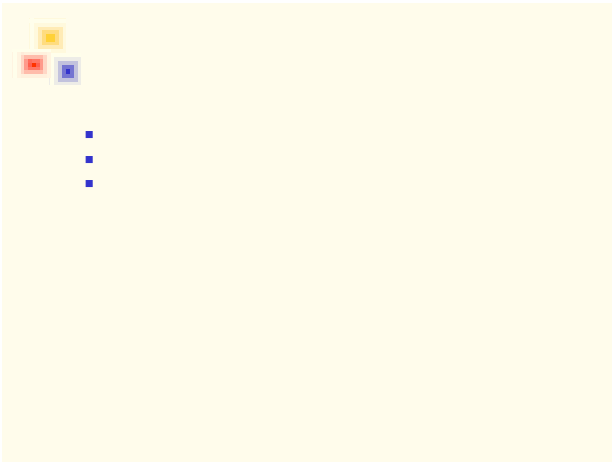

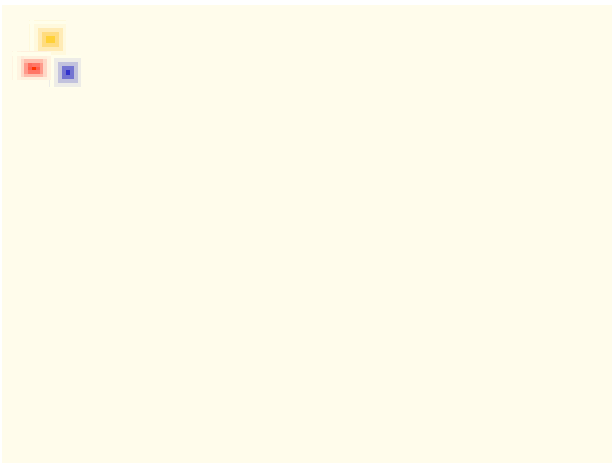

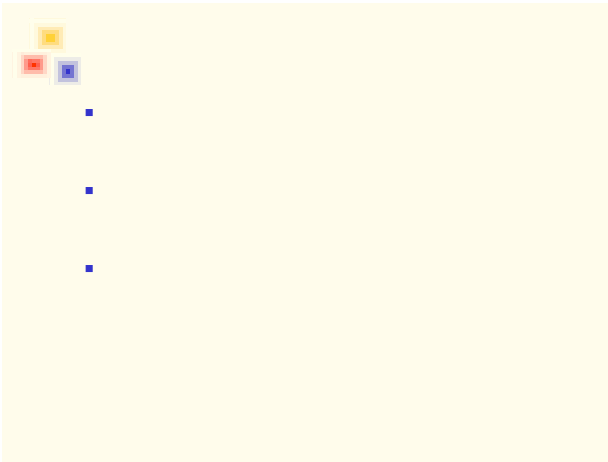

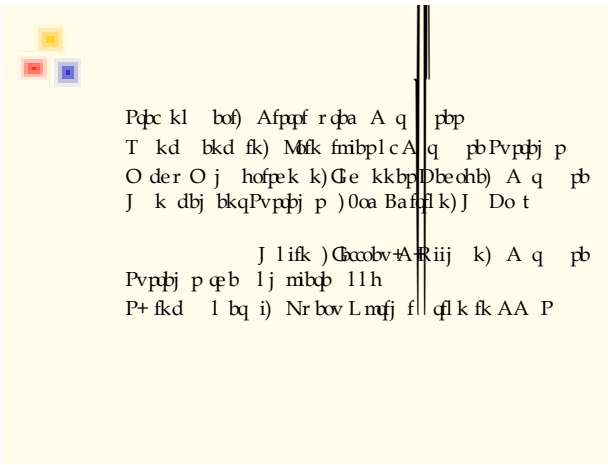
Pqbc kl bof) Afpqpf r qbpa A q pbp
T kd bkd fk) Mbfk fmibpl c A q pb Pvpqbj p
O der O j hofpe k k) Cle kk bp Dbe ohb) A q pb
J k dbj bkq Pvpqbj p) 0oa Ba fq fl k) J Do t
J l ifk) Gbccobv+A+Riij k) A q pb
Pvpqbj p qe b l j mibqb l l h
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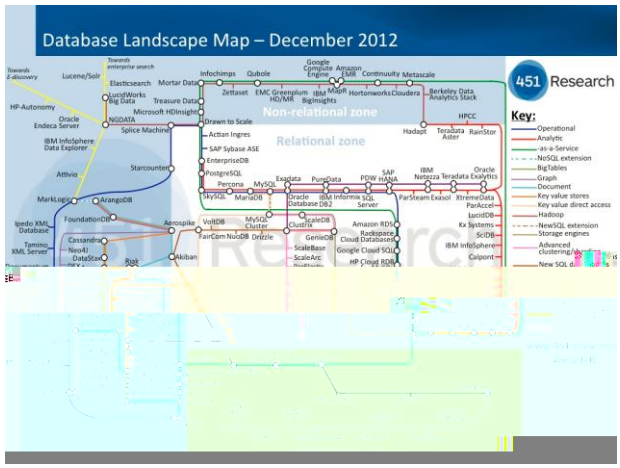
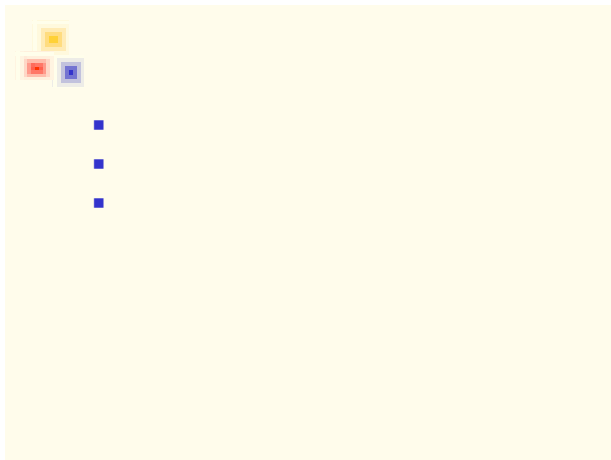
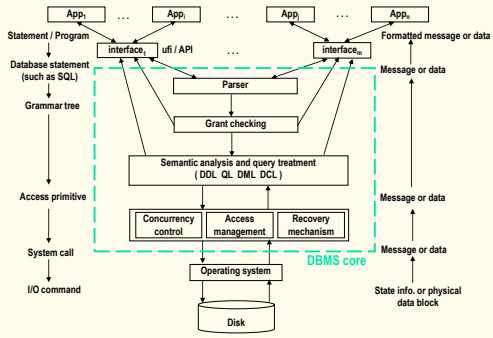
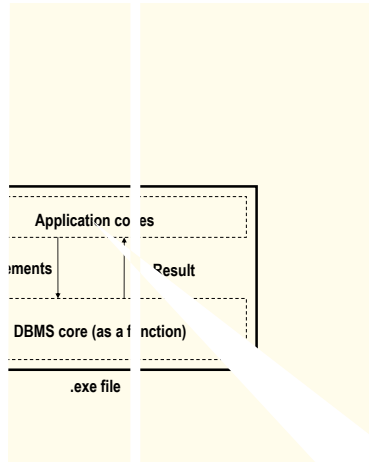
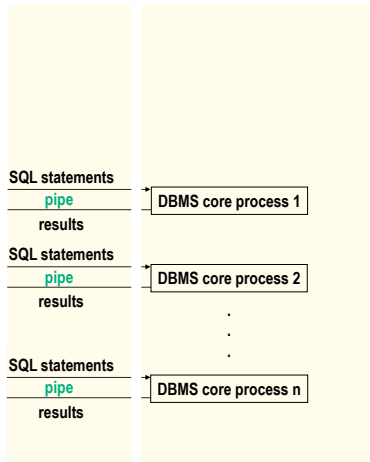
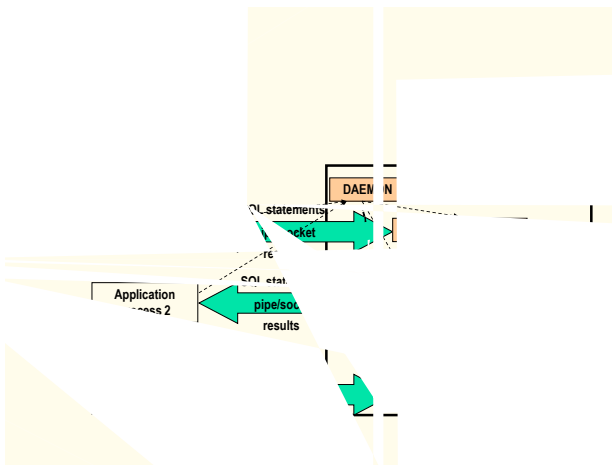

