

Multilevel Cache System

- L1, L2 – Level Cache
- Inclusion / Exclusion Policies

Contact :- 7899312226

VISHVADEEP GOTHI SIR

AIR 19

in GATE 2010



ME from IISc Bangalore



13+ Years of Teaching Experience,
9+ Years in GATE/IES



Subjects Taken:
Computer Organization,
Data Structure, ✓
Coding Interview Problems

VDEEP10

Get **10%** Off
on Unacademy
Plus Subscription

Vishvadeep Gothi

- **GATE Ranks:**
 - 682 (2009) – 3rd year
 - 19 (2010) – 4th year
 - 119, 440 etc.
- **Education:**
 - ME from IISc Bangalore
 - Mtech from BITS-pilani in Data Science
- **Work:**
 - 13 Year Teaching Experience
 - 9+ in GATE/IES (GateForum, Gate Academy, ACE)
 - Worked in Cisco, Audience Communication
- **Professions:**
 - Freelance S/W developer
 - Educator
 - CrossFit Trainer



Vishvadeep Gothi

Teaches in GATE & ESE

Following

- 13 years of experience, 9+ years for GATE/ESE. - ME from IISc, MTech from BITS-Pilani - Use code VDEEPLIVE for unacademy plus subscription

481k Watch mins

389k Watch mins (last 30 days)

944 Followers

120 Dedications



10 - 05

12 - PyQ

4 - CoA Revision

https://unacademy.com/@vd_gothi

USE CODE

VDEEP10

TO GET
MAX DISCOUNT ON

plus
Subscription

NEW BATCH ON UNACADEMY PLUS GATE- CS/IT



VISHVADEEP
GOTHI



MALLESHAM
SIR



SATISH
YADAV



KHALEEL
SIR



PANKAJ
MISHRA

GATE WARRIORS
BATCH

STARTS FROM :- 08 SEP, 2020

ICONIC



PLUS



ESE Mains Q&A



Personal Coach



Live Classes



Test Series



Structured Schedule



Unlimited Practice



Expert's Guidelines



Study Planner

GATE & ESE

PLUS  ICONIC 

6
MONTHS

SAVE 33%

₹3,333/mo

12
MONTHS

SAVE 58%

₹2,083/mo

24
MONTHS

SAVE 75%

₹1,250/mo

GATE & ESE

PLUS  ICONIC 

6
MONTHS

Not available
with ICONIC

12
MONTHS

SAVE 25%

₹3,750/mo

24
MONTHS

SAVE 50%

₹2,500/mo

VDEEP10

₹22,500
for 12 months



Proceed to
payment

VDEEP10

₹40,500
for 12 months



Proceed to
payment

Recap

Are you ready?

Cache → Tag,
write

Mapping →

- Direct, set-associative, fully ass.
- H/w imp.
- Block replacement
- Types of miss
- Miss penalty

Goals of Using Cache Memory

USE CODE

VDEEP10

TO GET
MAX DISCOUNT ON



Goals of Using Cache Memory

1. Minimize Access Time → Smaller cache
 2. Maximize Hit Rate → Larger Cache
 3. Minimize Miss Penalty
- Multi-level cache

