Computer Science & IT

Computer Networks

(CN)

IP address Subnetting, Supernetting

Lecture No. 2

By- Ravindra Sir

Topics to be Covered

Topic
IP address Subnetting, Supernetting

Unstoppable Indians: Stories to Ignite Student Motivation

Verghese Kurien – The Milkman of India Verghese Kurien (1921–2012) led Operation Flood (1970–1996), creating the world's largest dairy development program. As founder of the National Dairy Development Board, he devised a three tier cooperative model—village societies, district unions, and a national milk grid—linking 15 million rural farmers to urban markets. He introduced modern pasteurization, chilling centers, and transparent pricing. Milk production soared from 20 to over 50 million tonnes annually, boosting rural incomes and nutrition. Kurien's blend of engineering rigor and social vision transformed India into the global leader in milk production.

Unstoppable Indians: Stories to Ignite Student Motivation

Arogyaswami Paulraj – MIMO Wireless Innovator

Professor Arogyaswami Paulraj (b. 1944) invented MIMO (Multiple Input, Multiple Output) technology in 1992 at the Indian Institute of Science, Bangalore. He developed algorithms enabling multiple antennas at both transmitter and receiver ends to dramatically boost data rates and reliability. Through IIT Madras's technology transfer office, his patents paved the way for LTE and modern Wi Fi standards worldwide. Today's high speed mobile broadband networks rely on his work, and he has received numerous IEEE and governmental honors for revolutionizing wireless communications.

Unstoppable Indians: Stories to Ignite Student Motivation

Prafulla Chandra Ray – Father of India's Chemical Industry Dr. Prafulla Chandra Ray (1861–1944) founded Bengal Chemicals & Pharmaceuticals in 1892, India's first pharmaceutical company. After studying in Edinburgh, he returned to Calcutta to develop affordable, indigenous drug manufacturing using local raw materials. He pioneered formulations for compounds like calcium carbide and analgesics, drastically cutting import dependence. Ray also established advanced research facilities and mentored a generation of Indian chemists. His entrepreneurial spirit and scientific leadership laid the foundation for India's modern pharmaceutical and chemical sectors.

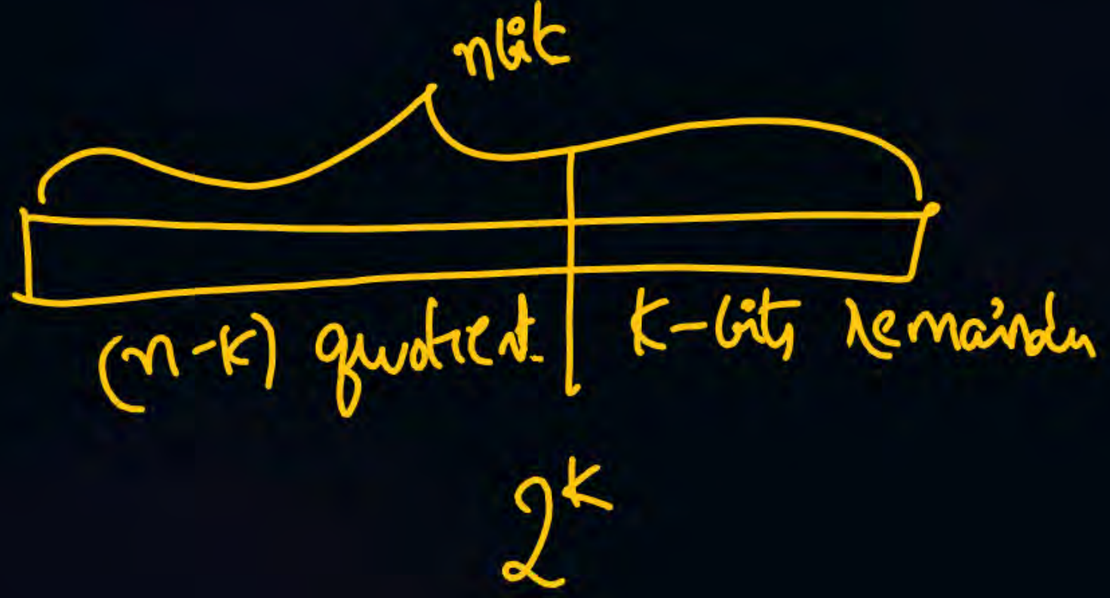
Unstoppable Indians: Stories to Ignite Student Motivation

P. K. Sethi – Jaipur Foot Inventor Dr. P. K. Sethi (1927–2008), an orthopedic surgeon at SMS Medical College, Jaipur, co invented the Jaipur Foot in 1969. Crafted from locally sourced rubber and wood, this low cost, flexible prosthesis replicates natural movement—allowing users to walk, squat, and run. Partnering with craftsman Ram Chander Sharma, Sethi developed a modular assembly method that rural artisans could produce. Distributed via a cost recovery model, over 1.5 million Jaipur Feet have been fitted globally, showcasing how frugal engineering and social innovation can transform millions of lives.