Database Landscape Map – December 2012
451 Research
Key:
Non-relational zone
Relational zone
Operational
Analytic
as-a-Service
NoSQL extension
BigTables
Graph
Document
Key value stores
Key value direct access
Hadoop
NewSQL extension
Storage engines
Advanced clustering/sh
New SQL d
Lucene/Solr
Elasticsearch
Mortar Data
Infochimps
Qubole
Google Compute Engine
Amazon EMR
Continuuity
Metascale
Zettaset
EMC Greenplum HD/MR
IBM BigInsights
MapR
Hortonworks
Cloudera
Berkeley Data Analytics Stack
HP-Autonomy
Oracle Endeca Server
LucidWorks Big Data
Treasure Data
Microsoft HDInsight
NGDATA
Splice Machine
Drawn to Scale
Actian Ingres
SAP Sybase ASE
EnterpriseDB
PostgreSQL
HPCC
Hadapt
Teradata Aster
RainStor
IBM InfoSphere Data Explorer
Attivio
Starcounter
MarkLogic
ArangoDB
Persona
MySQL
Exadata
PureData
PDW
SAP HANA
IBM Netezza
Teradata
Oracle Exalytics
MariaDB
Oracle Database
IBM Informix
DB2
SQL Server
ParStream
Exasol
XtremeData
ParAccel
LucidDB
Kx Systems
SciDB
IBM InfoSphere
Calpont
Ipedo XML Database
FoundationDB
Aerospike
VoltDB
FairCom NuoDB
MySQL Cluster
Drizzle
ScaleDB
Clustrix
GenieDB
Amazon RDS
Rackspace Cloud Databases
Google Cloud SQL
HP Cloud RDS
ScaleBase
ScaleArc
Cassandra
Neo4j
DataStax
Akiban
Redis
Tamino XML Server

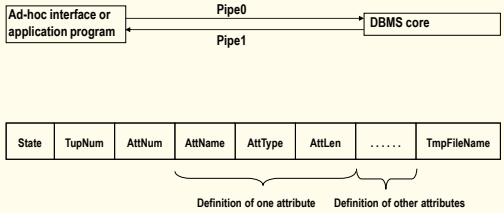



App1
Appi
Appj
Appn
Statement / Program
interface1
ufi / API
interfacem
Formatted message or data
Database statement (such as SQL)
Message or data
Parser
Grammar tree
Grant checking
Semantic analysis and query treatment (DDL QL DML DCL)
Access primitive
Concurrency control
Access management
Recovery mechanism
Message or data
System call
Message or data
DBMS core
Operating system
I/O command
State info. or physical data block
Disk


Application co es
ments
Result
DBMS core (as a f nction)
.exe file


SQL statements
pipe
results
DBMS core process 1
SQL statements
pipe
results
DBMS core process 2
SQL statements
pipe
results
DBMS core process n


DAEM N
Application
pipe/soc
results


Ad-hoc interface or application program
Pipe0
Pipe1
DBMS core

State
TupNum
AttNum
AttName
AttType
AttLen
.....
TmpFileName
Definition of one attribute
Definition of other attributes

R1

Site1

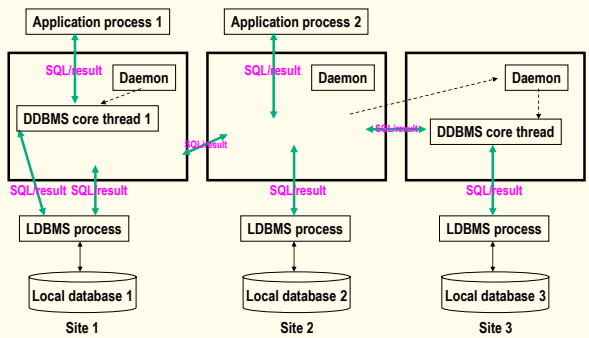
R2

Site2

q pfqb)O

Colj O)O

TebobO+: O+



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Date	Store	State	Class	Sales
3/1/96	32	NY	A	6
3/1/96	36	MA	A	9
3/1/96	38	NY	B	5
3/1/96	41	CT	A	11
3/1/96	43	NY	A	9
3/1/96	46	RI	B	3
3/1/96	47	CT	B	7
3/1/96	49	NY	A	12