Multibank, non-blocking cache

USE CODE

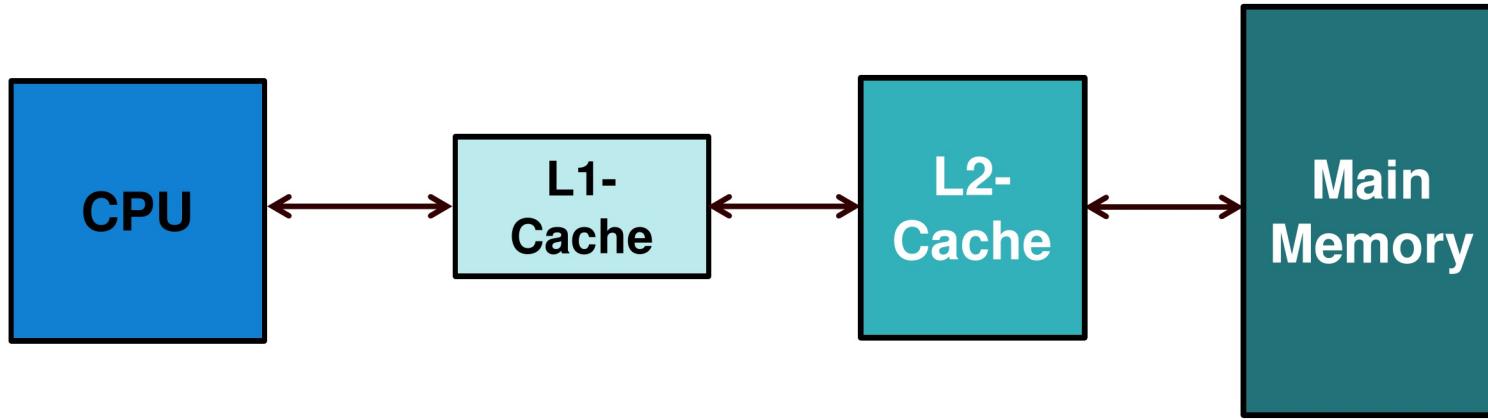
VDEEP10

TO GET
MAX DISCOUNT ON



Ph:- 7899312226

Multilevel Cache



USE CODE

VDEEP10

TO GET
MAX DISCOUNT ON



T_{avg} in Multilevel Cache

1. Simultaneous Access

$$T_{avg} = H_1 * t_1 + (1-H_1) \left[H_2 * t_2 + (1-H_2) t_{mm} \right]$$

2. Hierarchical Access

$$\begin{aligned} T_{avg} &= H_1 * t_1 + (1-H_1) \left[H_2 * (t_1 + t_2) + (1-H_2) (t_1 + t_2 + t_{mm}) \right] \\ &\text{or} \\ &= t_1 + (1-H_1) \left[t_2 + (1-H_2) t_{mm} \right] \end{aligned}$$

USE CODE

VDEEP10

TO GET
MAX DISCOUNT ON



Contact:- 7899312226

Cache Inclusion Policies

1. Inclusion Policy
2. Exclusion Policy

USE CODE

VDEEP10

TO GET
MAX DISCOUNT ON



Inclusion Policy

The content of L1 cache is present in L2 level cache also

USE CODE

VDEEP10

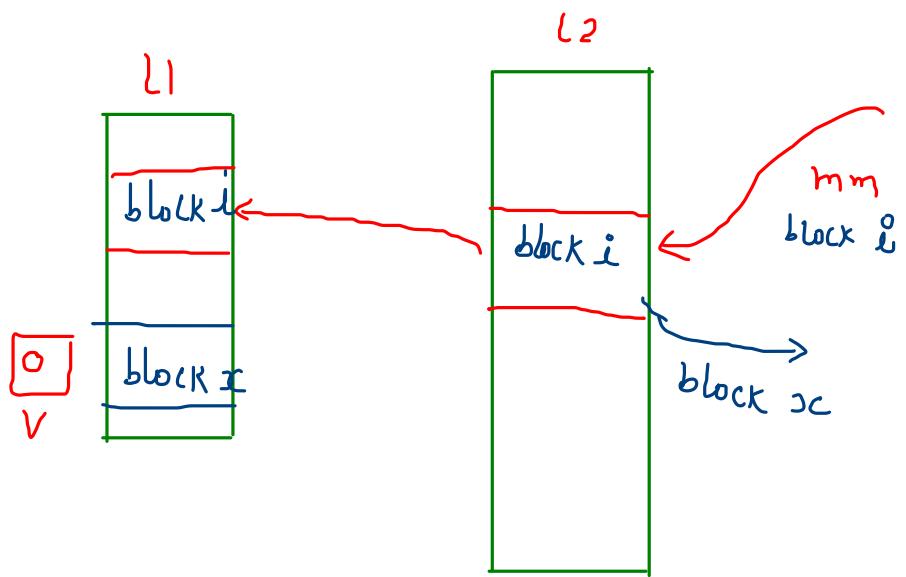
TO GET
MAX DISCOUNT ON



Inclusion Policy

for read operation

Scenario	Operation
Hit in L1	CPU gets content from L1
Miss in L1 & Hit in L2	copy a block from L2 to L1. & if a block is evicted from L1, then no participation of L2.
Miss in L1 & L2 Both	Copy the block from mm to L1 & L2 both. if a block is evicted from L2 then send back invalidation to L1.



