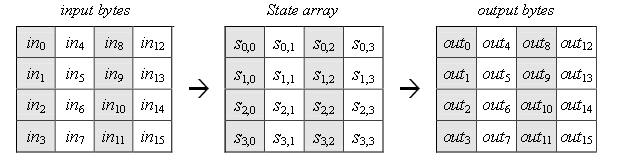
**Praktikum. Algoritm AES**

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| 1. **Kasutades oma nime ees ja perekonnanime tähti täida ruut avateksti jaoks.**  |  |  |  |  | | --- | --- | --- | --- | |  |  |  |  | |  |  |  |  | |  |  |  |  | |  |  |  |  | | 1. **Kasutades oma tänava ja/või linna tähti täida ruut krüpteerimisvõtme jaoks**  |  |  |  |  | | --- | --- | --- | --- | |  |  |  |  | |  |  |  |  | |  |  |  |  | |  |  |  |  | |
| 1. **Avatekst 16-nd süsteemis**  |  |  |  |  | | --- | --- | --- | --- | |  |  |  |  | |  |  |  |  | |  |  |  |  | |  |  |  |  | | 1. **Võti 16-nd süstemis**  |  |  |  |  | | --- | --- | --- | --- | |  |  |  |  | |  |  |  |  | |  |  |  |  | |  |  |  |  | |

1. **Järgnevalt genereerige esimese kahe raundi jaoks alamvõtmeid kasutades KeyExpansion.**

Esimest neli elementi täitke oma krüpteerimisvõtme osadega (Iga osa 4 Baidi)

Konvertimise abiks on <http://home2.paulschou.net/tools/xlate/>



|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| W0: |  |  |  |  |
| W1: |  |  |  |  |
| W2: |  |  |  |  |
| W3: |  |  |  |  |

Nk=4

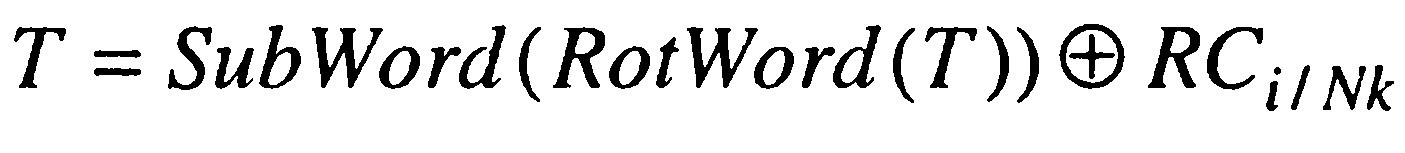
R=10 raundi

Suurim indeks alamvõtme jaoks : (4\*(R+1)-1)=(4\*(10+1)-1)=43

W4 jaoks on n=4, kordne Nk-le

Teostage teisendust

T: T=Wi-1



**RotWord** nihutab (keerab, ehk > >) sisendsõna 1 Baidi võrra (8 bitt) vasakule

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| T=RotWord(T) |  |  |  |  |

**SubWord** teostab iga Baidiga teisendust tabeli abil, mis on sama mis protseduuris SubBytes (vaata p.7)

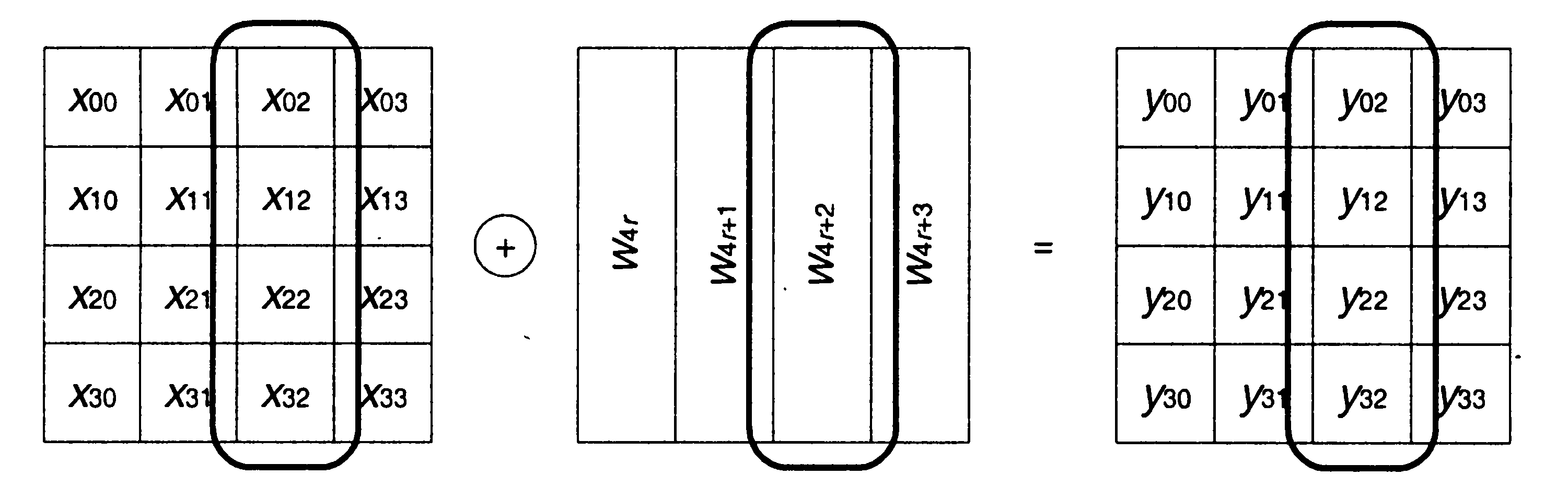
RCi/Nk kujutab endast sõnu, kus kõik Baidid peale esimest on nullid, ning esimene Bait on 2n-1 mod 256, kus n=i/Nk