K	K

A	B	C

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- lc lhc

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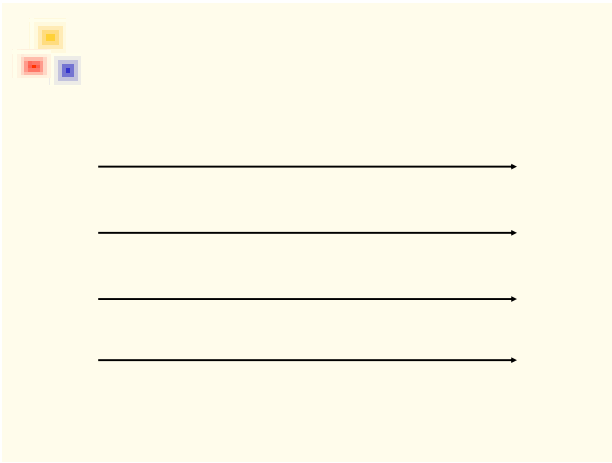
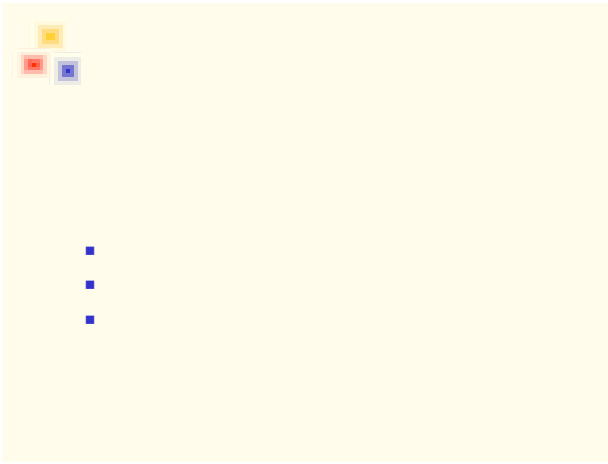
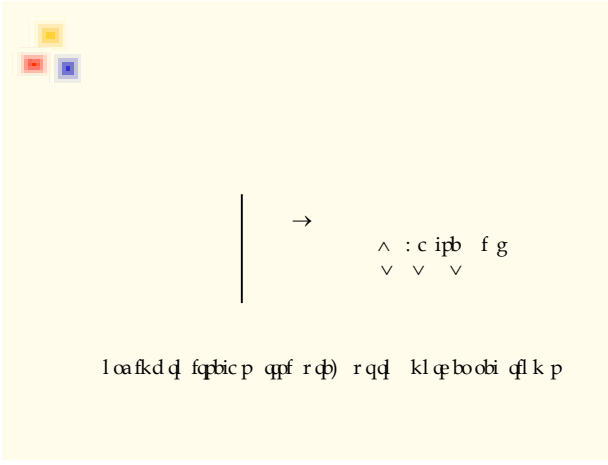
- qpf r qbe pqeb e f obi qfl k t fqe d æ d a e lhc



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loafkdql fqpbicp qpf rqb) rqql klqeboobi qflkp

abofsba col j QB> E BO pco dj bkq qfl k+

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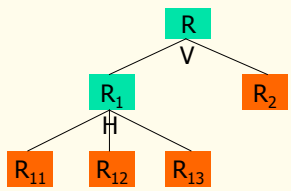

fkcloj qflkefafkd j bqpla

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To understand user's requirements, we

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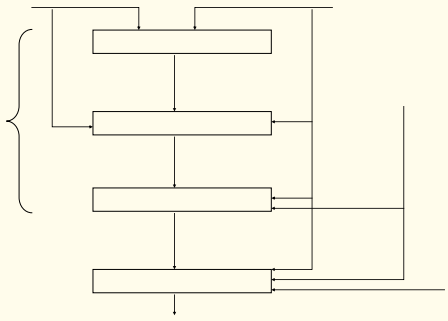
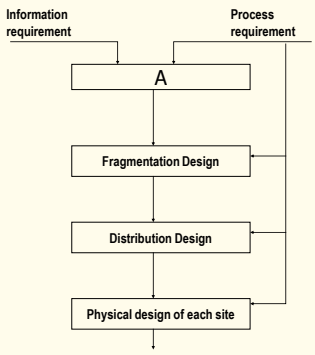
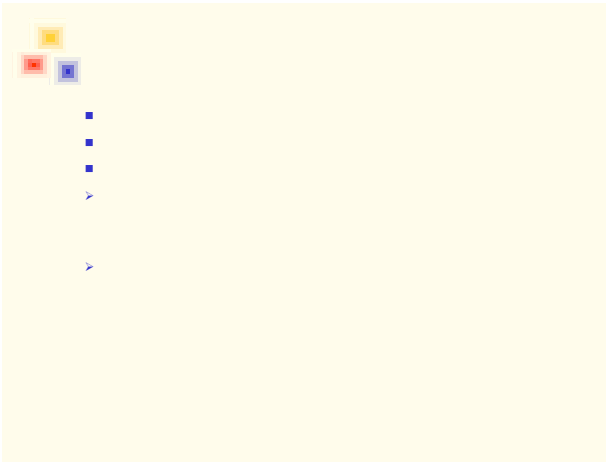
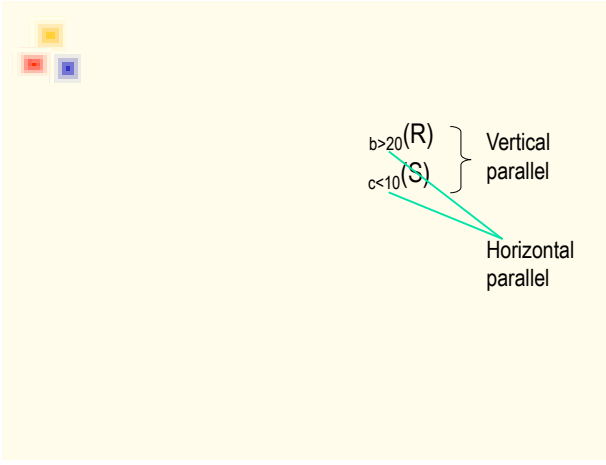
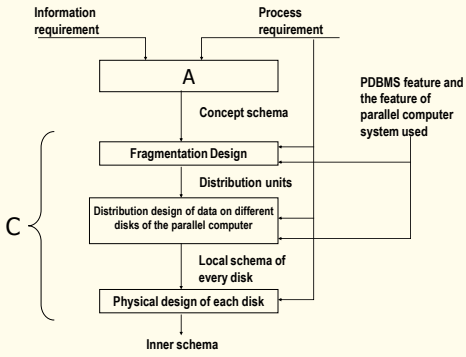