Exclusion Policy

The content of L1 cache is not present in L2 level cache also

USE CODE

VDEEP10

TO GET
MAX DISCOUNT ON



Exclusion Policy \Rightarrow L2 is called as \Downarrow Victim Cache.

for read only

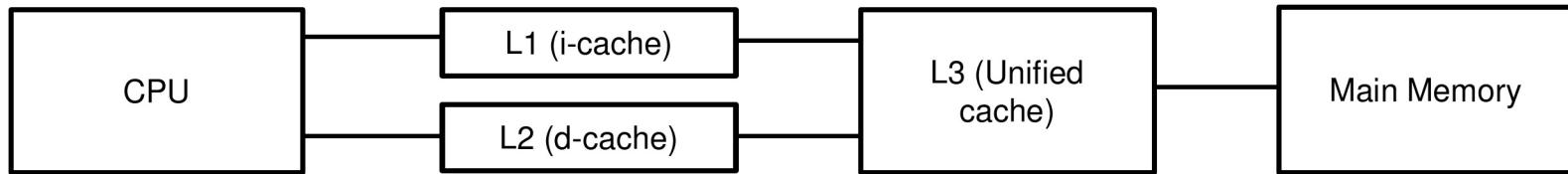
Scenario	Operation
Hit in L1	CPU gets content from L1
Miss in L1 & Hit in L2	Move a block from L2 to L1, evicted block from L1 is moved to L2.
Miss in L1 & L2 Both	Copy a block from mm to L1 only, evicted block from L1 is moved to L2.

Value Inclusion Policy:-

value of blocks in L1 & in L2 should be same.

Practice Question GPK 1

The multilevel memory hierarchy is given.



The hit ratio of L1, L2, L3 and main memory are 0.8, 0.9, 0.95 and 1.0 respectively. The access times of respective memories are 10ns, 10ns, 50ns and 500ns. Among total memory references 60% of them are for data.

1. Average memory access time for only instructions access
2. Average memory access time for only data access
3. Average memory access time

$$\begin{aligned} \textcircled{1} \quad t_{\text{avg init}} &= t_1 + (1-H_1) (t_3 + (1-H_3) t_{mm}) \\ &= 10 + 0.2 [50 + 0.05 * 500] \\ &= 25 \text{ nsec} \end{aligned}$$

$$\begin{aligned} \textcircled{2} \quad t_{\text{avg data}} &= t_2 + (1-H_2) (t_3 + (1-H_3) t_{mm}) \\ &= 10 + 0.1 [50 + 0.05 * 500] \\ &= 17.5 \text{ nsec} \end{aligned}$$

$$\textcircled{3} \quad t_{\text{avg}} = 0.6 * 17.5 + 0.4 * 25 = \underline{\underline{20.5 \text{ nsec}}}$$

SCHEDULE

PIONEER BATCH IN COMPUTER SCIENCE

TIME:
08:30-10
AM
SUBJECT:
CN



PANKAJ MISHRA

TIME:
04:30-05:30
PM
SUBJECT:
TOC



MALLESHAM DEVASANE

TIME:
06-07 PM
SUBJECT:
COA



VISHVADEEP GOTHI

TIME:
07:30-09
PM
SUBJECT:
DM



SATISH YADAV

← Select a payment method

Credit/Debit Card

Card number

Expiry date (MM/YY)

CVV

Name on card

Save card details securely

Pay ₹25,000

EMI

EMI (Credit cards)