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| T=SubWord(T) 16-nd süsteemis   |  |  |  |  | | --- | --- | --- | --- | |  |  |  |  | | Ci kahendkoodi kujul   |  |  |  |  | | --- | --- | --- | --- | |  |  |  |  | |
| T⊕Ci   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | |
| W4=:W4-4⊕T= W0⊕T   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | |
| Järgmise W5 arvutamiseks vajame T: T=Wi-1=W4  Antud juhul *i* ei ole kordne Nk-le ning ei ole Nk =8 või (i mod Nk)=4 | |
| W5=:W5-4⊕T= W1⊕T   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | |
| T=Wi-1=W5, *i* ei ole kordne Nk-le ning ei ole Nk =8 või (i mod Nk)=4  W6=:W6-4⊕T= W2⊕T   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | |

16-nd süsteemis:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| W4: |  |  |  |  |
| W5: |  |  |  |  |
| W6: |  |  |  |  |
| W7: |  |  |  |  |

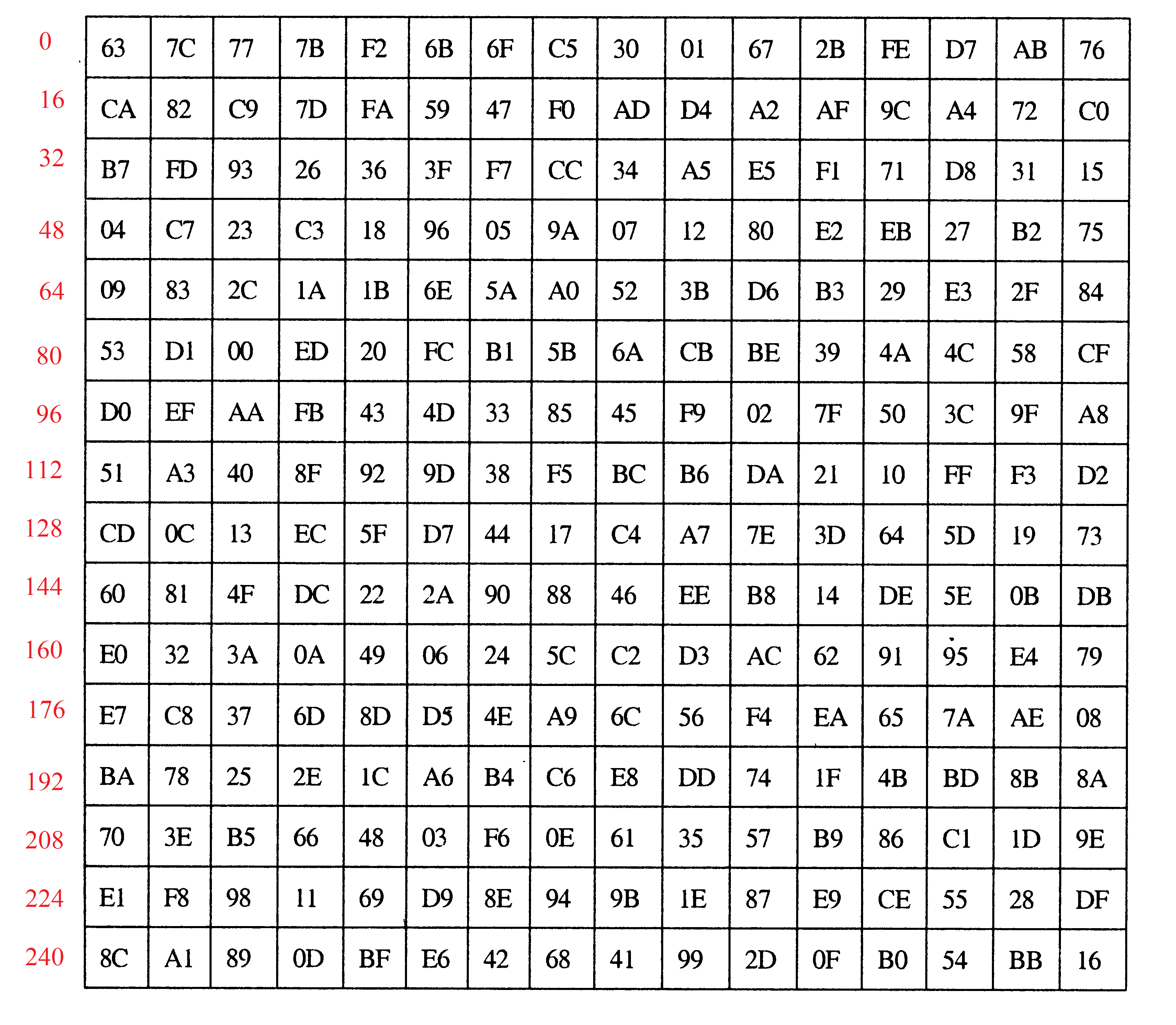
1. **Lisage alamvõtmed W0..W3 kasutades AddRoundKey**

