

CSE 332: Data Structures and Parallelism

Section 5: B-Trees and Hashing

0. Implement a B-Tree? Nah, Let's Analyze!

Given the following parameters for a B-Tree with a page size of 256 bytes:

- Key Size = 8 bytes
- Pointer Size = 2 bytes
- Data Size = 14 bytes per record (includes the key)

Assuming that M and L were chosen appropriately, what are M and L ? Recall that M is defined as the maximum number of pointers in an internal node, and L is defined as the maximum number of values in a leaf node. Give a numeric answer and a short justification based on two equations using the parameter values above.

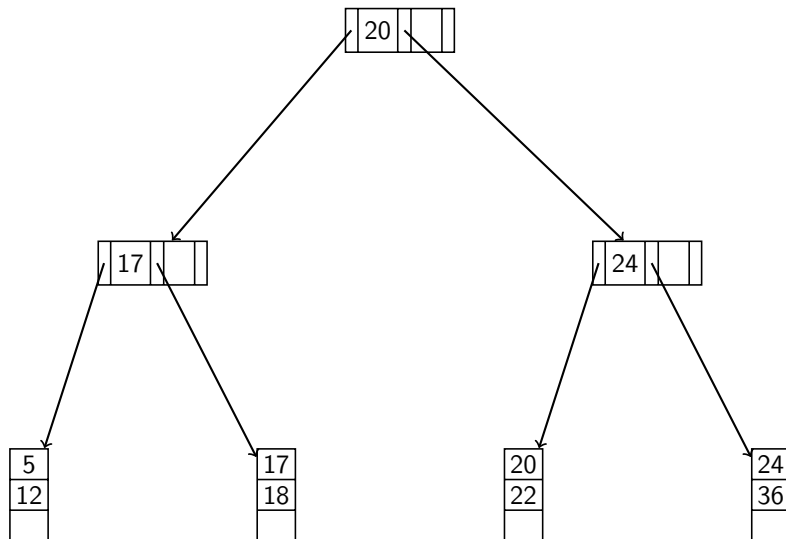
1. Oh, B-Trees

Find a tight upper bound on the *worst case runtime* of these operations on a B-tree. Your answers should be in terms of L , M , and n .

- (a) Insert a key-value pair
- (b) Look up the value of a key
- (c) Delete a key-value pair

2. B-Trees

(a) For the following B-Tree, delete 17, 12, 22, 5, 36



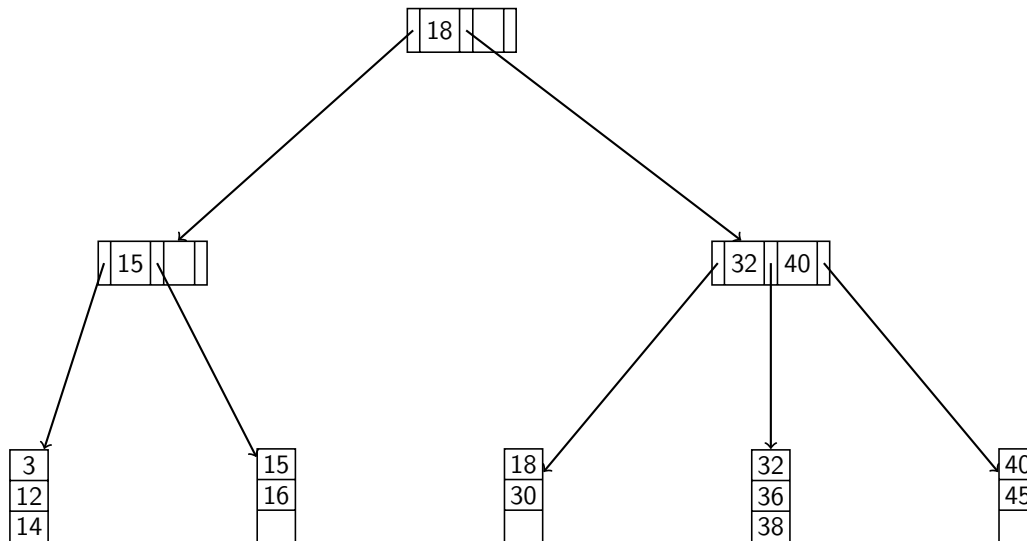
(b) Given the following parameters for a B-Tree with $M = 11$ and $L = 8$

- Key Size = 10 bytes
- Pointer Size = 2 bytes
- Data Size = 16 bytes per record (includes the key)

Assuming that M and L were chosen appropriately, what is the likely page size on the machine where this implementation will be deployed? Give a numeric answer and a short justification based on two equations using the parameter values above.

3. It's Fun to B-Trees!

(a) For the following B-Tree, delete 45, 14, 15, 36, 32, 18, 38, 40, 12



4. Hash... Browns?

For the following scenarios, insert the following elements in this order: 7, 9, 48, 8, 37, 57. For each table, TableSize = 10, and you should use the primary hash function $h(k) = k1 \bmod m0$. If an item cannot be inserted into the table, please indicate this and continue inserting the remaining values.

(a) Linear Probing

0	
1	
2	
3	
4	
5	
6	
7	
8	
9	

(b) Quadratic Probing

0	
1	
2	
3	
4	
5	
6	
7	
8	
9	

(c) Separate chaining hash table - Use a linked list for each bucket. Order elements within buckets in any way you wish.

0	
1	
2	
3	
4	
5	
6	
7	
8	
9	

5. Double Double Toil and Trouble

(a) Describe double hashing.

(b) List 2 cons of quadratic probing and describe how one of those is fixed by using double hashing.