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Question Paper ID - MDM-QP3

IMDM630E

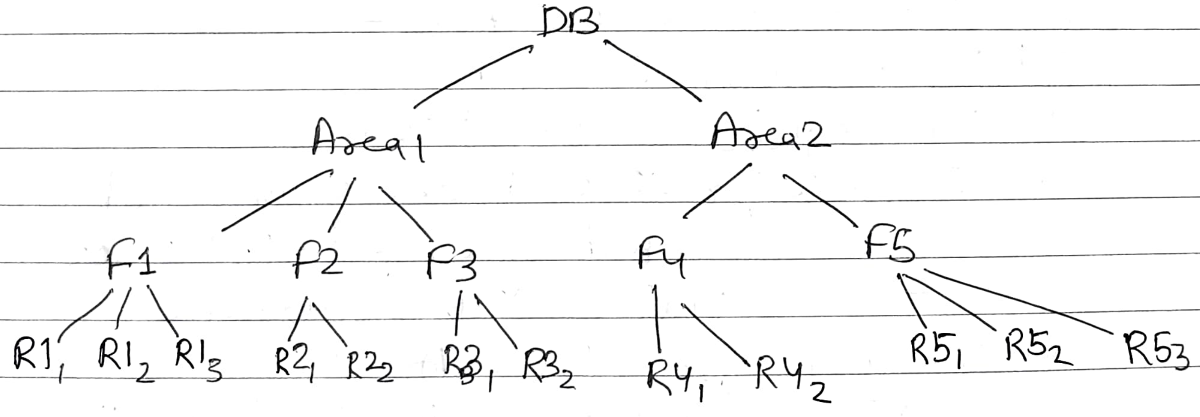
End Semester Exam

(Q1) Given,

Modes :- IS → Intentional Read
IX → Intentional Write
S → Read
X → Write
SIX → Read Intention write.

Here we can safely assume that Read locks are treated as shared(S) lock and write as exclusive(X) locks.

Tree :-



Now the given transactions are :-
T1 wants to Read $R3_1$.
T3 wants to Write $R3_2$.

The lock compatibility matrix used is as follows :-

	S	X	IS	IX	SIX
S	y	n	y	n	n
X	n	n	n	n	n
IS	y	n	y	y	y
IX	n	n	y	y	n
SIX	n	n	y	n	n

Here we assume the order :—
T1 executes before T3

∴ Order of Events

(i) T1 acquires IS in Database
(ii) T1 acquires IS on Area 1
(iii) T1 acquires IS on F3
(iv) T1 acquires S on $R3_1$.
(V) T3 looks for IX on Database, where it already has IS locks, but is compatible hence granted
→ T3 acquires IX on Database
(vi) T3 Looks for IX on Area 1
→ T3 acquires IX on Area 1 since (IS, IX) = Compatible
(vii) T3 looks for IX on F3
→ T3 acquires IX on F3, since compatible
(viii) T3 looks for X on $R3_2$
→ T3 acquires X on $R3_2$.

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Similarly if we assume that T3 works before T1, then the ~~following~~ also there wont be any conflict.

T3 execute before T1 :-

Order of Events :-

(i) T3 acquires IR on Database
(ii) T3 acquires IR on Area1.
(iii) T3 acquires IR on F3
(iv) T3 acquires R on $R3_2$.
(v) T1 asks for IS on Database, since compatible
⇒ T1 acquires IS on Database
(vi) T1 acquires IS on Area1.
(vii) T1 acquires IS on F3
(viii) T1 acquires S on $R3_1$.

Q5 In Moflex we have a transaction as :-

$T = \{M, S, F, D, H, J, G\}$

M → Set on compensatable or non-compensatable transactions
S → Set of success dependencies
F → Failure dependencies
D → Set of external dependencies.
H → Set of Handoff control rules
J → Set of acceptable join rules.
G → Set of acceptable states of T.

We define the following Sub-transactions as :-

t_1 → Find the right hospital (Compensatable)
t_2 → Take patient to default hosp (Compensatable)
t_3 → Given patient status to emergency doctor (Non compensatable)
t_4 → ~~Receive~~ ~~[illegible]~~ Get location of hospital.
t_5 → Dispatch the patient and receive the treatment.