Unstoppable Indians: Stories to Ignite Student Motivation

Govindappa Venkataswamy – Aravind Eye Care Model Maker

(1918–2006) founded Aravind Eye Hospital in Madurai in 1976 to 'eradicate needless blindness.' He devised a high volume, low cost surgical model: standardized cataract procedures, factory style lens manufacturing, and a mixed patient paying system that subsidizes free operations. His franchise style expansion and rigorous training have restored sight to more than 5 million people and inspired sustainable healthcare solutions in dozens of countries. Professor Arogyaswami Paulraj (b. 1944) invented MIMO technology in 1992 at the Indian Institute of Science, Bangalore. He developed algorithms enabling multiple antennas at both transmitter and receiver ends to dramatically boost data rates and reliability. Through IIT Madras's technology transfer office, his patents paved the way for LTE and modern Wi Fi standards worldwide. Today's high speed mobile broadband networks rely on his work, and he has received numerous IEEE and governmental honors for revolutionizing wireless communications.



2^k

Binary 1011

Dec $1 \times 2 + 0 = 2 \times 2 + 1$

$= 5 \times 2 + 1$

$= 11$

1011

1 2 5 (11)

$1 \times 2 + 0 = 2$

101

$2 \times 2 + 1 = 5$

1011

$2 \times 5 + 1$

1101

$1 \times 2 + 1$

$3 \times 2 + 0$

$6 \times 2 + 1 = 13$ ✓

101010 (42)

$1 \times 2 + 0$ 10 21 $10 \times 2 + 1 = 21$

$2 \times 2 + 1$

$= 5 \times 2 + 0$

$21 \times 2 + 0 = 42$

10 10 10

10X2+1
= 21X2 + 0
= 42

1010111 (175)

