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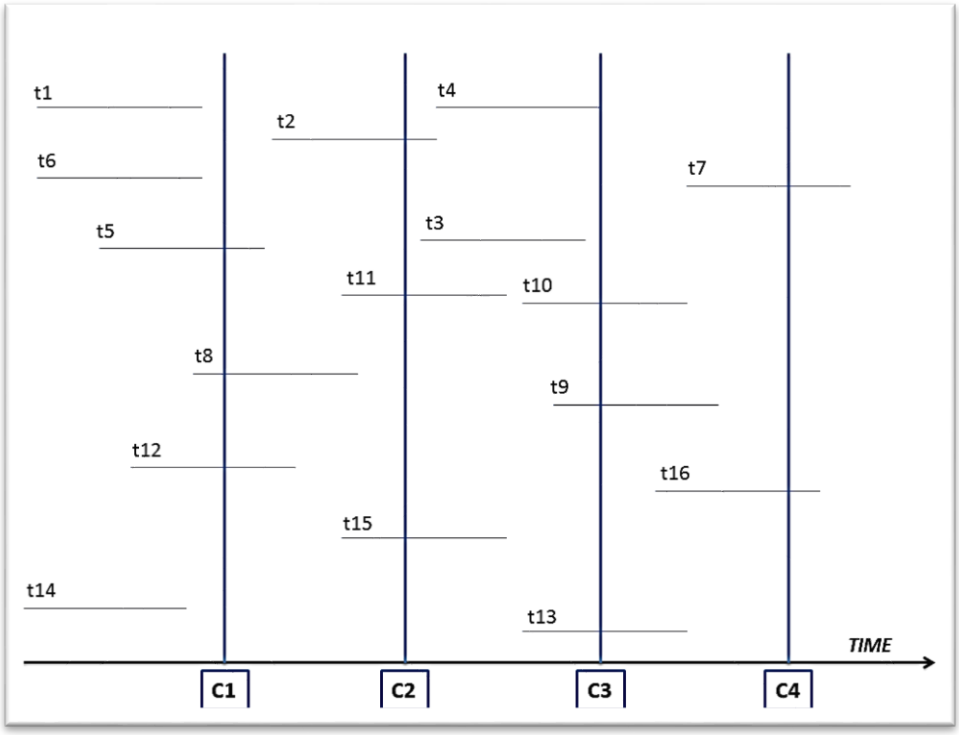
DBMS Questions and Answer Keys

1. Consider the below snapshot of concurrent execution for immediate update of recovery.



Assuming Check Points: C1, C2, C3, C4 and Transactions: t1, t2…. t16; what are the outcomes of the following tables at all the above 4 check points? **(2.5X 4= 10 Marks)**

I. Active Table
II. Commit Table

Answer:

C1	**Active Table**	**Commit Table**
	t5, t8, t12	t1, t6, t14

C2	**Active Table**	**Commit Table**
	t2, t11, t15	t1, t6, t5, t8, t12, t14

C3	**Active Table**	**Commit Table**
	t4, t10, t9, t13	t2, t11, t15, t1, t6, t5, t8, t12, t14

C4	**Active Table**	**Commit Table**
	t7, t16	t4, t10, t9, t13 ,t2, t11, t15, t1, t6, t5, t8, t12, t14

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2. Considering the following two transactions, Assume the following:

Transactions	T1 and T2
Bank Accounts	A and B
Initial Amount	550$

Task	Instruction
T1 transfers $100 from B's account to A's	BEGIN A=A+100 B=B-100 END
T2 credits both accounts with 5% interest.	BEGIN A=5%*A B=5%*B END

Answer the following Questions that follow:

a. What are the legal outcomes of both accounts running T1 and T2? **2 Marks**
b. What are the legal outcomes of both accounts running T2 and T1? **2 Marks**
c. What are the legal outcomes of both accounts running T1 and T2 concurrently? **2 Marks**
d. Suppose there is a network failure just after T1 is completed and T2 is about to begin. What solution could be added to this problem? Justify briefly **4 Marks**

Answer:

a. What are the legal outcomes of running T1 and T2?
After T1 Execution: A=650$ and B=450$
After T2 Execution: A=682.5$ and B= 472.5$
b. What are the legal outcomes of running T2 and T1?
After T2 Execution: A=577.5$ and B=577.5$
After T1 Execution: A=677.5$ and B= 477.5$
c. What are the legal outcomes of running T1 and T2 concurrently?
Results into The Incorrect Summary Problem
d. Suppose there is a network failure just after T1 is completed and T2 is about to begin. What solution could be added to this problem? Justify briefly
There are 2 solutions to this problem:
    1. **Serial Schedule:** If we prepare a serial schedule, then either T1 will completely finish before T2 can begin, or T2 will completely finish before

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T1 can begin

2. **Commit and Rollback:** write every temporarily calculated value from the volatile storage on to the stable storage and if Transaction files then entire transaction is rolled back

