21 \mid 7 \mid 3 \\ \hline \quad \quad 2 \mid 6 \mid 2 \\ \hline \quad \quad \quad 1 \end{array}$ </div> |
|---|---|

Misol:

Ikkilik sanoq sistemasida berilgan 101110 sonini o'nlik sanoq sistemasiga o'tkazing.

Yechish

$$101110_2 = 1 \cdot 2^5 + 0 \cdot 2^4 + 1 \cdot 2^3 + 1 \cdot 2^2 + 1 \cdot 2^1 + 0 \cdot 2^0 = 32 + 0 + 8 + 4 + 2 + 0 = 46_{10}$$

$$101110_2 = 2^5 + 2^3 + 2^2 + 2^1 = 32 + 8 + 4 + 2 = 46_{10}$$

Javob: 46_{10}

Misol:

8 lik sanoq sistemasida berilgan 467 sonini 10 lik sanoq sistemasiga o'tkazing.

Yechish

$$467 = 4 \cdot 8^2 + 6 \cdot 8^1 + 7 \cdot 8^0 = 4 \cdot 64 + 6 \cdot 8 + 7 \cdot 1 = 256 + 48 + 7 = 311_{10}$$

Javob: 311_{10}

Misol:

O'n oltilik sanoq sistemasida berilgan 3AF sonini o'n asosli sanoq sistemasiga o'tkazing.

Yechish

$$3AF = 3 \cdot 16^2 + A \cdot 16^1 + F \cdot 16^0 = 3 \cdot 256 + 10 \cdot 16 + 15 \cdot 1 = 768 + 160 + 15 = 943_{10}$$

2 8 16 lik sanoq sistemalari



Sonlarni o'tkazishda **2, 4, 8, 16 lik** sanoq sistemalarida yuqoridagi usullardan farqli kodlashni diada, triada va tetrada usullaridan foydalanish qulay. Sonlarni bunday o'tkazish (kodlash)da butun son oldiga yozilgan 0 raqamlari son qiymatiga ta'sir etmasligi hisobga olinadi. Diada, triada va tetrada usullarida «**ko'prik**» vazifasini ikkilik sanoq sistemasi o'taydi. Quyidagi misollar orqali o'tkazish mohiyatini tushunish mumkin:

$$72005642_8 = \underbrace{111}_7 \underbrace{010}_2 \underbrace{000}_0 \underbrace{101}_5 \underbrace{110}_6 \underbrace{100}_4 \underbrace{010}_{2_8} = 111010000101110100010_2$$

$$10001001010_2 = \underbrace{010}_2 \underbrace{001}_1 \underbrace{001}_1 \underbrace{010}_{2_2} = 2112_8$$

$$FE10A_{16} = \underbrace{1111}_F \underbrace{1110}_E \underbrace{0001}_1 \underbrace{0000}_0 \underbrace{1010}_{A_{16}} = 11111110000100001010_2$$

2 s.s. \rightarrow 8 s.s.

Ikkilik sanoq sistemasidan sakkizlik sanoq sistemasiga o'tish

100101110111_2

1 qadam o'ng tomondan boshlab triada usulida
ajratib chiqamiz:

$001\ 001\ 011\ 101\ 111_2$

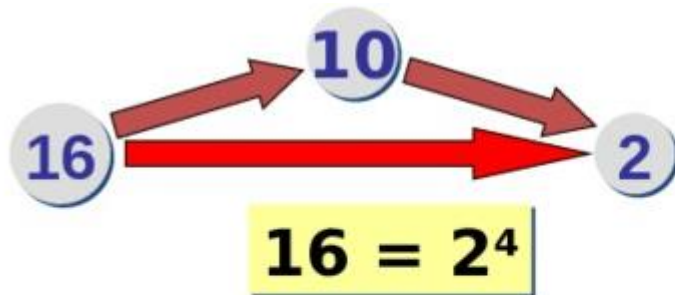
2 qadam. Har bir triadani 8lik sanoq sistemasidagi
raqami bilan almashtiramiz

$001\ 001\ 011\ 101\ 111_2$

$\boxed{1}\ \boxed{1}\ \boxed{3}\ \boxed{5}\ \boxed{7}$

Javob: $100101110111_2 = 11357_8$

16 s.s. \rightarrow 2 s.s.



