ADBMS Assignment-I Answers

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1. Disk File Problem:

- **Given:**
  - Number of records = 28,000
  - Block size = 256 bytes
  - Record size = 111 bytes
- **(a) No. of blocks needed to store the file:**
  - Blocking Factor (bfr) = Block size / Record size = 256 / 111 ≈ 2 records per block
  - Total Blocks needed = Number of records / bfr = 28,000 / 2 = **14,000 blocks**
- **(b) No. of Sorted Runs and Passes (External Sorting):**
  - Memory Buffers Available (M) = 11 blocks
  - Initial runs = 14,000 / 11 ≈ **1273 runs**
  - Number of passes = 1 + log(M-1)(Number of runs) ≈ 4 passes
- **(c) No. of Disk Block Accesses:**
  - Each pass = 2 x 14,000 = 28,000 accesses
  - For 4 passes: Total Accesses = 4 x 28,000 = **112,000 block accesses**

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2. Heuristic Query Optimization:

- **Query 1 Optimization:**
  - Apply selections early: σ(D.department_name = "Computer Science") (D) and σ(S.semester = "Fall99") (S)
  - Join S and D
  - Project section_id
- **Query 2 Optimization:**
  - Apply selection: σ(PLOCATION = 'Stafford') (PROJECT)
  - Join PROJECT and DEPARTMENT on DNUM = DNUMBER
  - Join with EMPLOYEE on MGRSSN = SSN
  - Project required fields

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3. Fine-grain vs Coarse-grain Parallel Machines:

Fine-grain Parallelism	Coarse-grain Parallelism
Very small tasks	Larger tasks
High communication overhead	Less communication overhead
Suitable for SIMD systems	Suitable for MIMD systems

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4. Performance of a Parallel Machine:

- Measured using Speedup, Efficiency, Execution time, Throughput, Scaleup.

5. Speedup and Scaleup:

- **Speedup (S)** = Time (one processor) / Time (multiple processors)
- **Scaleup** = Handling bigger problems with more processors at the same time.

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6. Blocking Factor (New Problem):

- **Given:**
  - Records = 15,000
  - Block size = 512 bytes
  - Record size = 110 bytes
- **Calculations:**
  - Blocking Factor = 512 / 110 ≈ 4
  - Blocks needed = 15,000 / 4 = **3750 blocks**
- **Index File Calculation:**
  - Attribute size = 7 bytes
  - Pointer size = 9 bytes
  - Total per index entry = 16 bytes
  - Blocking Factor of index = 512 / 16 = 32 entries per block
  - Number of index blocks = 3750 / 32 ≈ **118 blocks**

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7. Relational Algebra Expression:

SQL Query:

```
SELECT item_name
FROM ITEM A, SALES B, LOCATION C
WHERE A.Itemno=B.Itemno AND B.loc_id=C.loc_id AND LocationName="Delhi" AND
A.Itemprice>10000;
```

Relational Algebra:

σ(LocationName="Delhi" AND Itemprice>10000) ((ITEM ⋈ A.Itemno=B.Itemno SALES) ⋈ B.loc_id=C.loc_id LOCATION)

Then project π(item_name).

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8. SQL Statements:

- **(a) Booknames never borrowed:**

```
SELECT BName FROM Book WHERE Accno NOT IN (SELECT Accno FROM
Transaction);
```

- **(b) Accno, Bookname, and number of copies:**

```
SELECT Accno, BName, COUNT(*) AS NoOfCopies FROM Book GROUP BY Accno,
BName;
```

- **(c) Borrower with Booktype 'Journal':**

```
SELECT DISTINCT Borrower.BorrName FROM Borrower, Transaction, Book WHERE
Borrower.Borrowerno = Transaction.Borrowrno AND Transaction.Accno = Book.Accno
AND Book.Type = 'Journal';
```

- **(d) Borrowers keeping book more than 30 days:**

```
SELECT DISTINCT BorrName FROM Borrower, Transaction WHERE
Borrower.Borrowerno = Transaction.Borrowrno AND DATEDIFF(CURDATE(),
issuedate) > 30;
```

- **(e) Borrowers who never borrowed:**

SELECT BorrName FROM Borrower WHERE Borrowerno NOT IN (SELECT DISTINCT Borrowrno FROM Transaction);

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9. Armstrong's Inference Rules:

- **Reflexivity:** If $Y \subseteq X$, then $X \rightarrow Y$
- **Augmentation:** If $X \rightarrow Y$, then $XZ \rightarrow YZ$
- **Transitivity:** If $X \rightarrow Y$ and $Y \rightarrow Z$, then $X \rightarrow Z$

Proof Sketch:

- Reflexivity: A set implies its subset.
- Augmentation: Adding same attributes preserves dependency.
- Transitivity: If X implies Y and Y implies Z, then X implies Z.

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10. Primary vs Secondary Index:

Primary Index	Secondary Index
Built on primary key	Built on non-primary key
One per table	Multiple possible
Records physically sorted	Records not necessarily sorted