3A). Consider the following relation schemas be given:

R = (A, B, C)
S = (D, E, F)

Let relations r(R) and s(S) be given. Give an expression in SQL that is equivalent to each of the following queries.

a. ΠA(r)

b. σB = 17 (r)

c. r × s

d. ΠA,F (σC = D(r × s)) **(1.5X 4= 6 Marks)**

Answer:

a. ΠA(r)	SELECT DISTINCT A FROM r
b. σB = 17 (r)	SELECT * FROM r WHERE B = 17
c. r × s	SELECT DISTINCT * FROM r, s
d. ΠA,F (σC = D(r × s))	SELECT DISTINCT A, F FROM r, s WHERE C = D

3B). Consider the following data and parity-block arrangement on four disks

Disk 1	Disk 2	Disk 3	Disk 4
B_1	B_2	B_3	B_4
P_1	B_5	B_6	B_7
B_8	P_2	B_9	B_{10}
⋮	⋮	⋮	⋮

The B*i*'s represent data blocks; the P*i*'s represent parity blocks. Parity block P*i* is the parity block for data blocks B_{4i-3} to B_{4i}. What, if any, problem might this arrangement present? **(4 Marks)**

Answer: This arrangement has the problem that Pi and B4i − 3 are on the same disk. So if that disk fails, reconstruction of B_{4i-3} is not possible, since data and parity are both lost.

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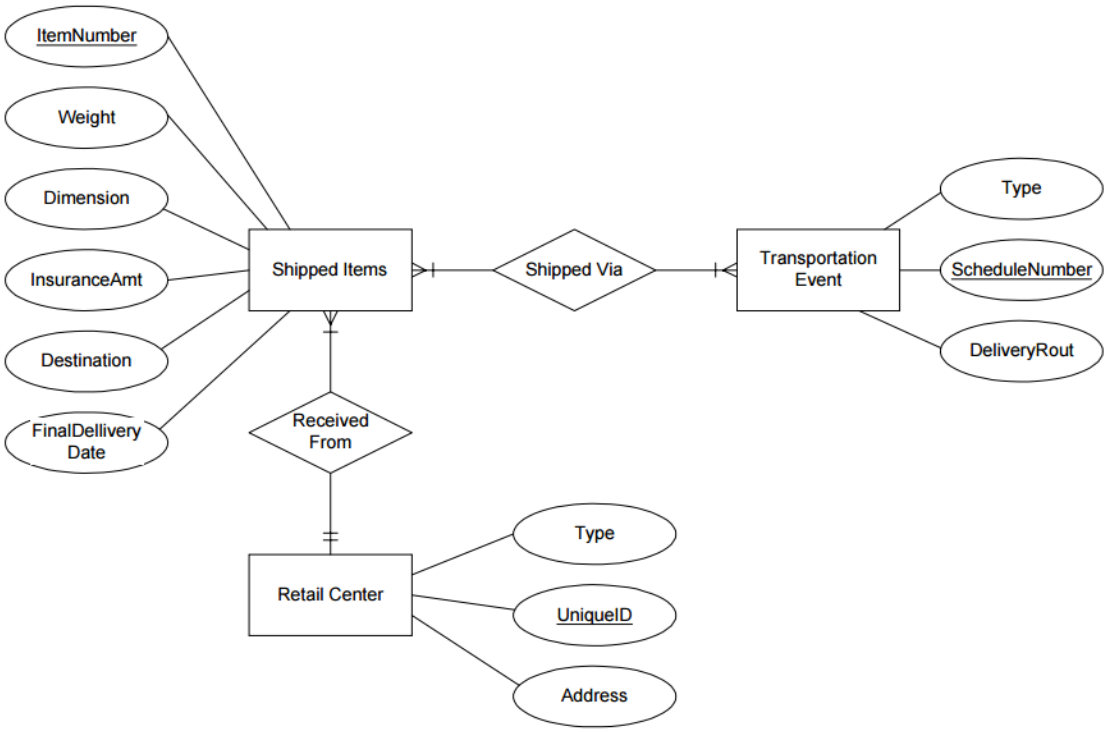
4. ***E-Courier Services*** keeps up-to-date information on the processing and current location of each shipped item. To do this, ***E-Courier Services*** relies on a company-wide information system. Shipped items are the heart of the ***E-Courier Services*** product tracking information system. Shipped items can be characterized by item number (unique), weight, dimensions, insurance amount, destination, and final delivery date. Shipped items are received into the ***E-Courier Services*** system at a single retail center. Retail centers are characterized by their type, uniqueID, and address. Shipped items make their way to their destination via one or more standard ***E-Courier Services*** transportation events (i.e., flights, truck deliveries). These transportation events are characterized by a unique scheduleNumber, a type (e.g, flight, truck), and a deliveryRoute.