! Tetrada usilida ikkilik sanoq sistemasining 4 ta raqami olinadi

O'n oltilik sanoq sistemasida berilgan 3FD5 sonini ikkilik sanoq sistemasiga o'tkazing.

Yechish: 3=0011, F=1111, D=1101, 5=0101

Javob: 11111111010101₂

Topshiriq

1. O'tkazishni bajaring:

| | | |
|--|--|--|
| a) $10111101_2 \rightarrow ?_{10}$ 189 | b) $1110000_3 \rightarrow ?_{10}$ 1053 | d) $6317_{10} \rightarrow ?_{11}$ 4823 |
| e) $1190_{10} \rightarrow ?_7$ 3320 | f) $909_{10} \rightarrow ?_9$ 1220 | g) $1236_{10} \rightarrow ?_3$ 1200210 |
| h) $11011 \rightarrow ?_{16}$ 1B | i) $13021_4 \rightarrow ?_{16}$ 1C9 | j) $1A2B_{15} \rightarrow ?_{10}$ 5666 |

2. Triada kodlash jadvalidan foydalanib, o'tkazishni bajaring:

| | | |
|--|--------------------------------------|--|
| a) $10111101_2 \rightarrow ?_8$ 275 | b) $1110000_2 \rightarrow ?_8$ 160 | d) $1001101_2 \rightarrow ?_8$ 115 |
| e) $1170_8 \rightarrow ?_2$ 1001111000 | f) $707_8 \rightarrow ?_2$ 111000111 | g) $1236_8 \rightarrow ?_2$ 1010011110 |

3. Tetrada kodlash jadvalidan foydalanib, o'tkazishni bajaring:

| | | | |
|---------------|--------------------------------------|---|---|
| 2CD | a) $1011001101_2 \rightarrow ?_{16}$ | b) $1110001110_2 \rightarrow ?_{16}$ ^{38E} | d) $10011100101_2 \rightarrow ?_{16}$ 4E5 |
| 1101011011010 | e) $1ADA_{16} \rightarrow ?_2$ | f) $90DED_{16} \rightarrow ?_2$ | g) $101001_{16} \rightarrow ?_2$ 1000000010000000000001 |

10010000110111101101

2 s.s. da amallar bajarish

Ma'lumki ikkilik sanoq sistemasi faqat ikkita: 0 va 1 raqamlaridan tashkil topgan. Bu sistemada qo'shish, ayirish va ko'paytirish amallari quyidagicha bajariladi:

| Qo'shish | Ayirish | Ko'paytirish |
|--------------|---------------|-----------------|
| $0 + 0 = 0$ | $0 - 0 = 0$ | $0 \cdot 0 = 0$ |
| $0 + 1 = 1$ | $1 - 0 = 1$ | $0 \cdot 1 = 0$ |
| $1 + 0 = 1$ | $10 - 0 = 10$ | $1 \cdot 0 = 0$ |
| $1 + 1 = 10$ | $10 - 1 = 1$ | $1 \cdot 1 = 1$ |

Namuna :

1-misol. $10011 + 11001$

Yechish:

$$\begin{array}{r} + 10011 \\ 11001 \\ \hline 101100 \end{array}$$

Javob: 101100.

3-misol. $101010 - 10011$

Yechish:

$$\begin{array}{r} 101010 \\ - 10011 \\ \hline 10111 \end{array}$$

Javob: 10111.

2-misol. $1101101,001 + 1000101,001$

Yechish:

$$\begin{array}{r} + 1101101,001 \\ 1000101,001 \\ \hline 10110010,010 \end{array}$$

Javob: 10110010,01.

