4.1.a) h(x)=(2x+1) mod 32. h(3)=(2-3+1)=7. 00111=7 the tool length is 0. estimate = 2°=1. h(1) = (2+1)=3 estimate = 20 = 1. 00011=3 the tail length is 0. 'hc4) = (2.4+1) =9. estimate = 2°=1 01001=9 -> thail dength is 0 h(6) = (2.6+1)=13 estimate = 20 = 1. 01101=13 -> thail dength is 0 Mcs)=(2-5+1)=11 estimate = 20=1 0101171 7 this length 0. h(9) = (29+1) =19 10011=19 -> thail leigth 0 estimate = 20=1 b) h(x)=(3x+7) mad 32 h(3) = (3.3+7) = 16 estimate = 24 = 16. 10000 = 16 -> trail leagth 4 h(1) = (3.1+7)=10 estimate = 1'=2. 0/0/0 =10 -> trail dougth 1 hc4) = (3-4+1) = 19 estimate = 20 = 1 10011 =19 -> thail length 0 n(6) = (3.6+7) = 25 Estimate = 2° = 1 11001=25 -) trail length 0 hcs)=13.5+7)=22 estimate = 21 = 2 10/10=22 -> +Wail length 1 h(9)=(3.9+7)=34 mod 32=2. 000/0=2. -) this length 1 estimate=2'=2.

the max that length for hix = (3x+7) is 4.

The estimate number of distinct elements

the max trial length is o.

the estimate number of distinct demonts

C) $h(x) = 4x \mod 32$ h(3) = 12 $01100 \rightarrow tind length 2$ estimate = $2^2 = 4$. h(1) = 4 $00100 \rightarrow tind length 2$ estimate = $2^2 = 4$. h(4) = 16 $10000 \rightarrow tind length 4$ estimate = $2^4 = 16$. h(6) = 24 $1000 \rightarrow tind length 3$ estimate = $2^3 = 8$.

h(s) = 20. $10100 \rightarrow thail flength 2$ estimate = $2^{2} = 4$. h(9) = 36 in mode 32 = 4. $00100 = 4 \rightarrow thal flength 2$ estimate = $2^{2} = 4$.

the max that length for h(x)=4x is 4.
The estimate number of distinct elements is 16.

4.2 a) h(6xct2) mod 32. h(4) = (6x4t2) = 26. 11010 = 26 $\rightarrow third length 1 estimate <math>2^{1} = 2$.

h(s) = 16xs+2 = 32 Mod 32=0. $000000 \rightarrow third$ length 0. estimate $2^{\circ} = 1$.

h(6) = (6x6 + 2) = 38 mod 32 = 6 $00110 \rightarrow \text{thinh length } 1$ estimate 2! = 2

 $h(7) = (42+2) = 44 \mod 52 = 12$. $01(00 = 12 \rightarrow \text{third denyth } 2 \text{ estimate } 2^2 = 4$. $h(6) = 62 \mod 32 = 30$.

11110 = 30 -> than length 1 estimate 2'=2.

h(15) = 92 mod 32 = 28. 11/06 = 28 -> thail length 2 estimate 22=4. The max thial length for hix)=(6xt2) is I the estimate humber of distinct elements is 4.

h) h(x)=12x+5) mood 32.

h(4)=13

01101 =13 -> trial length 0 estimate 2°=1

h(5)=15

01111 =15 -> trial length 0 estimate 2°=1

h(6)=(2x6+5)=17

10001=(7 -> trial length 0 estimate 2°=1

h(7)=(2x7+5)=19

10011=19 -> trial length 0 estimate 2°=1

h(6)=(2x1+5)=25

11001=25 -> trial length 0 estimate 2°=1

h(15)=()x15+5)=35 mod 32=3.

00011=3 -> thial length 0 estimate 2°=1

The max think length for hex)=(1xt5) is o The estimate number of distinct elements is 1.) h(x)=2x mod 32.

h(4) = 2x4=8 01000=8->thail length is 3, estimate 23=8.

h(S)=2x5=10 01010=10-) third length is 1 estimate 2'=2.

h(7)=2x7=14

01/10=14 > think dougth 12 1 estimate 2'=2

h(0) = 2x = 2010100 = 20 - 3 thial length is 2 estimate $2^2 = 4$

h(15)=2×15=30

11110=30 -> trial forth is 1 Estimate 2'=2

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The mox think deagth for hox)=2x is 3.
The estimate number of distinct demonts is 8