   Create an Entity Relationship diagram that captures this information about the ***E-Courier Services*** system. Be certain to indicate identifiers and cardinality constraints. **(10 Marks)**

   Answer:

Entities correctly identified:	**2 Marks**
Attributes correctly identified:	**2 Marks**
Primary keys correctly identified:	**2 Marks**
Relationships and cardinality correctly identified:	**4 Marks**



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5. A) Let R = (A, B, C), and let r1 and r2 both be relations on schema R. Give an expression in SQL that is equivalent to each of the following queries.

   a. r1 ∪ r2

   b. r1 ∩ r2

   c. r1 − r2

   d. ΠAB(r1) ⋈ ΠBC (r2) **(4 Marks)**

   Answers:

   a. (SELECT * FROM r1) UNION (SELECT * from r2)

   b. SELECT * FROM r1 WHERE (A, B, C) in
   (SELECT * FROM r2)
   Note: Nested Queries can also be written

   c. SELECT ∗ FROM r1
   WHERE (A, B, C)
   NOT IN (SELECT ∗ FROM r2)
   Note: This can also be solved using except clause.

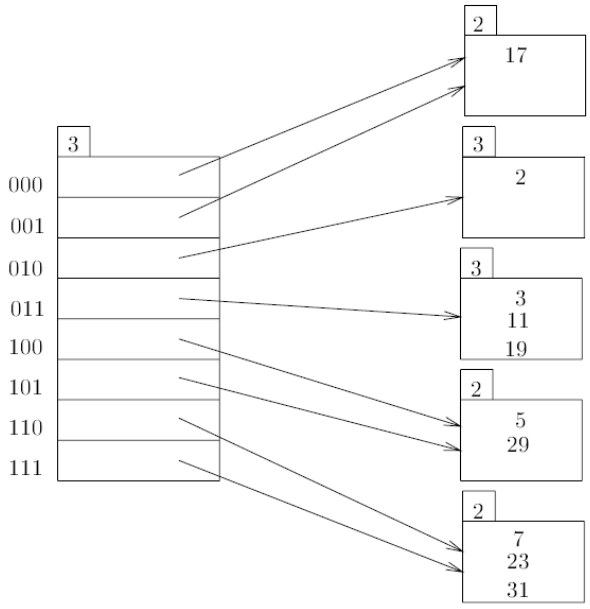
   d. SELECT r1.A, r2.B, r3.C
   FROM r1, r2
   WHERE r1.B = r2.B

5. B). Suppose that we are using extendable hashing on a file that contains records with the following search-key values:

   2, 3, 5, 7, 11, 17, 19, 23, 29, 31

   Show the extendable hash structure for this file if the hash function is h(x) = x mod 8 and buckets can hold three records. **(6 Marks)**

   Answers:



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6. Construct a B+-tree for the following set of key values:

(2, 3, 5, 7, 11, 17, 19, 23, 29, 31)

Assume that the tree is initially empty and values are added in ascending order. Construct B+-trees for the cases where the number of pointers that will fit in one node is as follows:

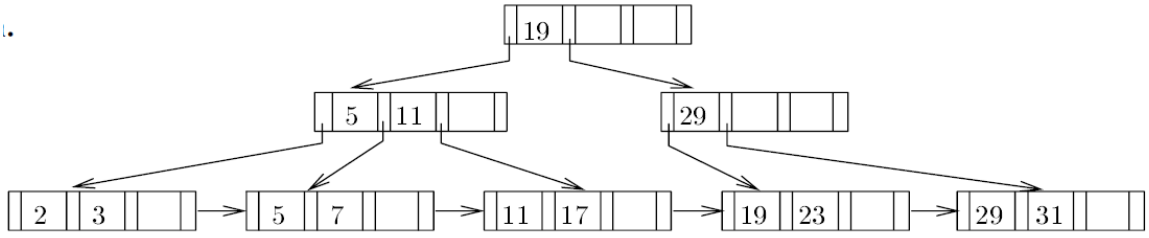
a. Four

b. Six

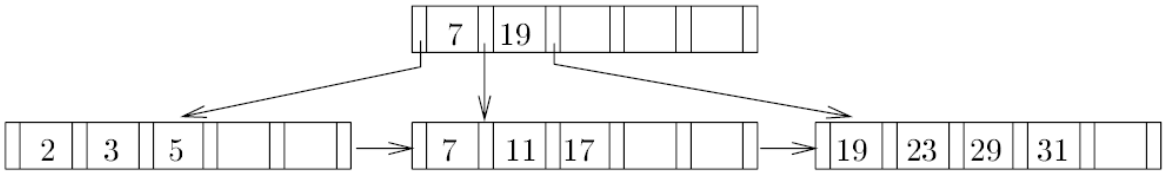
c. Eight **(3+3+4=10 Marks)**

Answer: The following will be generated by inserting values into the B+-tree in ascending order. A node (other than the root) will never be allowed to have fewer than n/2! Values/pointers.

a. Four Node



b. Six Node



c. Eight Node