Then

$M = \{t_1(C), t_2(C), t_3(NC), t_4(C), t_5(C)\}$

$S = \{t_1 <_s t_3, t_2 <_s t_3, t_1 <_s t_4\}$

$D = \{t_1, t_4\}$

$H = \{restart(t_1), continue(t_2), continue(t_3), split\text{-}resume(t_4), continue(t_5)\}$

$J = \{user(t_4)\}$

$G = \{(S, -, S, S, S), (-, S, S, -, S)\}$

Here in Set G, S represents Successful execution of t_i and '-' means that state of that transaction does not matter.

Here the situation is that the ambulance is a Mobile Agent with mobile facility, and tries to find a hospital in close proximity or nearby cells. It if is successful in

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finding the hospital in nearby cells, then it succeeds, else it dispatches request to default hospital.

Q7

~~To~~ ~~s~~ Given,

Consistency Req ⇒ $A_1 = 0 \vee B = 0$

Initial State ⇒ $A = B = 0$.

(a) For the order T1 → T2.

T1	T2	A	B
Read(A)		0	0
Read(B)		0	0
if (A=0) then B=B+1		0	0
write B		0	1
	read(A)	0	1
	read(B)	0	1
	if (B=0) then A=A+1	0	1
	write(A)	0	1
		0	1

Since A=0, hence consistency is ~~sta~~ satisfied

Next for the order, T2 → T1.

T1	T2	A	B
	read (A)	0	0
	read (B)	0	0
	if (B=0) then A=A+1	0	0
	write (A)	1	0
read (A)		1	0
read (B)		1	0
if (A=0) then B=B+1		1	0
write (B)		1	0

Here we can see that (B=0)
Then (A=1) V (B=0) satisfy our constraint, hence consistent.

(b)

	T1	T2
1)	read (A)	
2)	read (B)	
3)	if (A=0) then B=B+1	
4)		read (A)
5)		read (B)
6)		if (B=0) then A=A+1
7)		write (A)
8)	write (B)	

Here we can see that the above transaction can not be transformed to a serial schedule, as :-
T1 (read (A)) has RW conflict with T2 (write (A))
Then, T1 → T2

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And ~~T2 (execute~~ T2 (read (B)) has RW conflict with T1 (write (B)).

(c)

T1	T2
read (A)	
	read (A)
read (B)	
	read (B)
if (A = 0) then B = B+1 write (B)	
	if (B=0) then A=A+1 write (A)

Above we can see that there are no conflict as Read - Read result in no conflicts. Hence the above transaction can be converted to a Serializable Schedule as

T1 → T2.

(Q3) HiCoMo, stands for High Commit Mobile Transaction Model for mobile execution, which is mainly for processing aggregate data stored in a data warehouse in mobile units.

In HICOMO database reside on fixed networks and are manipulated by source or base transactions initiated at fixed network. The transactions initiated and processed at mobile units are called HICOMO. It is based on nested transaction model. To install updates of HiComo transactions at server, the Transaction Transformation Func. convert them to source transactions as:-

(i) Conflict Detection - Conflicts among HICOMO transactions are identified and base transactions, and ~~can~~ ~~be~~ a transac-tion a transaction considered for transformation is aborted.

(ii) Base transaction generation - In absence of conflict, initial base transactions are produced and executed as subtransactions on base database at server.

(iii) Alternate base transaction gen :- If some subtransactions violate the integrity constraints, then they are aborted. Their updates a tried again by redistribution of error margin. In worst case when nothing can be done, the whole HICOMO transaction may be aborted. If no issue of integrity constraint happen, then the base transactions are committed.

Q2

Given,

1) Bandwidth = 66 MHz.
2) Mobile uses two 5 KHz simplex channel to provide full duplex con.

Channel Bandwidth = 2×50 KHz
= 100 KHz per duplex channel.

Now, Total available channel = $\frac{\text{Bandwidth}}{\text{Channel Bandwidth}}$

$$= \frac{66 \times 10^3}{100} = \underline{660 \text{ channels}}$$

(a) For 8 cell reuse

No. of Channel per cell $= \frac{660}{8}$

$\approx$ 83 channels

(b) For 14 cell reuse

No. of channels per cell $= \frac{660}{14}$

$\approx$ 48 channels

(c) for 24 channel reuse

No. of channels per cell $= \frac{660}{24}$

$\approx$ 28 channels

Now if 2MHz of spectrum is used for control channel then

For 8 cell reuse

$\frac{20}{8}$ control channel ≈ 3

$\frac{640}{8}$ voice channels ≈ 80.