No cost EMI options available

Net Banking



SBI



ICICI



HDFC



AXIS



KOTAK

3-months EMI

₹7,500 per month

6-months EMI

₹3,750 per month

9-months EMI

₹2,500 per month

12-months EMI

₹1,875 per month

EMI value

₹22,500

Interest charged by bank

₹1660

No cost EMI discount

- ₹1660

Total amount payable

₹22,500

Next

GATE & ESE subscription

12 months

Valid till 7 May, 2021

Change duration

VDEEP10

Subscription fee

₹19,068

SGST

₹1,716

CGST

₹1,716

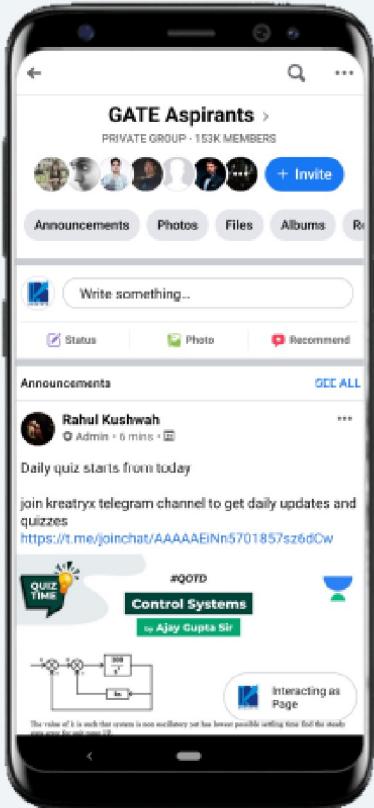
Total (incl. of all taxes)

22,500



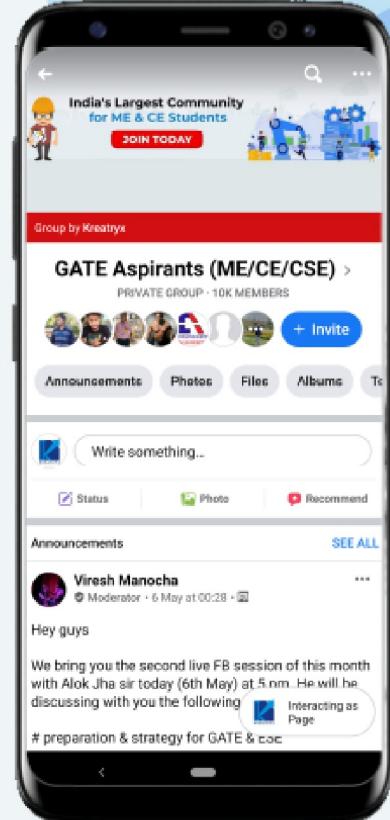
GATE Aspirants

150K+ Members



GATE Aspirants (ME,CE,CSE)

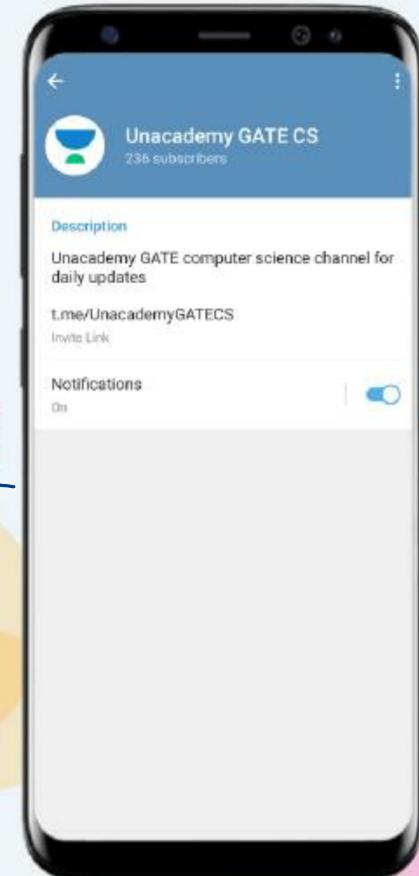
10K+ Members



@kreatryx.official



[**https://t.me/UnacademyGATECS**](https://t.me/UnacademyGATECS)



India's No. 1 Study Channels

Kreatryx GATE
EE,ECE,IN



Unacademy GATE
ME,PI,XE



Unacademy
GATE CE



Unacademy
GATE Telugu



✓ Unacademy
SSC JE



Unacademy
Computer Science



Unacademy GATE
Questions



Electrical
Junction



Unacademy
Engineering
Foundation



Engineering
Pathshala





Happy Learning

Thank You