Information requirement
Process requirement
A
Fragmentation Design
Distribution Design
Physical design of each site




b>20(R)
c<10(S)
Vertical parallel
Horizontal parallel



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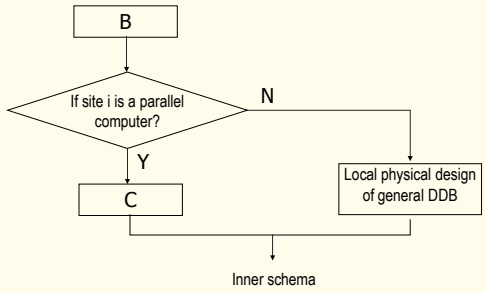
B
If site i is a parallel computer?
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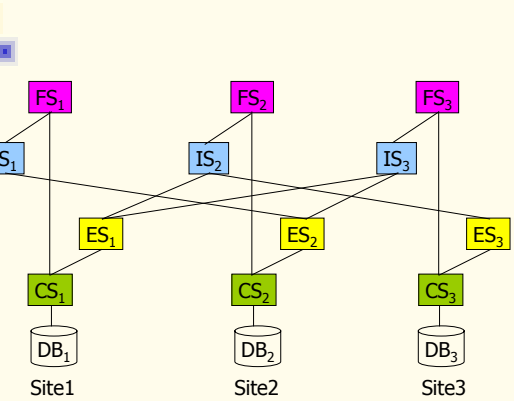
Y
C
Local physical design of general DDB
Inner schema


FS1
FS2
FS3
IS1
IS2
IS3
ES1
ES2
ES3
CS1
CS2
CS3
DB1
DB2
DB3
Site1
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Fqpj fk cr k qfl k fpql qp kpdbo qe b r pbo pl mbo qfkd

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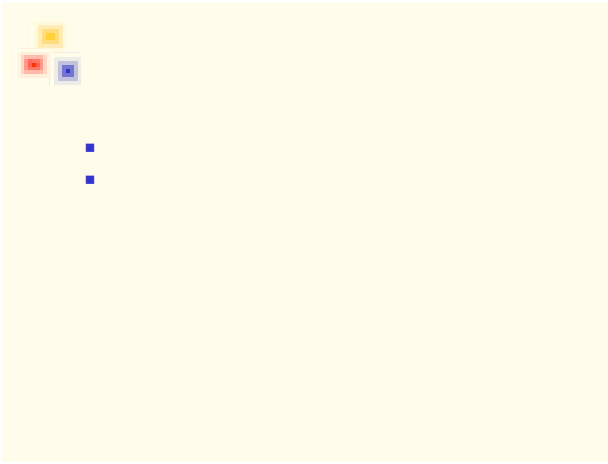

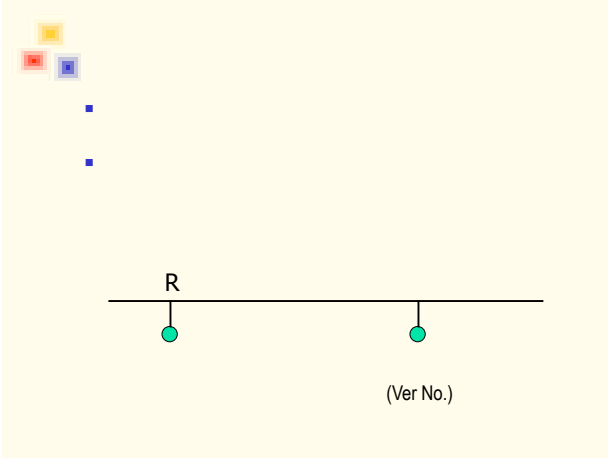
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(Ver No.)

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r pbo r pfkd Abcfkb Pvkl kvj "

Lkiv e s b L gb q j b pb o e L gb q j b fk

r pbo Rpbo l k r oobkq pfqb+

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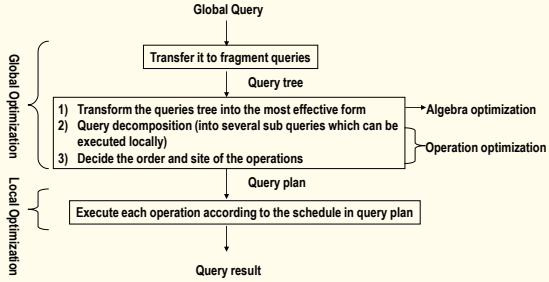
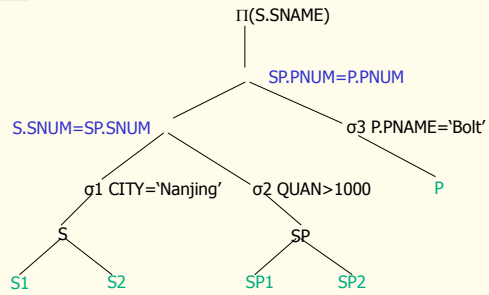
- Qe b dl i fpql d fk qe b obpr iql c r pbo p

