THE HONG KONG POLYTECHNIC UNIVERSITY

DEPARTMENT OF COMPUTING

EXAMINATION

Course : MSc Scheme - 61030

Subject : COMP5527 Mobile Computing and Data Management

Group : 201, 202, 204, 2888

Session : 2008 / 2009 Semester II

Date : 11 May 2009 Time : 18:30-20:30

Time Allowed: 2 Hours Subject Lecturer: Shao Zili

This question paper has 5 pages (cover included).

Instructions to Candidates:

1. Close books and notes.
2. Answer **ALL** questions.

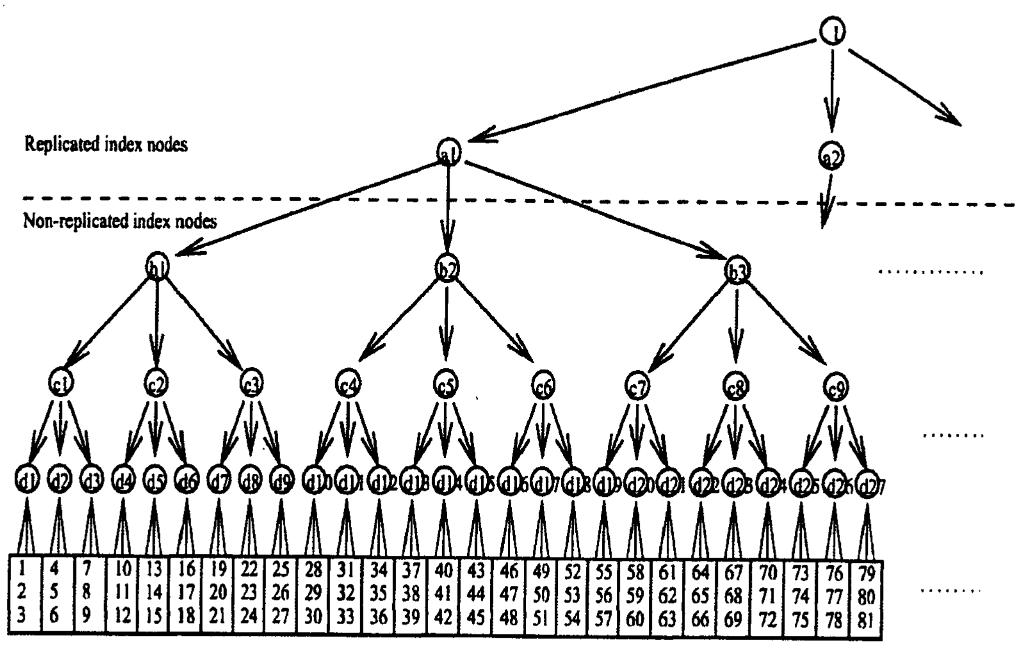
Do not turn this page until you are told to do so!

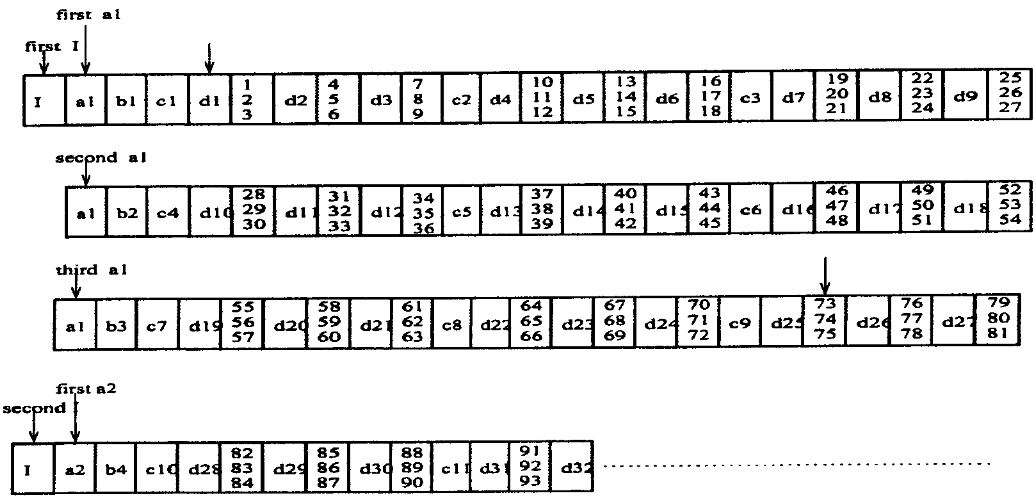
1. **(10 marks)**
Assume that there are 13 items (items 1, 2, 3, …, 13), and the size of each item is 1. Their access probabilities are as follows: *6/29 for items 1, 2 and 3*; *3/58 for items 4, 5, 6, 7, 8, 9 and 10*; *1/174 for items 11, 12 and 13*. Please use **the Wong's algorithm** to obtain a best schedule with the cycle length 42 (you need to give the computation steps about how to determine the broadcast frequencies and how to obtain the final schedule).

