National University of Computer and Emerging Sciences, Lahore Campus

	Course:	**Advance Database Concepts**	**Course Code:**	**CS4064**
	Program:	**BS (Computer Science)**	**Semester:**	**Spring 2023**
	Date:	**Thu 30-Mar-2023**	**Total Marks:**	
	Section:	**BCS-6A**		
	Roll No:			
	Quiz:	**3 (Indexing Structures)**		

SOLUTION

Q1. Consider a file of customer data that consists of 300,000 records, spread over 5000 disk blocks. There is a secondary index on the key attribute, customer Id with 5 levels. There is another secondary index (with level of indirection) on total amount spent by customer with 4 levels. For each of the following selection queries, estimate the I/O cost of the best possible solution, making use of the access paths available. Justify your answer.

a. SELECT * FROM customer WHERE customerId= 786 OR customerId= 222;
b. SELECT COUNT(*) FROM customer WHERE customerId= 222 OR customerId= 786;
c. SELECT * FROM customer WHERE totalAmountSpent >= 99000; *(Assume 1% of the customers have spent 99,000 or more)*

Answer:
a. 2(X+1)= 2(5+1)= **12**
b. 2(X)= 2(5)= **10**
c. x + 1 + s = 4 + 1+ 3000 = 3005

Q2. Assume: A block size is B= 1024 bytes, file has r= 300,000 records, each record is 100 bytes long, a block pointer is P= 10 bytes, a record pointer is P_r= 11 bytes, and a key field for the index is 5 bytes long. A database system uses a B^+-trees index on key field. A leaf node and non-leaf node are one block in size and contain as many keys (and appropriate pointers) as will fit in a block. How many blocks will this index use? Show your working.

Answer:
order of p: (p * 10) + (p-1) * 5) < 1024, which gives us **order p** = (1024 + 5)/15 **= 68**.
order of p_{leaf}: (p * (5+11) + 10) < 1024, which gives us **order p** = (1024 - 10)/16 **= 63**.
This means the leaves (**b1**) will require ceiling (300,000/63) = **4762 blocks**.
Thus, our second level (**b2**) above the leaves will require ceiling (4762/68) = **71 blocks**.
The third level (**b3**) above that will require ceiling (71/68) = **2 blocks**.
The fourth level (**b4**) above that will require **1 block**.
The **total blocks** this index use, are **4862 blocks**.