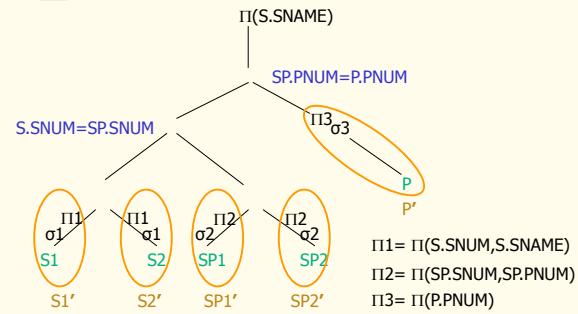


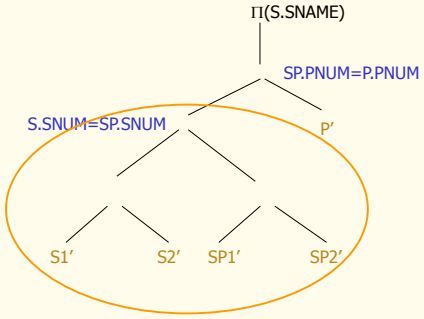
P : IQ : kgfkd

P : IQ : Pe kde f

IQ : kgfkd
M > J B: l iq







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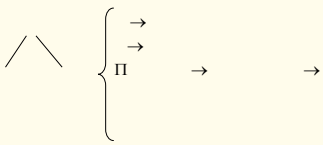

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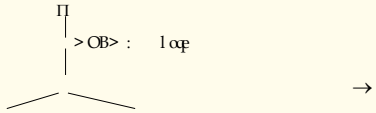

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qpf r qbp fk C) ka qe bob ob l kiv B p qpf r qbp fk
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C) ka qe bob ob l kiv B p

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σ B σ σ
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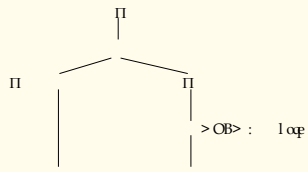

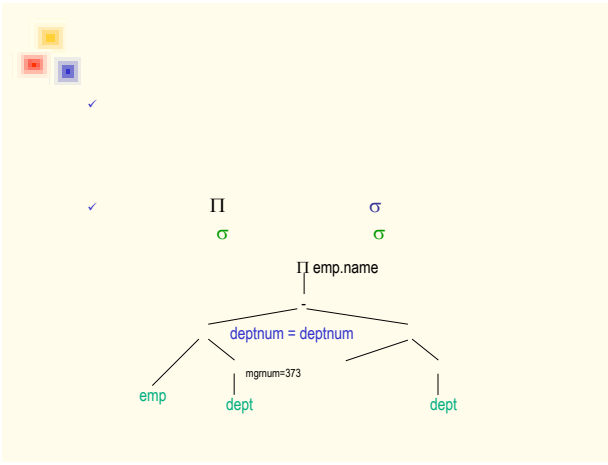
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deptnum = deptnum
mgrnum=373
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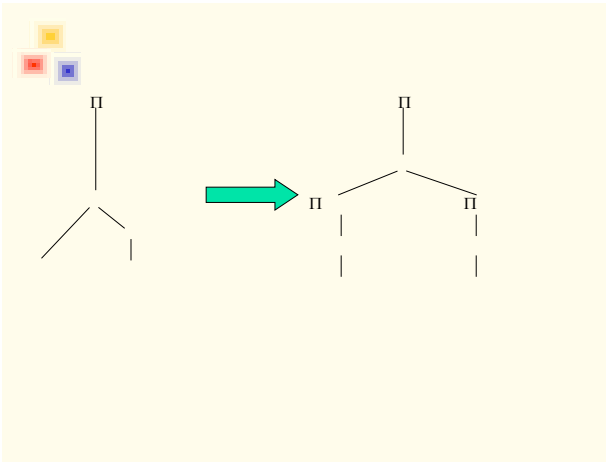
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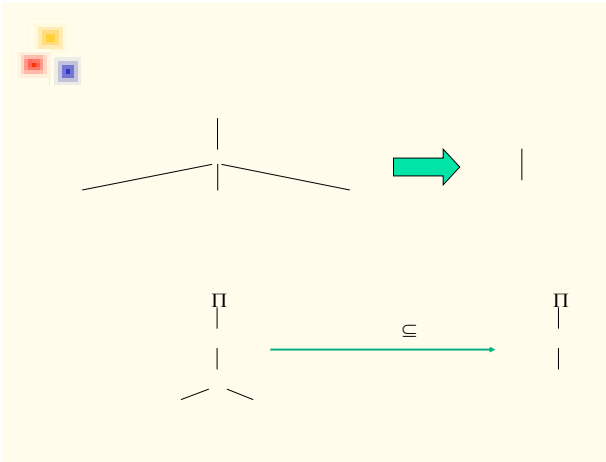
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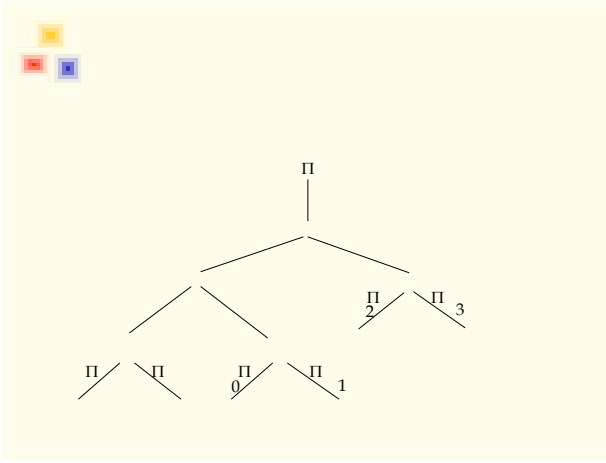
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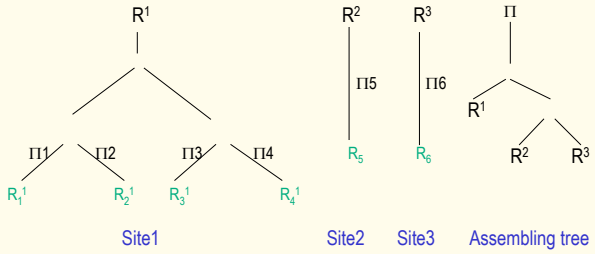

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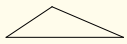

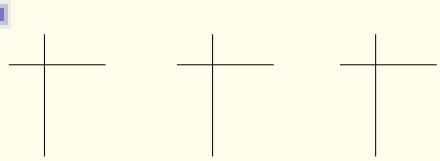

O: O ——— P: P O: ——— Q: Q P: ———

O : O Q: ——— P : P O : ——— Q : Q P : ———

O : O Q :)Pl qe b cr ii obar bo l cobi qfl k Ofk

O: O P: P O Q: Q P O : O Q
P : P O Q : Q P O : O Q :