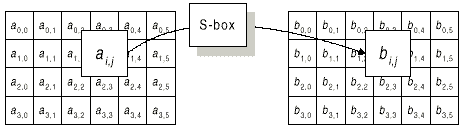


Selles punktis kasutage XOR arvutamiseks kalkulaatorit

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| x:   |  |  |  |  | | --- | --- | --- | --- | |  |  |  |  | |  |  |  |  | |  |  |  |  | |  |  |  |  | | W:  W0 W1 W2 W3   |  |  |  |  | | --- | --- | --- | --- | |  |  |  |  | |  |  |  |  | |  |  |  |  | |  |  |  |  | | y:   |  |  |  |  | | --- | --- | --- | --- | |  |  |  |  | |  |  |  |  | |  |  |  |  | |  |  |  |  | |

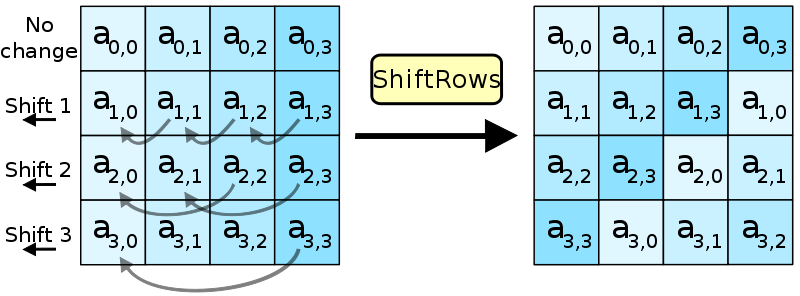
1. **Alustatakse raundidega. SubByte protseduuri teostame S-boxi abil**





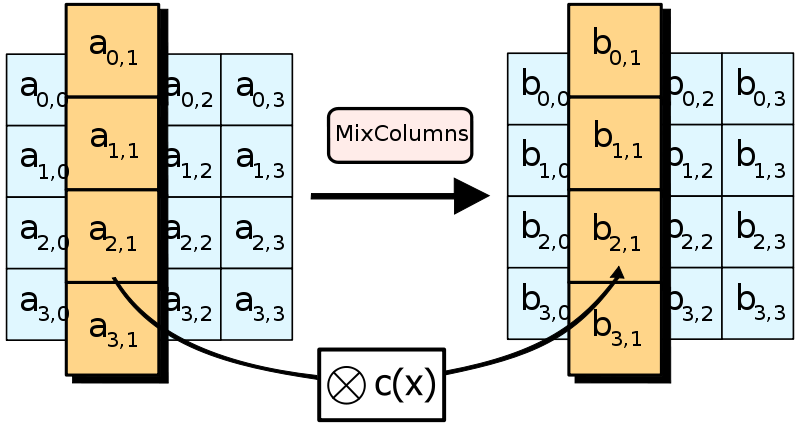
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| ai:   |  |  |  |  | | --- | --- | --- | --- | |  |  |  |  | |  |  |  |  | |  |  |  |  | |  |  |  |  | | Tulemus (bi)   |  |  |  |  | | --- | --- | --- | --- | |  |  |  |  | |  |  |  |  | |  |  |  |  | |  |  |  |  | |