10X2+1
= 21X2+1 = 43
43X2+1 = 87

87
87
174+1

Binary $0.1^{2^{-1}}$ 0.5

$0.1^{2^{-1}}1^{2^{-2}}$ 0.75

$0.1^{2^{-1}}1^{2^{-2}}1^{2^{-3}}$ =

RBR trick

$0.(101)$

$\frac{11}{2^4}$

$0.(1)$

$\frac{1}{2^1} = 0.5$

$0.(11)$

$\frac{3}{2^2} = 3/4 = .75$

0.101

$\frac{5}{2^3}$

$0.\overbrace{101101}^{45}$

$\frac{45}{2^5}$

RBR SIR PW

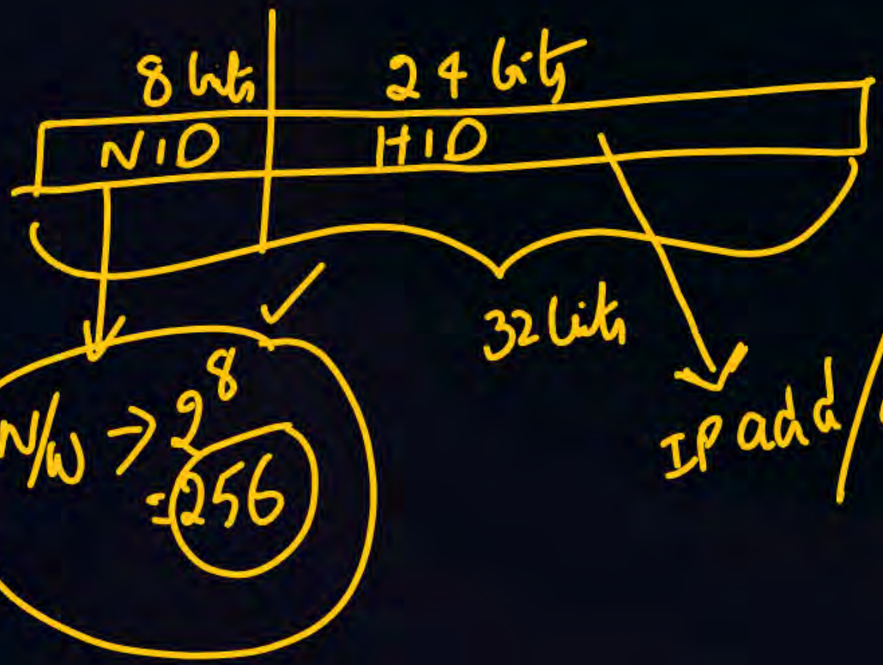
IP add :-

32 bits

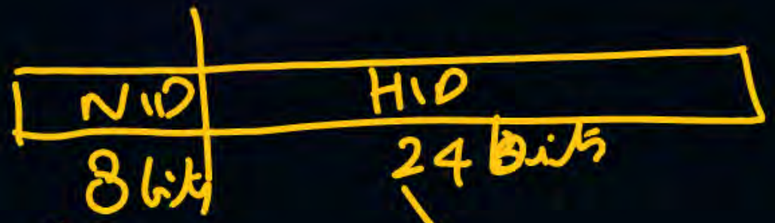
Initially ARPANET IP add :-

HYD

10,000 N/w



10 - K
20 - M
30 - G

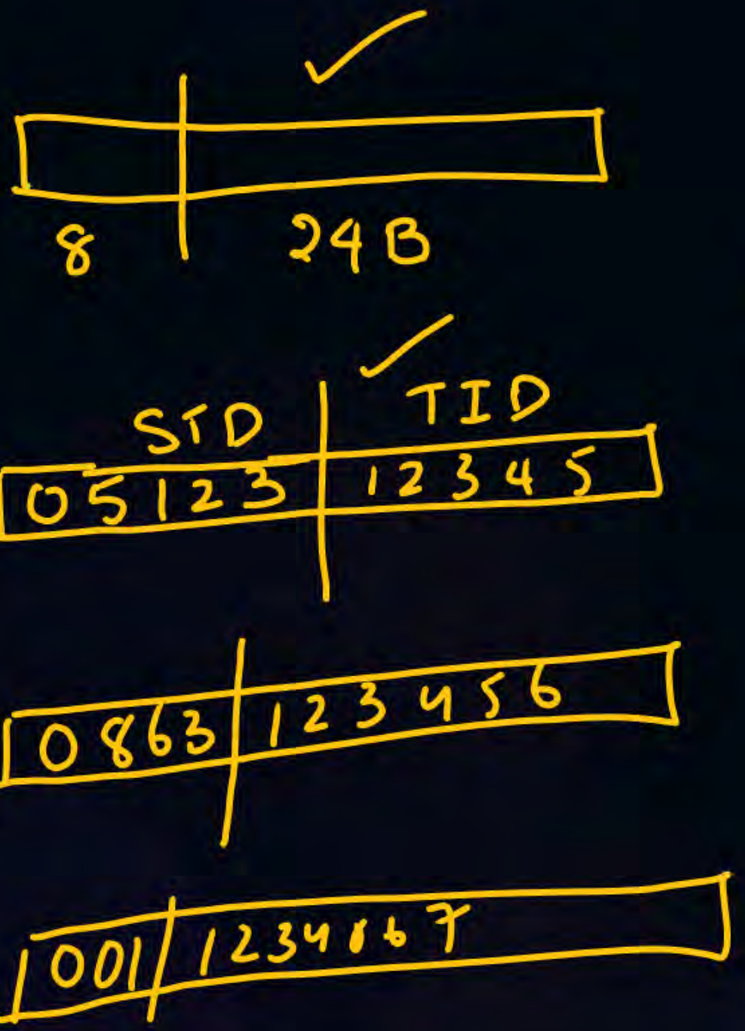


2^8 N/W $\qquad$ 2^{24} = 16 millions

Disadv :- 1) Too few N/W (256)

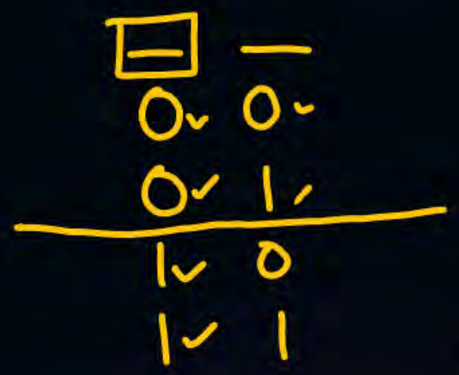
2) Too many IP address/N/W (16 million)