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“ shipped whole”

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- Cl o L) qe b obi qfl k a l bpk qkbba pq ofkd+
  “Fetch as need”

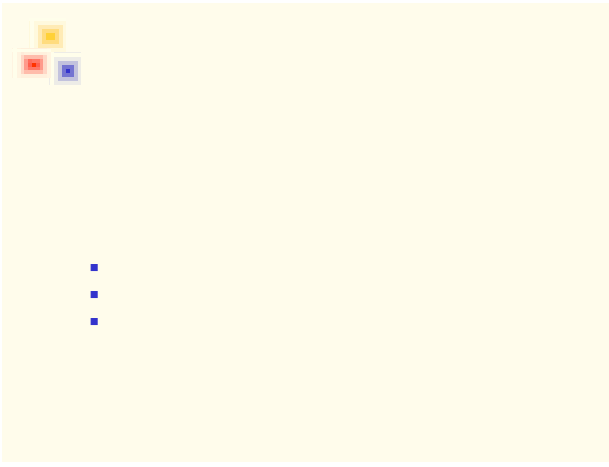
-
- Ik I) fc Ffp pe fmmba t e l ib) fka bu k q b pe fmmba

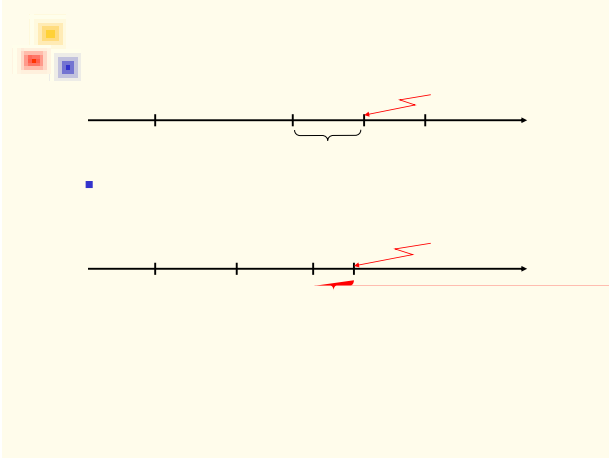
))P

))PRJ P
) LR QP

))J F P
))J >UP

$$\lim_{n\to\infty} \boldsymbol{P}^n = \mathbf{0}$$





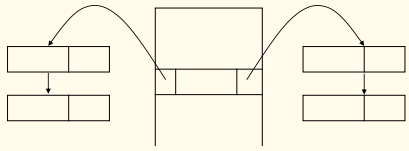
-
-

kklq b lii mpba b rpblcplj b lmv pc firob+

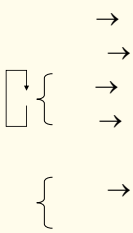
- ✓
- ✓
  →
- ✓
- ✓

fc>9 qebk Afpmi v fkprccf fbkqcrka

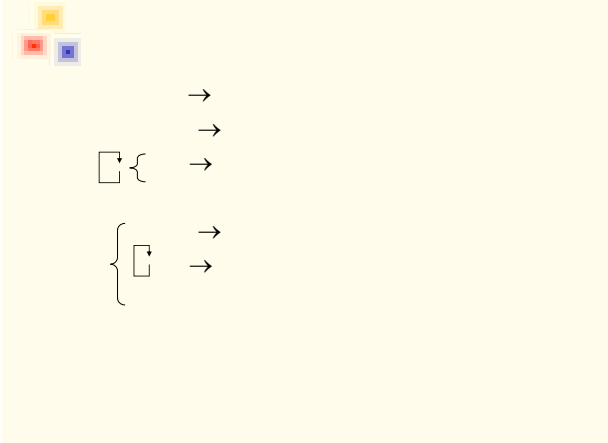
Afpmi v qp kpcbo l j nibqb

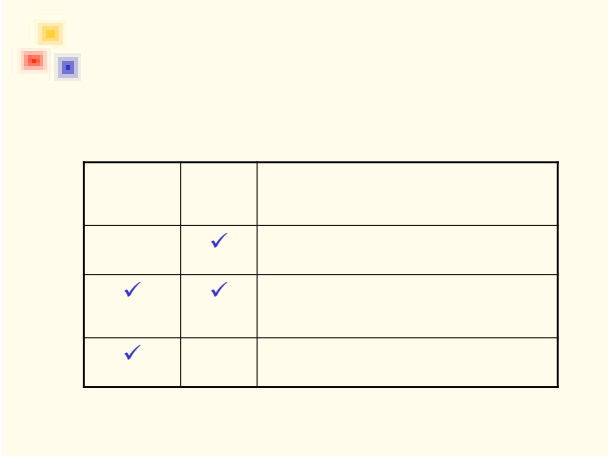


- Alkqe sbql pqlobIldfkdcloj qflkcdo loqba
-
-



	✓	
✓	✓	
✓		





	✓	
✓	✓	
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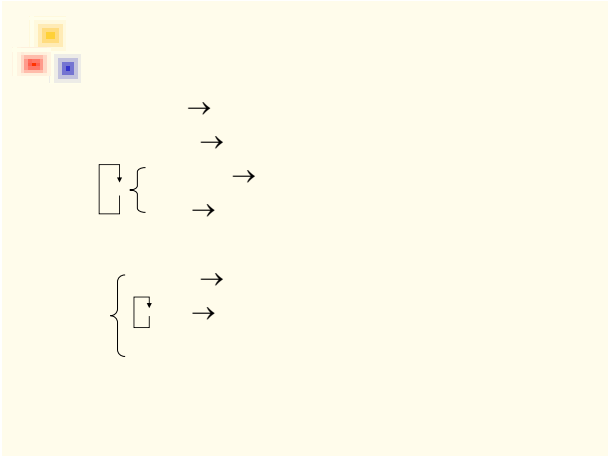

