Database Management Systems

Lecture 12

Problems

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I

Let R and S be 2 relations. R has 10.000 records; a page can hold 10 R records. S has 2.000 records; a page can hold 10 S records.

1. 52 buffer pages are available. Compute the cost of:

SELECT *
FROM R INNER JOIN S ON R.a = S.b

using *page-oriented nested loops join* and *block nested loops join*; S is the outer relation.

R – 10000 records; a page can hold 10 R records => 1000 pages
S – 2000 records; a page can hold 10 S records => 200 pages

- page-oriented nested loops join
  - 200 + 200 * 1000 = 200200 I/Os

- block nested loops join
  - block size: 50 => $\left\lceil \frac{200}{50} \right\rceil$ = 4 S blocks
  - 200 + 4 * 1000 = 4200 I/Os

Let R and S be 2 relations. R has 10.000 records; a page can hold 10 R records. S has 2.000 records; a page can hold 10 S records.

2. Compute the cost of sorting R using *external merge sort* with 200 buffer pages.

- 2 * 1000 * 2 = 4000 I/Os
- $2 * N * \left(\left\lceil log_{B-1} \left\lceil \frac{N}{B} \right\rceil \right\rceil + 1 \right)$ I/Os

Let R and S be 2 relations. R has 10.000 records; a page can hold 10 R records. S has 2.000 records; a page can hold 10 S records.

3. R is stored at București, S is stored at Cluj-Napoca. Compute the cost of:

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SELECT *
FROM R INNER JOIN S ON R.a = S.b
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using *simple nested loops join (tuple-oriented)* in Cluj-Napoca, without caching; S is the outer relation.

- t_d time to R / W a page from / to disk
- t_s time to ship a page
  - $200t_d + 2000 * 1000 (t_d + t_s) = 200t_d + 2000000 (t_d + t_s)$

4. Encode the data *de gustibus non disputandum* using the secret encryption key *metallica* and the table of codes below. Write the last 5 characters in the result.

	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	-
00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27

- see lecture 6

II

1. T1 and T2 are 2 concurrent transactions, both active at time *t*. Choose the correct answer(s):

a. The following execution describes a *write read* conflict: At time *t*, T2 is reading a data object previously written by T1.

b. The following execution describes a *write read* conflict: At time *t*, T2 is writing a data object previously read by T1.

c. The following execution describes a *read write* conflict: At time *t*, T2 is reading a data object previously written by T1.

d. The following execution describes a *read write* conflict: At time *t*, T2 is writing a data object previously read by T1.

e. none of the above answers is correct.

2. A schedule S:

a. is conflict serializable if and only if its precedence graph has exactly one cycle.

b. is conflict serializable if and only if its precedence graph is acyclic.

c. is conflict serializable if and only if its precedence graph has exactly two cycles.

d. is conflict serializable if and only if its precedence graph has exactly three cycles.

e. none of the above answers is correct.

3. In SQL Server, under the READ UNCOMMITTED isolation level:

a. S locks must be acquired to perform read operations.

b. read operations are performed without acquiring S locks.

c. X locks must be acquired to perform write operations.

d. write operations are performed without acquiring X locks.

e. none of the above answers is correct.

4. In horizontal fragmentation:

a. the reconstruction operator is the natural join.

b. the union of the horizontal fragments must be equal to the original relation.

c. fragmentation is performed with projection operators.

d. fragmentation is performed with selection predicates.

e. none of the above answers is correct.

5. I is an index with search key <C1, C2, C3, C4>.

a. If I is a hash index, I matches condition *C1 > 10 AND C2 > 7.*

b. If I is a hash index, I matches condition *C1 = 10 AND C2 = 7 AND C3 = 1 AND C4 = 5.*

c. If I is a B+ tree index, I matches condition *C1 = 10 AND C2 = 7.*

d. If I is a B+ tree index, I matches condition *C2 = 7 AND C3 = 9.*

e. none of the above answers is correct.

6. Let R be a relation with P pages. The cost of sorting R using *simple two-way merge sort* (i.e., with 3 pages in the buffer pool) is:

a. π^{P}

b. $2P(\lceil \log_4 P \rceil + 1)$

c. $2P(\lceil \log_2 P \rceil + 1)$

d. $2P(\lceil \log_3 P \rceil + 1)$

e. none of the above answers is correct.