2. **(10 marks)**
Assume that there are three disks, A, B and C, and there are three items: *1, 2, and 3* in Disk A, four items: *4, 5, 6, and 7* in Disk B, and 18 items: *8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25* in Disk C. Suppose that we have determined the broadcast frequencies of Disks A, B, C as 4, 3, 2, respectively. Please obtain the corresponding the broadcast schedule using **the broadcast disk dissemination scheme.**

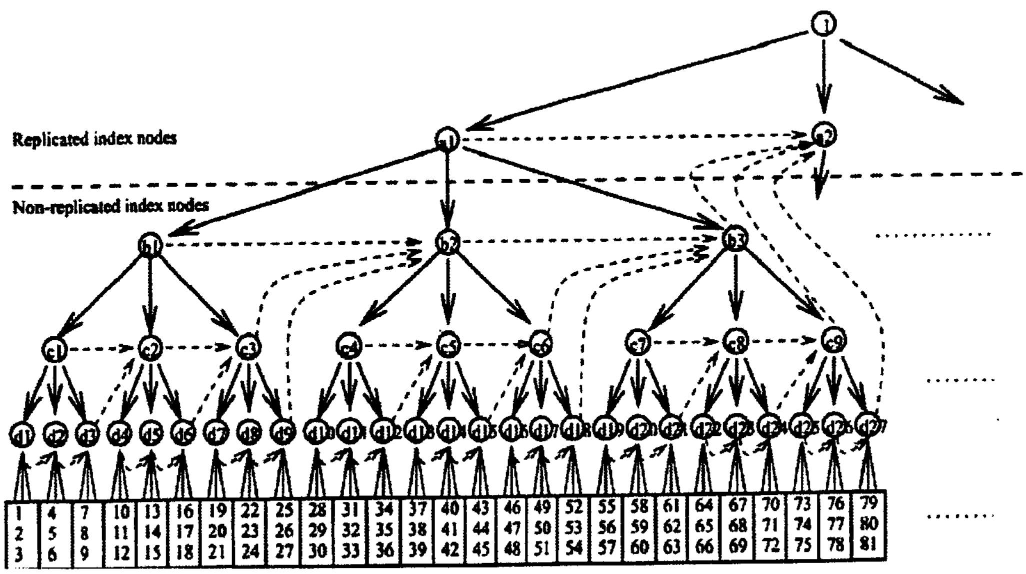
3. **(10 marks)**
With the distributed indexing shown as follows, give the sequence of nodes visited in order to access node d when node p is the first node that a client tunes in.

Probe p	b1	b2	First a1	Second a1	Second a1
Destination d	5	80	77	17	51





4. **(20 marks)**
Given the Tree-based Fault-tolerant Indexing Replication Scheme as shown below, please answer the following questions:



(1) When a client tunes in, in which situation, the client can guarantee that a data item requested is not missed. Give an example to show this situation (show the probe node and the node sequence it visits). (*8 marks*)

(2) In which situation, the client cannot determine whether a data item requested has been missed or not. Give an example to show this situation. (*8 marks*)

(3) Based on the above, design a new tuning protocol for clients at the client side in such a way that clients will continue tuning on only when data items requested are not missed; otherwise, they will follow the original distributed indexing scheme. (*4 marks*)

5. (20 **marks)**

For the group-based cache invalidation scheme, given the following system environment: there are 16 items and the sever log at time 34 is listed as follows:

ID	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
TS	25	16	10	6	22	18	26	32	2	15	14	30	8	4	11	28

The 16 items are separated into 4 groups: G1 = {1, 2, 3, 4}, G2 = {5, 6, 7, 8}, G3 = {9, 10, 11, 12}, G4 = {13, 14, 15, 16}. Let L = 4, W = 22, w = 10, and now = 34.