	✓	
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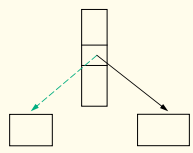
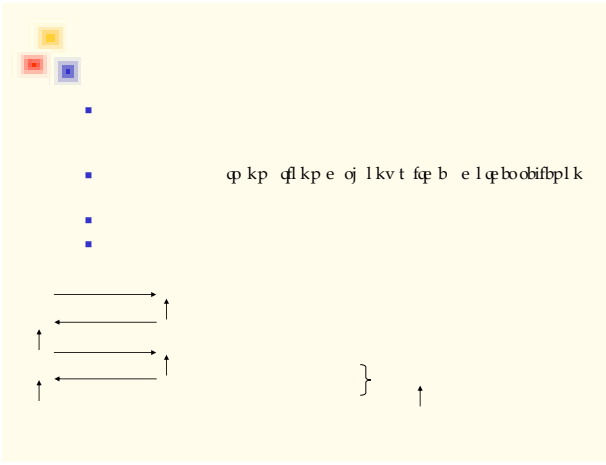
✓		

	✗	✓
	✓	✗
	✓	✓
	✗	✗



P141 : lorie's approach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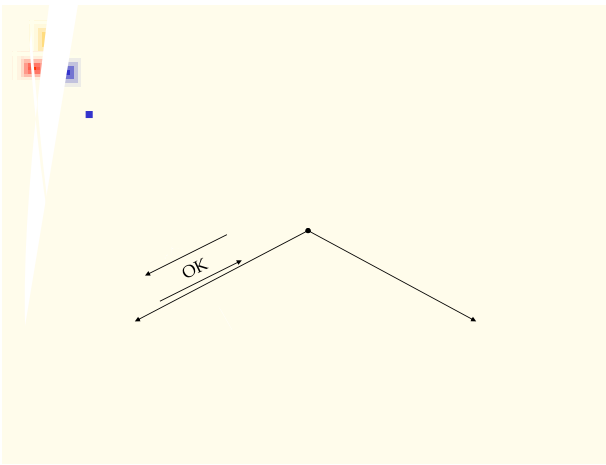
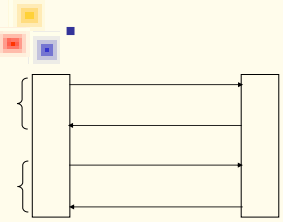
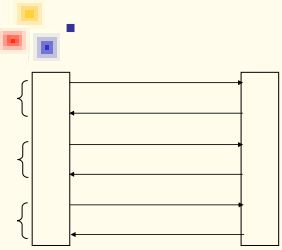
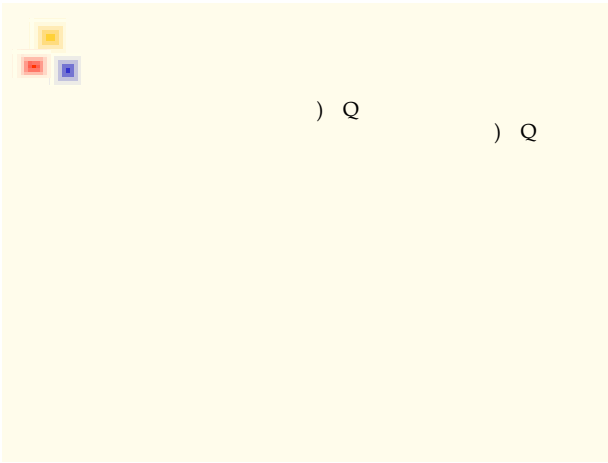

OK

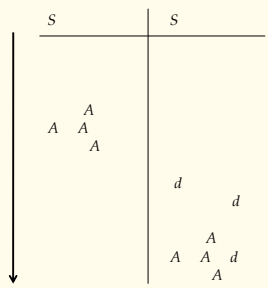




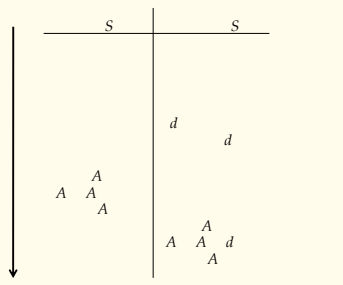

) Q
) Q

- *Rbgdc d*
  - ✓
  - ✓

- *S A S*
  A S S



- *S S*
  d h d



View equivalent *Conflict equivalent*

- *R*
  R *hd d h d*
-
-
- *R*
  R *b e hb d h d*

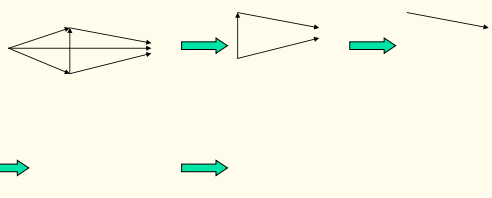
- *R*
-
-
  v O u : p
  pfp l kcif qpbof if qfl k b r pb p fp pbof i bub r qfl k+
-
  p e bar ib p
  p : O
  Eqfps fbt bnr fs ibkqt fqe p) ka p fp pbof i bub r qfl k) pl p fp

-

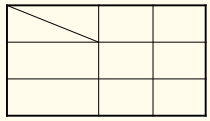
Q

-
-
-

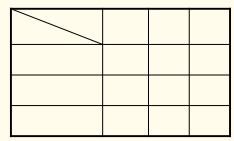
Example:

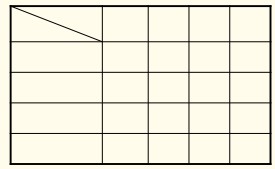


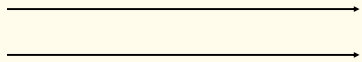
Q Q Q



- *dh h*
- *dh hh 1*
- *Sgd d*







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- al k qibqfql r o

f:)) k

f g

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-

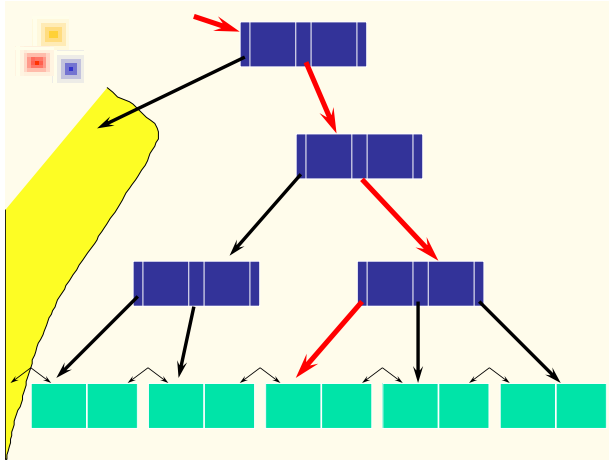
- Mf h sf ofj vl r kdbpq j fkfj r j l oq l pq