4-misol. $110011,01 - 10111,101$

Yechish:

$$\begin{array}{r} 110011,010 \\ - 10111,101 \\ \hline 11011,101 \end{array}$$

Javob: 11011,101.

BINARY MULTIPLICATION

$$\begin{array}{r} \times 1011 \quad (11) \\ 1101 \quad (13) \\ \hline 1011 \\ + 0000 \\ 1011 \\ 1011 \\ \hline 10001111 \quad (143) \end{array}$$

Topshiriq

1. Ikkilik sanoq sistemasida berilgan sonlar ustida qo'shish amalini bajaring:

| | | | | | |
|---------------|--------|----------------|--------|--------------------|----------|
| a) $101+111$ | 1100 | b) $1101+110$ | 1 0011 | d) $1111+1011$ | 1 1010 |
| e) $1011+110$ | 1 0001 | f) $1010+1111$ | 1 1001 | g) $11,011+101,01$ | 1100,101 |

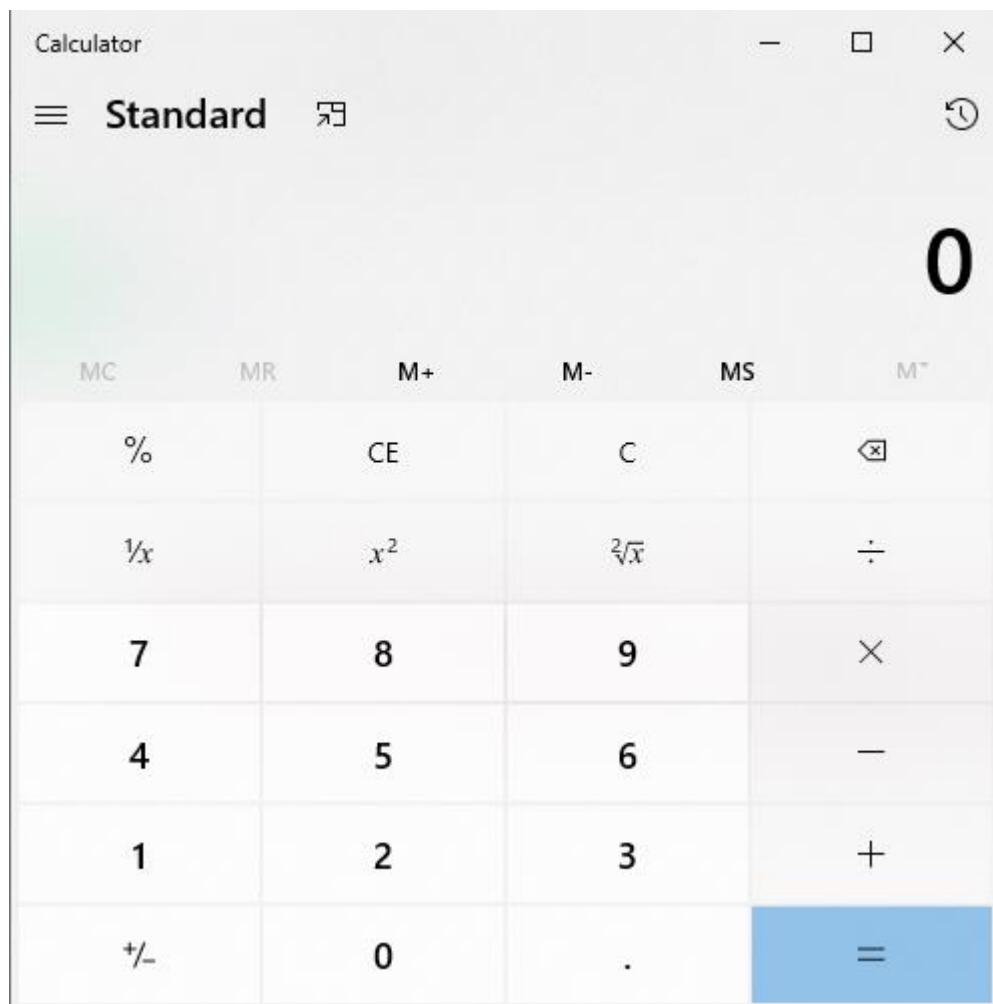
2. Ikkilik sanoq sistemasida berilgan sonlar ustida ayirish amalini bajaring:

