Motilal Nehru National Institute of Technology Allahabad
Department of Computer Science and Engineering
B.Tech IT -VI Sem, End-Sem Exam, May 2018
Database Management Systems

Time 3 hrs **M.M. 60**

All questions are compulsory. Assume any missing data and mention it at the top of answer.

Q1 Consider the following schema that records information about primates and the trees they have been found on (Primary keys are underlined): **(1+1.5)*2=5**

Primate(pid, species, tail_length, age)
Tree(tid, tree_type, num_branches)
Found_On(pid, tid, date)

Express the following queries in relational algebra and relational calculus.

a) Find the pid and age of all primates that have been found on trees of type 'Juniper' but not of type 'Cedar'.
b) Find distinct pid pairs of primates that have been found on the same tree on the same day (note that a pair is unordered, so if you return (pid1, pid2) in the result, you should not return(pid2, pid1)).

Q2 Consider a MOVIE database in which data is recorded about the movie industry. The data requirements are summarized as follows: **10**

a) Each movie is identified by title and year of release. Each movie has a length in minutes. Each has a production company, and each is classified under one or more genres (such as horror, action, drama, and so forth).
b) Each movie has one or more directors and one or more actors appear in it. Each movie also has a plot outline. Finally, each movie has zero or more quotable quotes, each of which is spoken by a particular actor appearing in the movie.
c) Actors are identified by name and date of birth and appear in one or more movies. Each actor has a role in the movie.
d) Directors are also identified by name and date of birth and direct one or more movies. It is possible for a director to act in a movie (including one that he or she may also direct).
e) Production companies are identified by name and each has an address. A production company produces one or more movies.

Design an Entity-Relationship diagram for the movie database.

Q3 Examine the schedule given below. There are four transactions, T1, T2, T3, and T4. **1+(3*3)=10**

T1	T2	T3	T4
			R(Tax)
R(Salary)			
			W(Tax)
	R(Tax)		
	W(Tax)		
R(Tax)			
W(Salary)			
		R(Salary)	
W(Tax)			
		W(Salary)	
			R(Salary)
			W(Salary)

a) Draw the precedence graph for this schedule.
b) What is the equivalent serialization order for this schedule? If no order is possible, then state 'none'.
c) Assume that transaction T4 did not run at all. What is the precedence graph in this case?
d) What is the equivalent serialization order for this second schedule? If no order is possible, then state'none'.

[P. T. O]

Q4 Consider a disk with the following characteristics (these are not parameters of any particular disk unit): block size=512 bytes, interblock gap size=128 bytes, number of blocks per track=20, number of tracks per surface=400. A disk pack consists of 15 double-sided disks. **10*1=10**

a) What is the total capacity of a track?
b) What is the useful capacity of a track?
c) How many cylinders are there?
d) What is the total capacity and the useful capacity of a cylinder?
e) What is the total capacity and the useful capacity of a disk pack?
f) Suppose the disk drive rotates the disk pack at a speed of 2400 rpm (revolutions per minute); what is the transfer rate in bytes/msec?
g) What is the block transfer time in msec?
h) What is the average rotational delay in msec?
i) Suppose the averages seek time is 30 msec. How much time does it take (on the average) in msec to locate and transfer a single block given its block address?
j) Calculate the average time it would take to transfer 20 random blocks.

Q5 Consider a database organized in terms of the following hierarchy of objects: **10**
The database itself is an object (D), and it contains two files (F1 and F2), each of which contains 1000 pages (P1 . . . P1000 and P1001 . . . P2000, respectively). Each page contains 100 records, and records are identified as *p:i*, where p is the page identifier and *i* is the slot of the record on that page.
Multiple-granularity locking is used, with S, X, IS, IX and SIX locks, and database-level, file-level, page-level and record-level locking. For each of the following operations, indicate the sequence of lock requests that must be generated by a transaction that wants to carry out these operations:

a) Draw the hierarchy tree of the objects.
b) Read record *P1200:5*.
c) Read records *P1200:98* through *P1205:2*.
d) Read all (records on all) pages in file F1.
e) Read pages *P500* through *P520*.
f) Read pages *P10* through *P980*.
g) Read all pages in F1 and (based on the values read) modify 10 pages.
h) Delete record *P1200:98*.
i) Delete the first record from each page.
j) Delete all records.

Q6 Consider the attribute set R = ABCDEGH and the FD set F = {AB→C, AC→B, AD→E, B→D, BC→A, E→G}. For each of the following attribute sets, **5*3=15**
(a)ABC, (b)ABCD, (c)ABCEG, (d)DCEGH, (e)ACEH do the following:
(i) Compute the set of dependencies that hold over the set and write down a minimal cover.
(ii) Name the strongest normal form that is not violated by the relation containing these attributes.
(iii) Decompose it into a collection of BCNF relations if it is not in BCNF.