Exercise Session 3

Buffer Management in Database Systems

3.1 Buffer Management Basics

a) Discuss the main principles of Buffer Management in a DBMS.

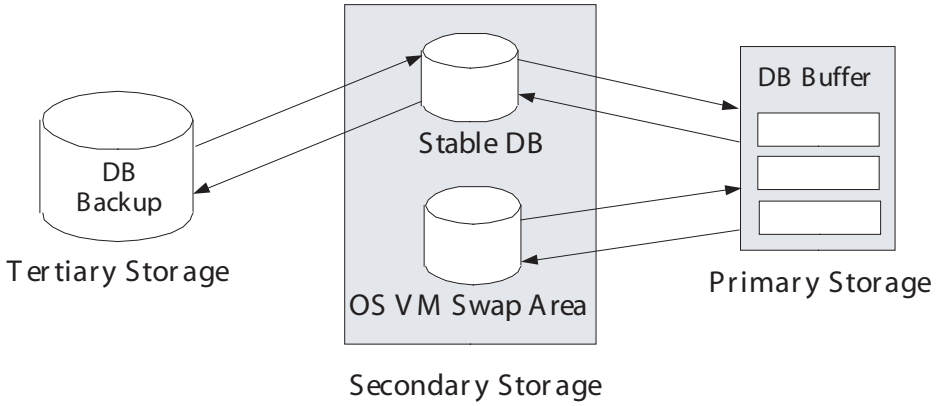
b) Explain the three operations of the buffer manager interface - FixPage(x), UnfixPage(x), FlushPage(x). What is the difference between physical and logical page references? Under what circumstances are database buffer pages flushed?

c) Describe how techniques such as "blocked I/O", "double buffering" and "page prefetching" can be used to boost performance.

3.2 Allocation and Replacement Strategies. Effect of Virtual Memory.

a) Explain the difference between global, local and page-type specific allocation strategies. How are allocation strategies related to replacement strategies?

b) Under what circumstances are database pages copied (transferred) among the different storage locations in the diagram below? The database buffer generally resides in the virtual memory of the OS. This could lead to a situation referred to as a **double page fault**. How many I/O accesses would in this case be required for fetching a page in the buffer? What can be done to avoid double



page faults?

3.3 Working-Set Allocation Strategy, LRU Replacement Strategy

Given is the following logical page reference string:
"T2:L T1:A T1:B T1:C T2:K T1:D T1:E T2:L T1:F T1:G T1:H T2:K T1:I"

"Ti:X" denotes a logical reference to page X by transaction Ti. The size of the database buffer pool is 4 pages and they are initially free.

a) Show how the buffer space would be managed during the execution of the above references if global allocation with LRU replacement strategy is employed.

b) Show how the buffer space would be managed under the Working-Set Method, with a window size $\tau = 2$. Describe how the auxiliary structures W(Ti, t), TRC(Ti) and LRC(Ti, X) for i=1..2 are used assuming that initially TRC(Ti)=0.

3.4 Buffer Management in Practice

Discuss what kind of buffer management techniques are implemented in the major commercial database systems.