Database Systems Technology (CSC443-W2019)
Assignment 3
Submission Deadline: Mar 31, 2019 11:59 PM
(Please submit a PDF of the solutions - can be hand written.)

Question 1. [50 MARKS]

Query Optimization

Consider the following relations and query:

Employee(eid, name, age, did)
Department(did, name, type)

```
SELECT E.name
FROM Employee E, Department D
WHERE E.did = D.did
AND D.type = 1
AND E.age BETWEEN 30 and 39
```

Assume the following:

1. There are 5,000 employee records stored on 100 pages
2. There are 240 department records stored on 4 pages
3. There are 4 types of departments that are equally distributed
4. The employees are aged from 20 to 59 years old. The ages are uniformy distributed.

Part (a) [10 MARKS] Draw all possible query plans for this query, assuming there are no indexes and data is not sorted on any attribute. Use simple nested loops join.

Part (b) [20 MARKS] Compute the cost (number of disk I/Os) for all query plans. Which one is the most optimized plan?

Part (c) [20 MARKS] Now assume there is an unclustered hash index on D.did and a clustered hash index on D.type? Re-compute the cost of the query plans. Which plan is the most optimized plan? Assume the cost of searching in a hash index is 1.2 I/Os.

Question 2. [50 MARKS]

Crash Recovery

Consider a DBMS with ARIES recovery algorithm that contains two pages (P1, P2). It has just crashed. The sequence of opeartions from two transactions (T1, T2) before the crash are as follows:

- T1 updates P1
- T2 updates P2
- T2 updates P1
- The log and P2 are flushed to disk.
- T1 updates P2
- T1 commits (inserts commit log record and flushes log to disk)
- T2 updates P1
- The system inserts an END log record for T1
- T2 updates P2
- The system crashes

Part (a) [10 MARKS] What is the state of the system (both on disk and in memory) before the crash:

Part (b) [30 MARKS] Explain what will happen during Analysis, Redo and Undo phases. Show the state of the system after recovery.

Part (c) [10 MARKS] What happens if the system crashes again during recovery? Cosnsider possible scenarios.