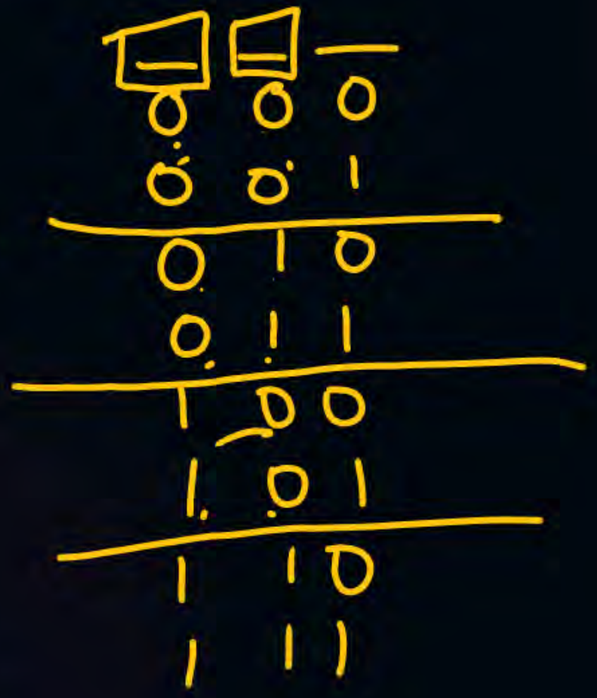
NASA, pentagon → 2^{24} IP

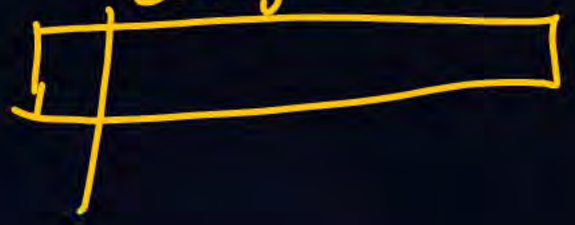


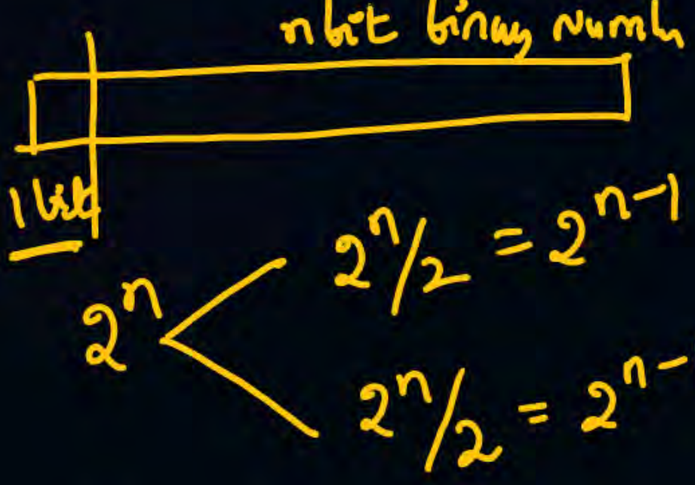
IP

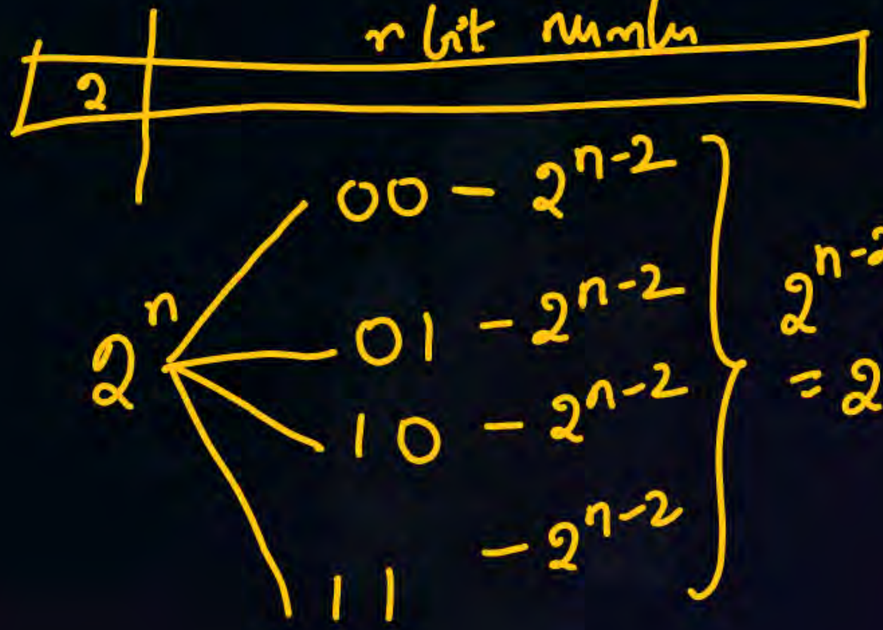
Classful classification

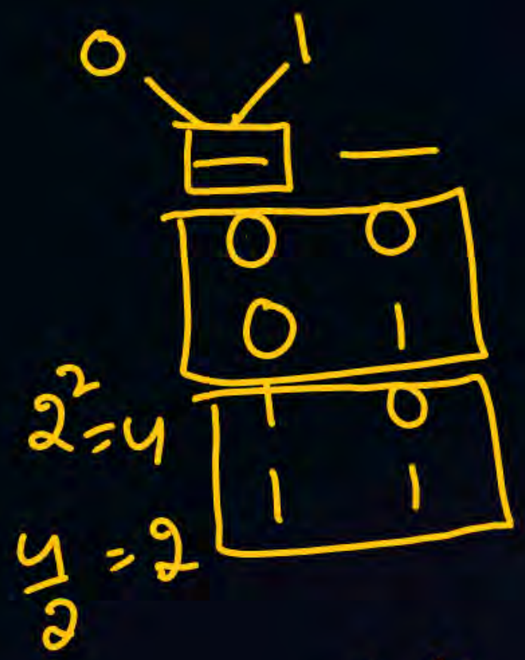