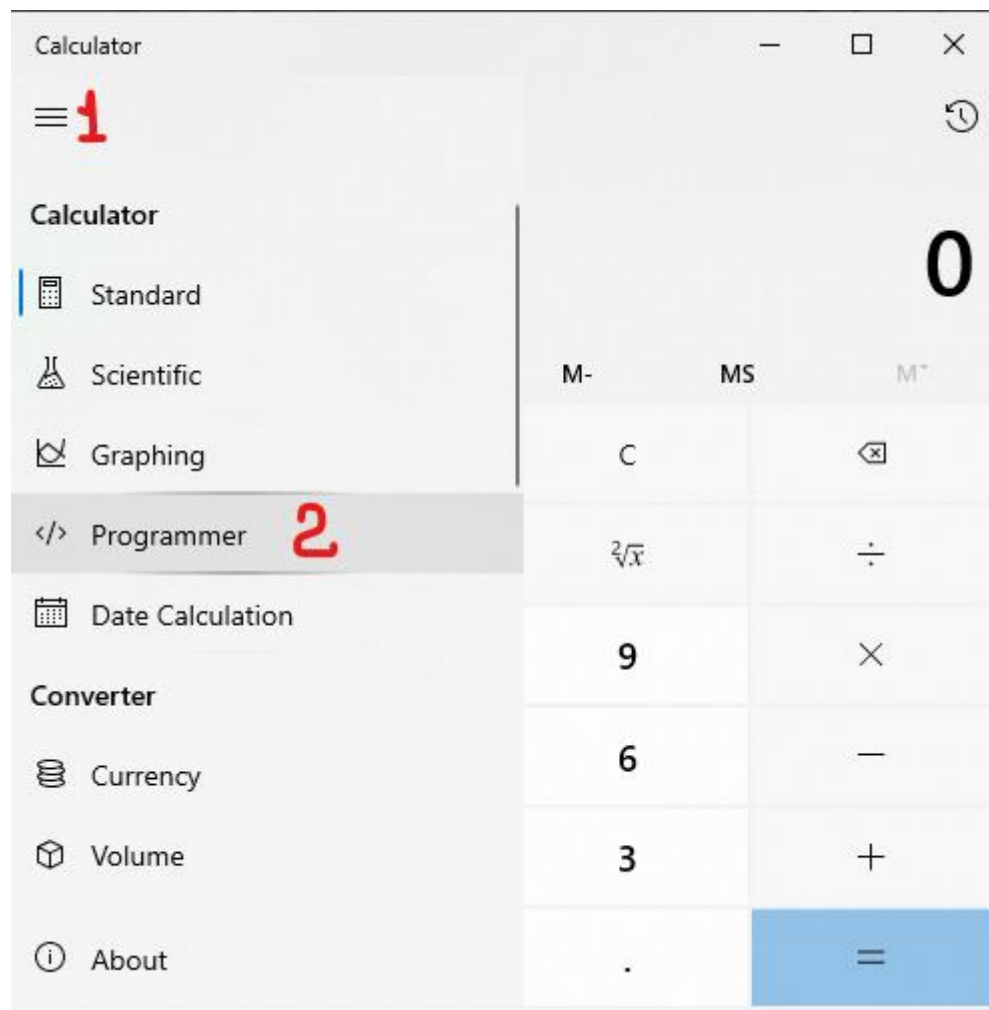
| | | | | | |
|----------|----------------------|-----------------|------|-----------------------|---------|
| 100 | a) $1010-110$ | b) $1100-11$ | 1001 | d) $1011-101,11$ | 101,01 |
| 10110,10 | e) $11011,11-101,01$ | f) $1111-10,11$ | 1100 | g) $1101,101-1001,01$ | 100,001 |