In practice each cell should have 1 control and 80 voice channel.

For 14 cell reuse

No. of voice channels $= 640/14$

$= 46$,

If X = Cell with 46 voice channel

$\Rightarrow (14-X)$ = Cells of 45 voice channel.

$\therefore 46X + (14-x)45 = 640$

$\Rightarrow X = 10$

Hence 1 control channel per cell and 10 cells with 46 voice ~~or~~ and 4 with 45 voice channels.

For 24 cell, voice channels $= 640/24 = 27$.

$\therefore 27X + 26(24-X) = 640$

$\Rightarrow X = 16$,

$\therefore$ 16 cells with 27 voice channel and 8 with 26 voice channel and 1 control channel each.

Q6

(a)

(i) Same Sensing Rates:

When sensors in WSN have the same sensing rate, then each sensor can be treated equally, and hence a cluster based method is used in which any set of sensors can be selected as cluster heads, and clustering is done. The best of the cluster heads, i.e, sensor closest to center are selected as the RP and if the travelling length of such formed set of RP is greater than the threshold then more clusters are created.

Another approach is called Weighted Rendezvous Planning in which spanning tree is form in which each sensors are given some weights, and RP with max. weight are selected and used a TSP problem for path finding

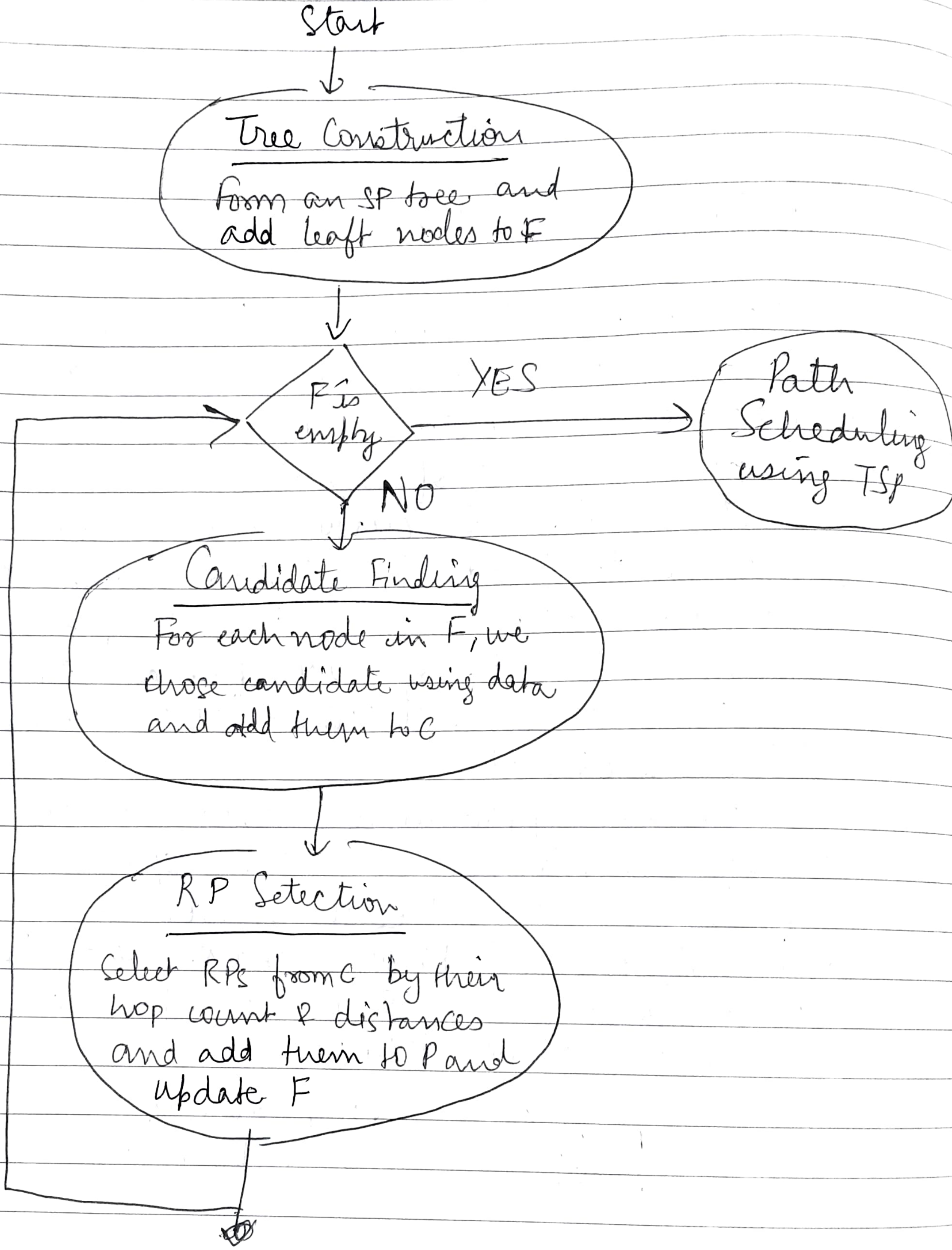
Here $W_i = N_i \times H(i, M)$

No of packets

Hop count of sensor i with closest RP.

(ii) Different Sensing Rate

For different sensing rate, the authors of paper propose eEARTH and EARTH algo which can be seen in the following flowchart :-


Start
Tree Construction
Form an SP tree and add leaft nodes to F
F is empty
YES
NO
Path Scheduling using TSP
Candidate Finding
For each node in F, we chose candidate using data and ~~add~~ them to C
RP Setection
Select RPs from C by their hop count & distances and add them to P and update F

(b)(i) For decision of Round Time T, we assume an upper limit on the path travelled for data collection by sinks as L_{max}.

Then,

$$\text{Default } T = L_{max}/V$$

Where V = Avg. Speed of Sink.

Or we can set the time to max. tolerable delay that BS should get while sensing data. Otherwise we may use the EARTH or EEARTH that use TSP, to calculate the exact time ~~to~~ for ~~us~~ the sink to travell to all RPs and collect the data.

(ii) Effect of Sensor Numbers :-

If the number of sensors will be increased, then the number of RPs may increase, and also the no. of child sensors from where RPs collect data will increase, resulting in increase in total energy consumption. Further the buffer utilisation will increase with decrease in average energy consumption