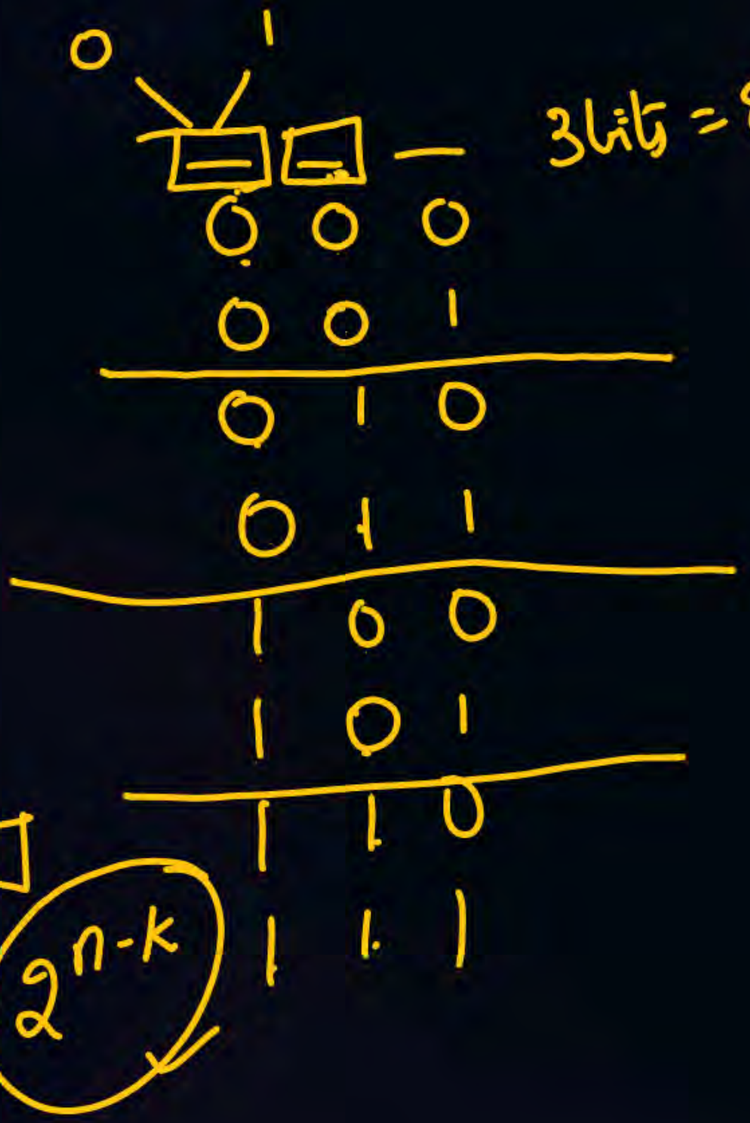



Binary number


n bit binary numb
1 bit
2^n
$2^n/2 = 2^{n-1}$
$2^n/2 = 2^{n-1}$

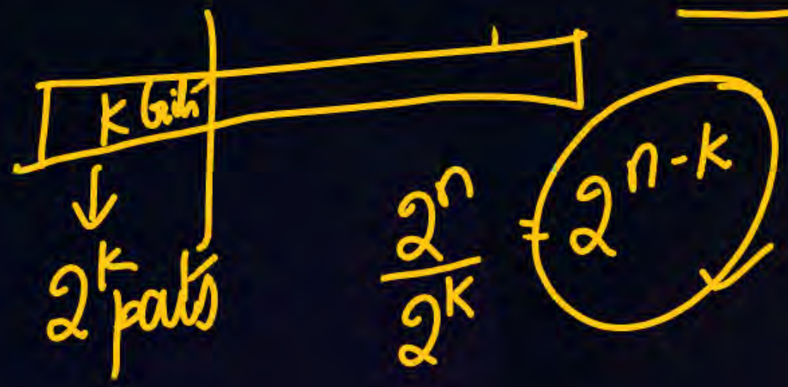

n bit number
2
2^n
00 - 2^{n-2}
01 - 2^{n-2}
10 - 2^{n-2}
11 - 2^{n-2}
$2^{n-2} \times 4 = 2^n$