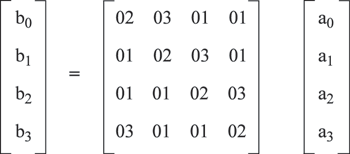
1. **ShiftRows. Esimene rida jääb muutmatul kujul. Teise rea nihutatud Baitide arv on 1, kolmanda – 2, neljanda – 3.**



|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| ai:   |  |  |  |  | | --- | --- | --- | --- | |  |  |  |  | |  |  |  |  | |  |  |  |  | |  |  |  |  | | Tulemus   |  |  |  |  | | --- | --- | --- | --- | |  |  |  |  | |  |  |  |  | |  |  |  |  | |  |  |  |  | |

1. **MixColumns. Teostage korrutamist GF(28) korpuse siseselt.**

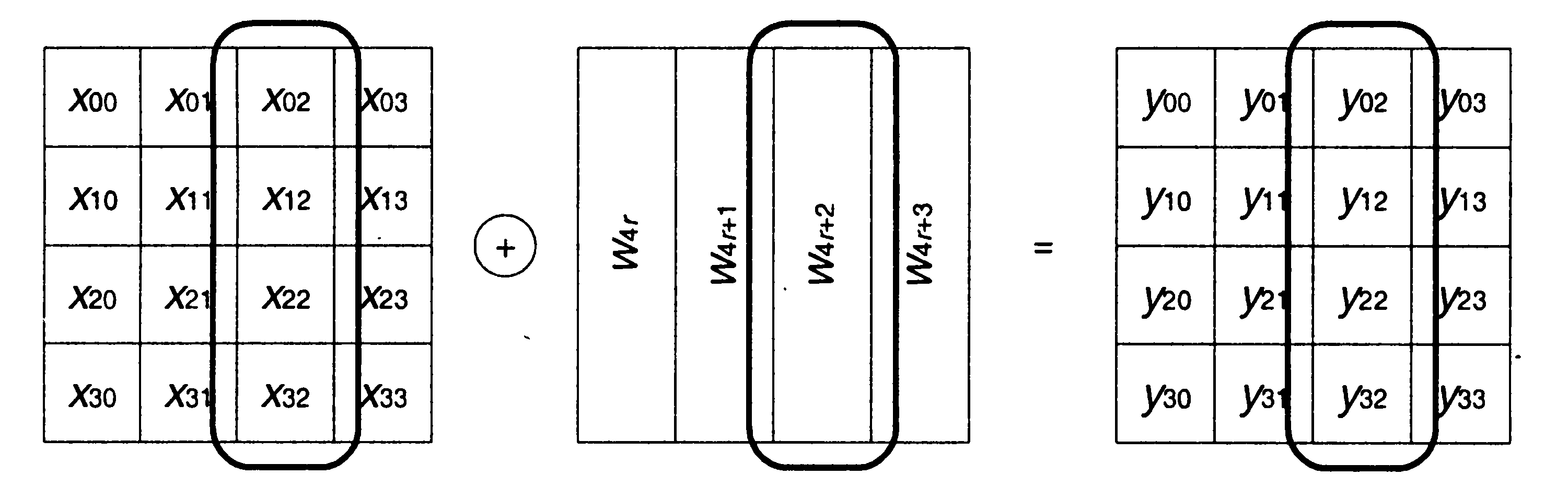




XOR teostamiseks kasutage kalkulaatorit

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| ai:   |  |  |  |  | | --- | --- | --- | --- | |  |  |  |  | |  |  |  |  | |  |  |  |  | |  |  |  |  | | Tulemus   |  |  |  |  | | --- | --- | --- | --- | |  |  |  |  | |  |  |  |  | |  |  |  |  | |  |  |  |  | |

1. **Lisage alamvõtmed W4..W7 kasutades AddRoundKey**



Selles punktis kasutage XOR arvutamiseks kalkulaatorit

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| x:   |  |  |  |  | | --- | --- | --- | --- | |  |  |  |  | |  |  |  |  | |  |  |  |  | |  |  |  |  | | W:  W4 W5 W6 W7   |  |  |  |  | | --- | --- | --- | --- | |  |  |  |  | |  |  |  |  | |  |  |  |  | |  |  |  |  | | y:   |  |  |  |  | | --- | --- | --- | --- | |  |  |  |  | |  |  |  |  | |  |  |  |  | |  |  |  |  | |

Esimene raund on läbitud