7. Consider the query:

SELECT *

FROM R1, R2, R3

WHERE p1 AND p2 AND p3

The conditions tested by the predicates in the WHERE clause are statistically independent. The cardinality of a relation R is denoted by |R|. The reduction factor associated with predicate p is denoted by RF(p). The cardinality of the query's result set can be estimated by:

a. $\frac{|R1|*|R2|*|R3|}{RF(p1)+RF(p2)+RF(P3)}$

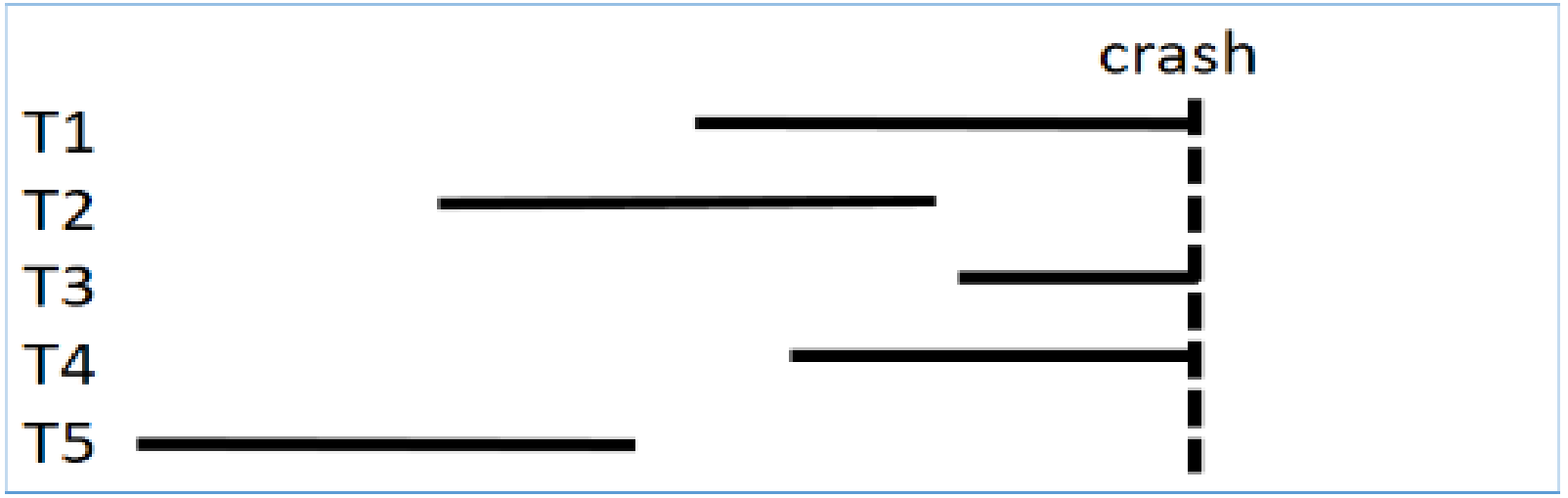
b. $|R1| * |R2| * |R3| * RF(p1) * RF(p2) * RF(p3)$

c. $RF(p1) * RF(p2) * RF(p3) - (|R1| + |R2| + |R3|)$

d. $|R1| + |R2| + |R3| + RF(p1) + RF(p2) + RF(p3)$

e. none of the above answers is correct.

8. Consider the execution below. When the system comes back up after the crash, it must ensure that:



a. T1, T3, T4 are durable; T2 and T5 are undone.
b. T1, T3, T4 are undone; T2 and T5 are durable.
c. T1 is undone only if T2 and T4 are also undone.
d. T2 is durable only if T5 is undone.
e. none of the above answers is correct.

9. In data replication:

a. *primary site replication* is an asynchronous replication technique.

b. *primary site replication* is a synchronous replication technique.

c. *read-any write-all* is a synchronous replication technique.

d. *read-any write-all* is an asynchronous replication technique.

e. none of the above answers is correct.

10. A database access request contains:

a. the requesting user.

b. the criminal record of the requesting user.

c. the operation the user wants to perform.

d. the requested object.

e. none of the above answers is correct.

11. Consider schedule S below over transactions T1, T2, T3, T4 (all transactions commit):

T1	T2	T3	T4
W(A)			
			R(C)
	R(B)		
		W(D)	
	R(A)		
R(D)			
			W(B)
R(C)			

a. S is conflict serializable.

b. S is not conflict serializable.

c. (R(T4, C), R(T1, C)) belongs to the conflict relation of S.

d. (W(T1, A), R(T2, A)) belongs to the conflict relation of S.

e. none of the above answers is correct.