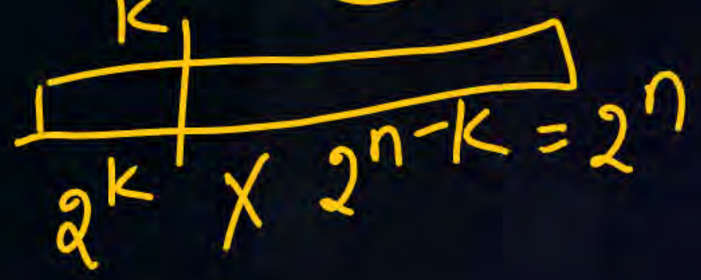


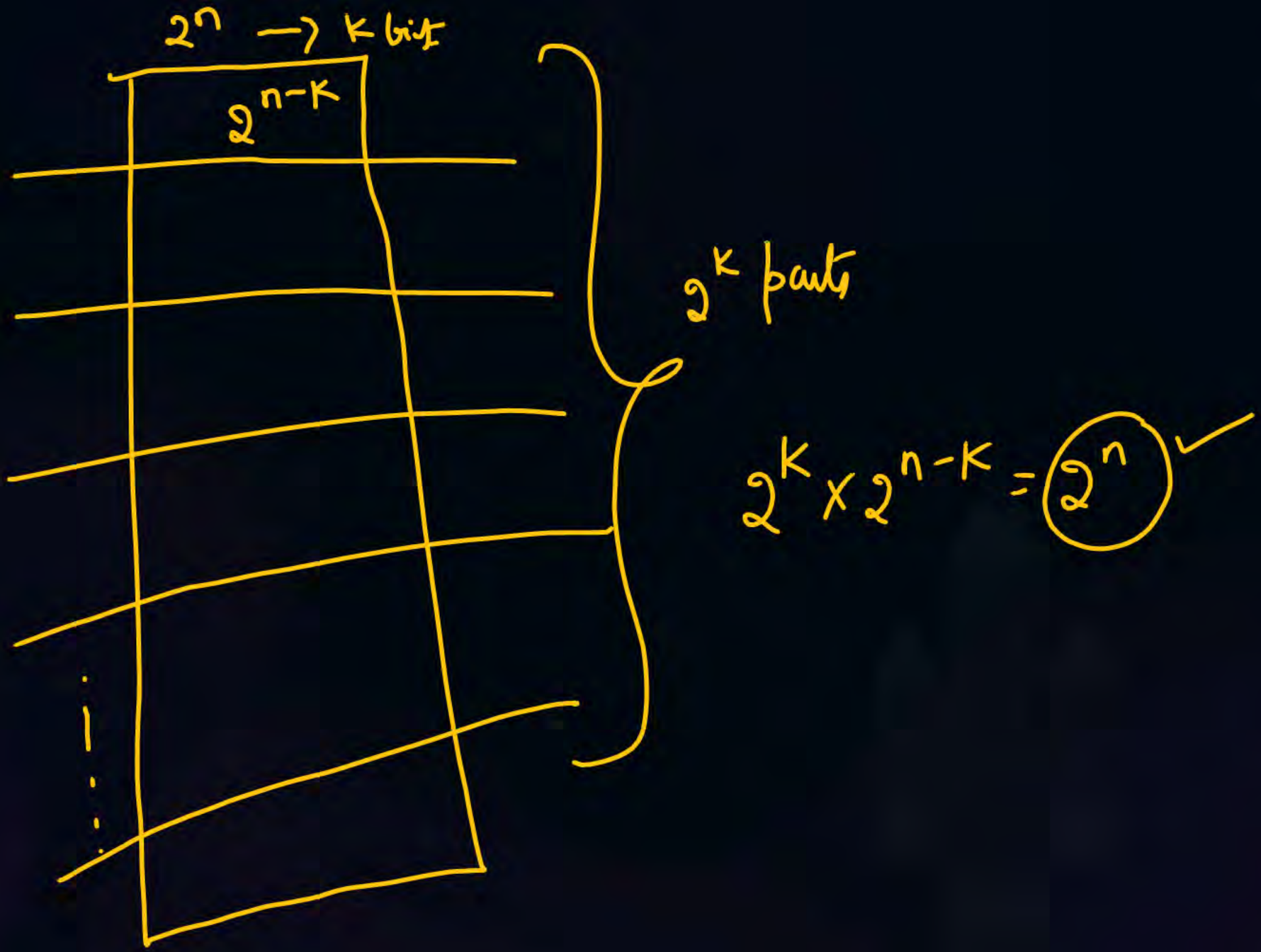


Parts 2^k

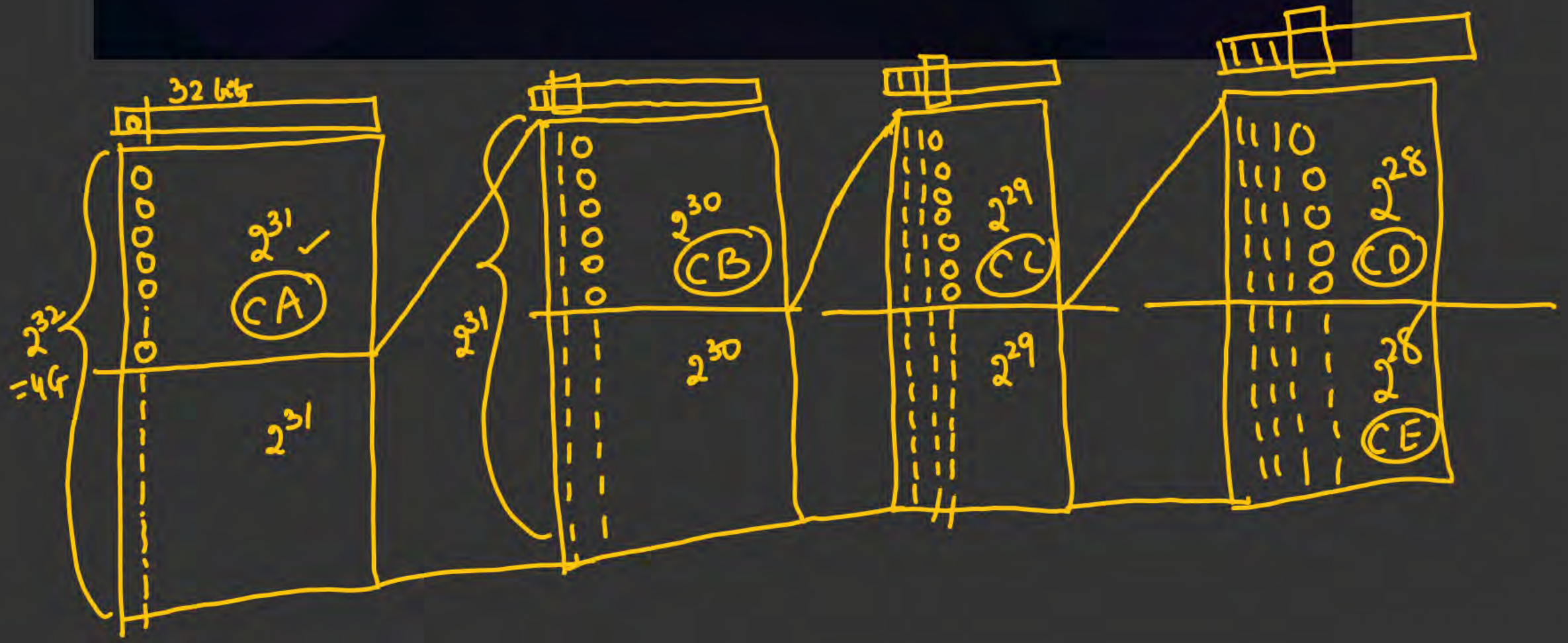
$\frac{2^n}{2^k} = 2^{n-k}$

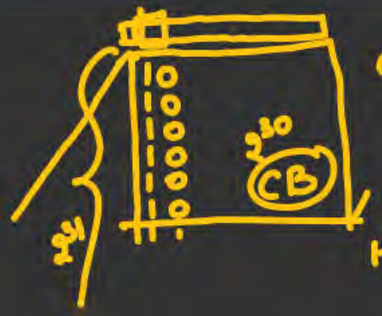





2^n → k bit
2^{n-k}
2^k parts
$2^k \times 2^{n-k} = 2^n$

IP addrn has 32 bits


32 bits
2^{31}
CA
2^{31}
2^{32}
$= 4G$
2^{30}
CB
2^{30}
2^{31}
2^{29}
CC
2^{29}
2^{28}
CD
2^{28}
CE



Class B always starts with '10'

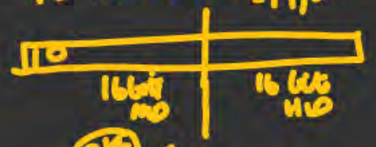
How many n/ws are possible in CB = 2^{14}

10 000000 – 128
10000001
10000010
10000011