(1) Show the content of the invalidation report with now=34. *(5 marks)*

(2) Show one case that with an invitation report somehow **all** cache items at a client side needs to be discarded for update **but actually not necessary.** (because not all items are updated). Please briefly explain the reason. *(15 marks)*

6. (10 marks)

Consider the following history H1.

H1: r1(y) r2(z) r3(y) r2(x) w1(x) r4(x) w3(z) w3(y) w4(y).

(1) Is H1 serializable? Please give the reason why it is or is not. *(5 marks)*

(2) Explain whether H1 can or cannot be accepted by 2PL (Two Phase Locking Protocol). *(5 marks)*

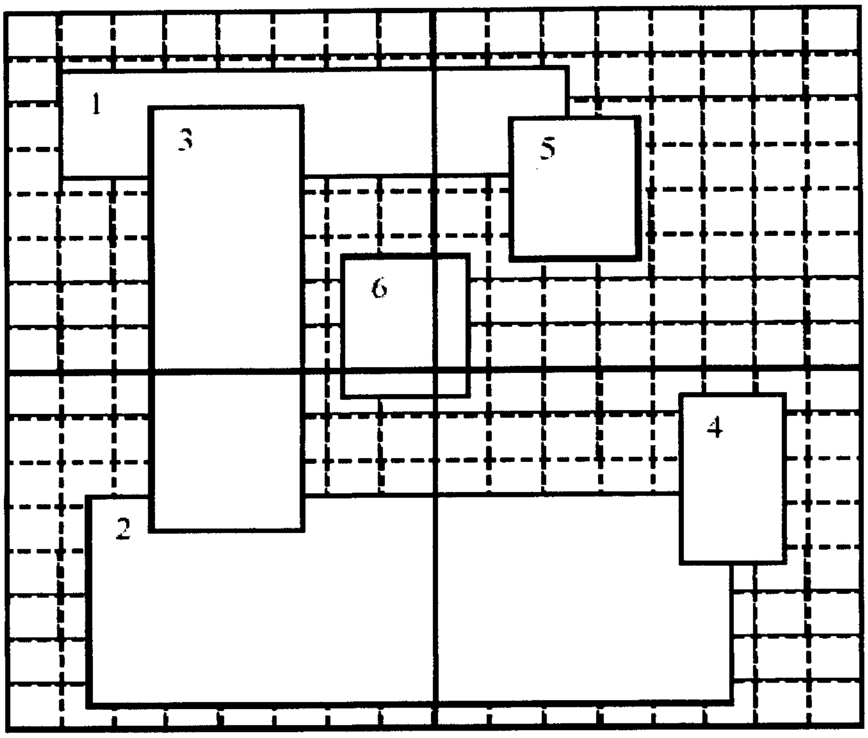
7. (10 marks)

Consider that mobile clients A, B and C execute the following transactions locally at the clients, by reading data items from a consistent broadcast and that the server generates the broadcast at the beginning of the broadcast cycle. They submit the transactions to server in the order A then B and then C. Would any of the mobile transactions be aborted with Optimistic Concurrency Control Protocol (for Mobile Transactions)? What would be the final observable history?

T_A:	rA(x)	rA(y)	rA(z)	wA(a)	wA(y)	commitA			
T_B:		rB(y)	rB(z)		rB(a)	wB(b)	commitB		
T_C:	rC(x)		rC(z)		rC(b)			wC(c)	commitC

8. (10 marks)

Assume that grid file is used to store spatial objects and each index page can contain at most two objects, with an initial partitioning of 2 by 2. Objects 1 to 6 are inserted one by one sequentially. Draw the grid file and indicate the split, if any, after each object is inserted. Splitting is done via bisection, first vertically and then horizontally in an alternating manner.



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