- afbp) f+b+fqfp l oqba ka r ql j of iiv obopfba

  l qebot fpb fq t l r ka Q

  l ia bo vl r kdbo l o vl r kdbo l ia bo+Fqfpfj ml ppf ib

-
-



l k m obkq k bobib pba) b r pbqp s bopfkd k qdl h+

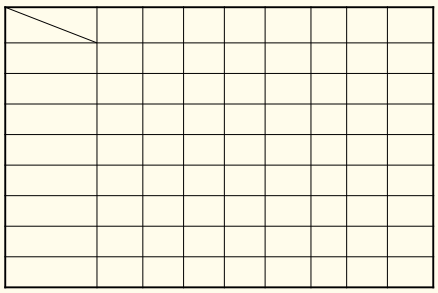
- *h f* *fd*
- *h f* *fd*
- *fd*
- *h f* *fd*
- l l kpfpqbkqA pq qbt e bobQ fp l oob q

- *h f*
- Fc qe b pvpqbj a l k qpr mml oqj r iqf do kr i ofqv il hfkd)

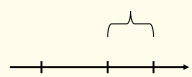
- *h f*
- *h f*
- *h f*
- *h f*
- *fd*: 63)e b k qdbqqe b Uil h l k qe b fka bu kl a b k qfk pboqqe b kbt fka bu fqbj q ob if b qe b fk pboq

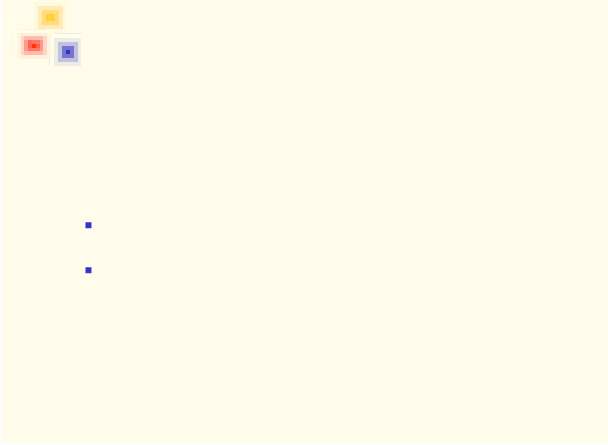
- *fd = 1)*


```
SET TRANSACTION ISOLATION LEVEL
{  READ COMMITTED |
   READ UNCOMMITTED |
   REPEATABLE READ |
   SERIALIZABLE
}
```



> krj bodbkbo qba v l j mrqbopfkqbok i





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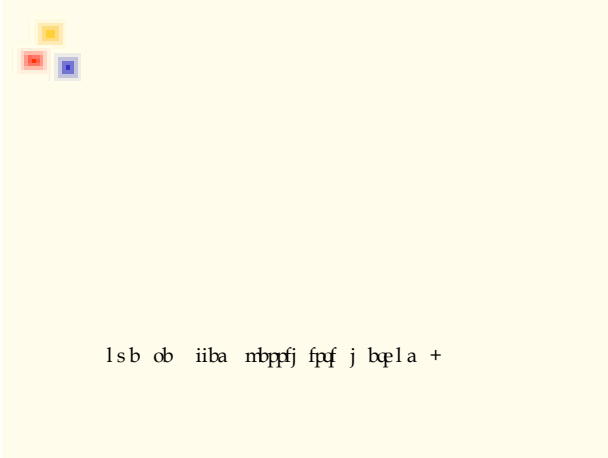
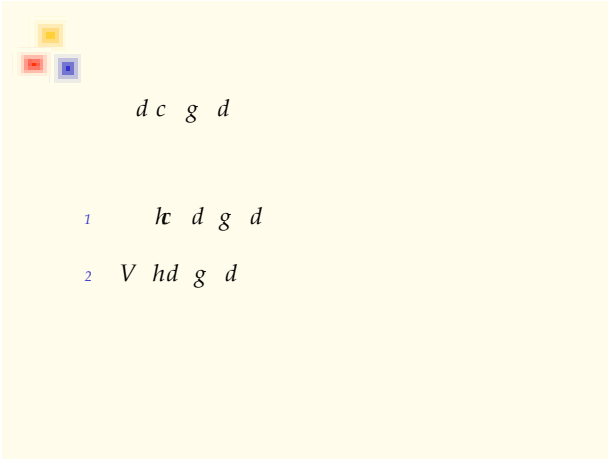


1 s b ob iiba mbppfj fpqf j bqe1 a +

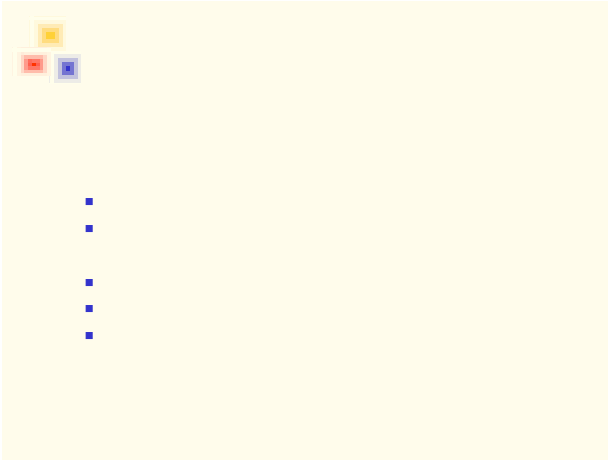


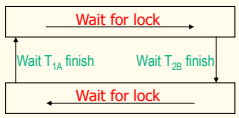
d c g d

1 hc d g d

2 V hd g d


Q





Global wait-for graph:

BUQ QfkqI qeb do me fcQfpqeb q fi l ct fq
r oobkqpfqb) aa Q BUQfkqI qeb do me+

Fc l k pl j b pfqbe p BUQ Q Q Q BUQ
eb h l qebo pfqbpfce p BUQ Q Q Q BUQ

Q
BUQ Q Q Q Q Q BUQ