⋮
10 111111 – 128+63 = 191

a.b.c.d

(128-191) → 64

CB



2^{14}

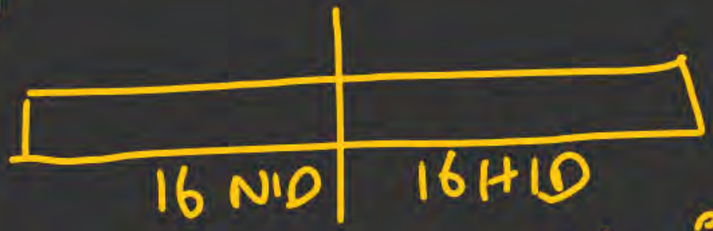
(128-191) – 64

64×2^8

$2^6 \times 2^8$

$= 2^{14}$ n/ws

How many IP addrs are present in a N/w of class B = 2^{16} = 64K

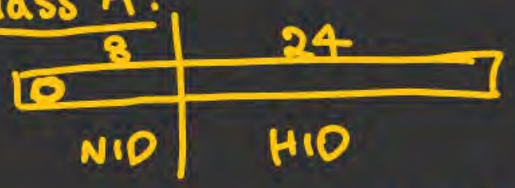


How many hosts are possible in a N/w of CB?

$2^{16} - 2$

later

Class A :-



2^7 → N/w are possible in Class A

00000000 - I n/w - 0 ✗ → special

00000001 - II

00000010 - III

} 126

0 1111111 — last — 127 ✗ → special

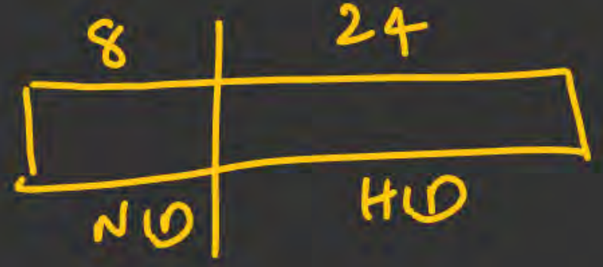
1 — 1

11 — $2^2-1=3$

111 — $2^3-1=7$

1111 — $2^4-1=15$

1111111 — 2^7-1 = 127



How many networks are there in CA? 126

How many IP addresses are in a N/w of CA? $2^{24}=16m$

How many hosts are present in a N/w of CA? $2^{24}-2=(16m-2)$ ↓ later ✓

IP 32 bit number

10111101.11011101.10111100.01100011

Dotted decimal number system

a.b.c.d → a, b, c, d → Decimal number

$2^8 \times 2^8 \times 2^8 \times 2^8$

$= 2^{32}$

189.221.188.115

2^8 2^8 2^8 2^8

10000010.00000011.00000111

128 . 2 . 3 . 7

→ Dotted decimal number System

8 bit 8 bit 8 bit 8 bit

THANK - YOU