Effect of Buffer Capacity

If Buffer capacity increase then packet dropping will decrease and the average as well as total energy consumption will inc. because of more number of incoming packets.

The path length of data collection on the other hand will decrease because increase of buffer capacity will also result in decrease in number of RPs.

Field Area :- With increase in field area, the RPs are expected to be farther apart and hence the distance to be travelled will increase, with inc. in energy ~~and~~ consumption and also the inc. in buffer utilisation

Q8

(a) An execution fragment e, satisfy Location Dependent Commit, iff the fragment operations terminate with a commit and a location to data mapping exist. Each location dependent query or transaction will have different values at different locations and they must be associated with the origin where they were generated. If the Same query is executed from a different location, then they may have a different effect, since places may varry in attributes and integrity contraints. Hence there must be a one-to-one mapping to a a query and its location. Owing to this fact, when such a query or transaction commits we must all show the location mapping along with the result of the query or transactions.

(b) In presence of processor mobility, data and transactions acquire execlusive properties like the time at which the data was updated or transaction was fired, the location mapping of the data or the location from where the transaction was fired. Further the transactions, in case when the callers moves to different regions, should also keep a track of the movement of

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the user across region such that the data it recieved is consistent with the location and time.

(Q4)

In the above tree protocol, we may observe that each transaction first locks all data items from trees and each tree before granting the lock always follow upto its parent node to check for availibility. Further if lock is not recieved then the transaction waits for the unlocking. Hence this follows a growing phase of lock acquiring and then starts the execution. Furthermore queuing of requests for locks at the tree wont allow preemption of a running transaction with lock. Hence considering above cases there may be a case of deadlock and hence also serializability can not be ensured since there may be a cycle in wait for graph produced due to the queue.