COMP7640
Written Assignment #2

Due: 11:59 PM 27 Mar (Thursday), 2025

1. Given a disk with the following characteristics:

average seek time	20 ms
track-to-track seek time	4 ms
rotational delay	4 ms
max transfer rate	20 ms per track
#bytes per sector	256
#sectors per track	50
#tracks per cylinder	10
#tracks per surface	1,000

Suppose that we are given a file containing 500 256-byte records.

(1) How many seconds will it take to transfer all the records from this disk into the main memory, when adopting the "random" strategy? (**10 marks**)

(2) How many seconds will it take to transfer all the records from this disk into the main memory, when adopting the "next" strategy? (**20 marks**)

2. Suppose that we are given a relation R containing 1,000,000 records, each of which takes 64 bytes. Each disk block (page) can hold 4,000 bytes of data. If we build an ISAM index on relation R in which each entry in the leaf/non-leaf pages of the index takes 4 bytes, estimate the search I/O cost of using the ISAM index and the I/O cost of using binary search on relation R. (**35 marks**)

3. Given a B+ tree index (each data entry in the leaf page is a <key, record-id> pair and all key values are integers) as shown in Figure 1, answer the following questions
   (1) If we are given a query with the condition 12<key<23, how many I/Os in total (including reading the records) are needed for this query when using this B+ tree index? (**10 marks**)
   (2) Draw the B+ tree after inserting 4* and 6* into the original B+ tree; (**10 marks**)
   (3) Draw the B+ tree after deleting 37* from the original B+ tree. (**15 marks**)

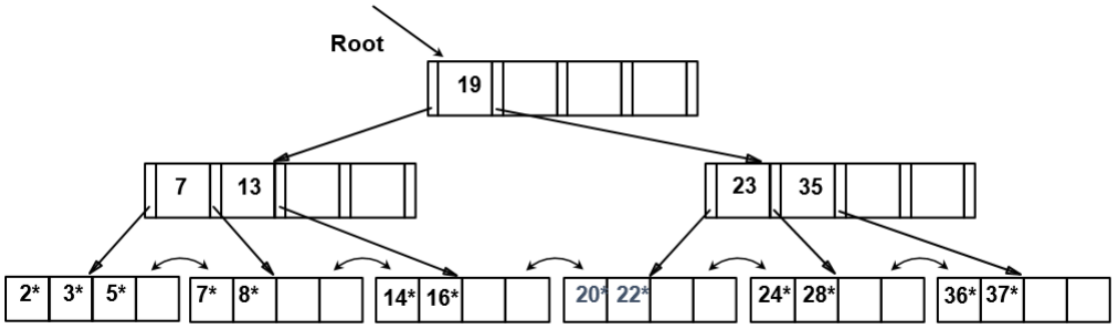

Figure 1

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Late Penalty: Late submissions will be marked down **50% for each day it is late**. Any exceptions to this rule must be made prior to when the assignment is due and the excuse needs to be a good one - just too busy won't cut it. Individual exceptions are unfair to other students and hence they won't be made unless the circumstances are truly exceptional.

Plagiarism: All work submitted by you should be your own. **Copying or sharing of assignments would constitute plagiarism. Penalty will be given to those involved in plagiarism. This will be no exception once plagiarism is caught – being copied without notice won't excuse it; you should simply keep your assignment well.**

Submission: Please submit your assignment via BUMoodle.