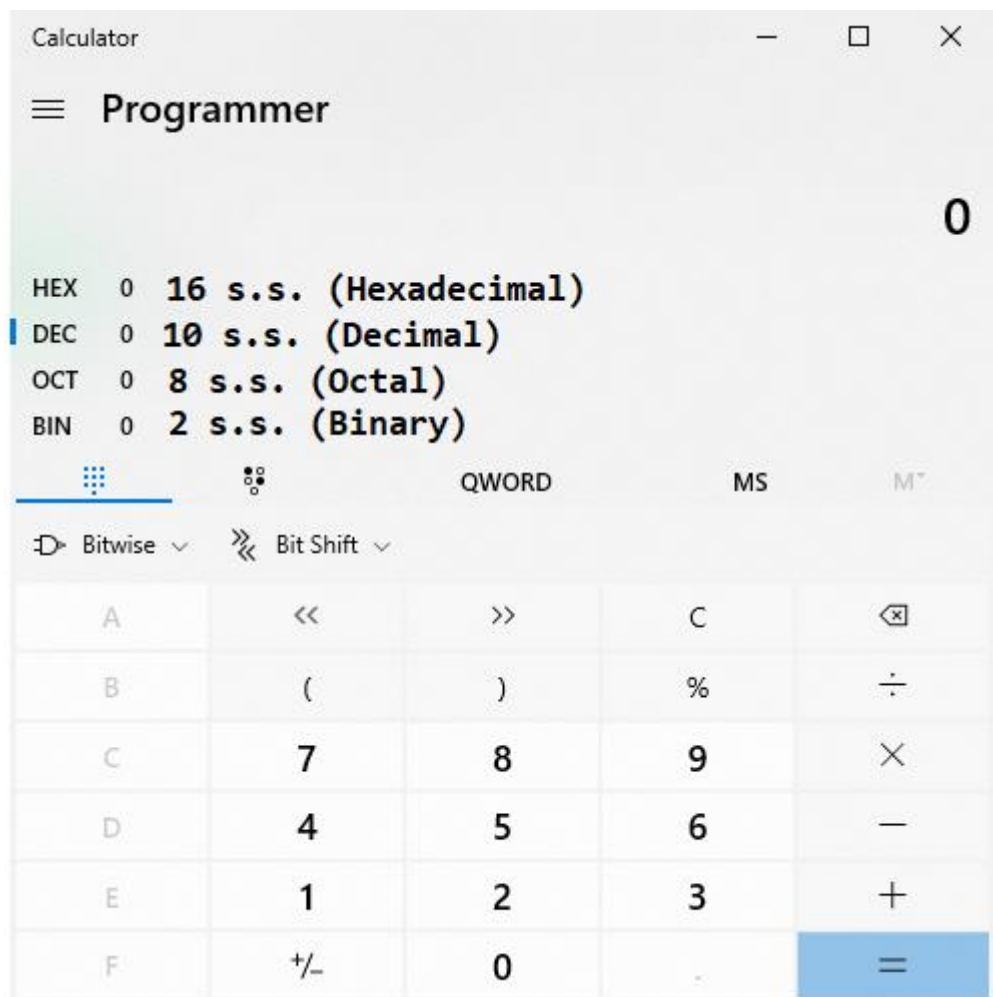
3. Ikkilik sanoq sistemasida berilgan sonlar ustida ko'paytirish amalini bajaring:

| | | | | | |
|-----------|-----------------------|------------------------|-------|-------------------------|------------|
| 1111 | a) $101 \cdot 11$ | b) $110 \cdot 101$ | 11110 | d) $111 \cdot 11$ | 10101 |
| 101111,11 | e) $1011 \cdot 11,01$ | f) $1111,01 \cdot 101$ | | g) $101,11 \cdot 1,101$ | 1001,01011 |

Kalkulyatorda sanoq sistemalari bilan ishlash







Darsda bajarilgan masalalarni kalkulatorlarda bajarish



E`tiboringiz uchun rahmat!