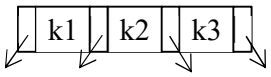
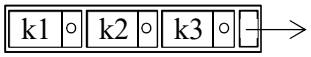
CS3402 Tutorial 7:

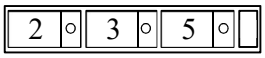
1. **Answer**:
   - When the number of key value in internal nodes is 3, a full internal node of this B+ tree will look like:



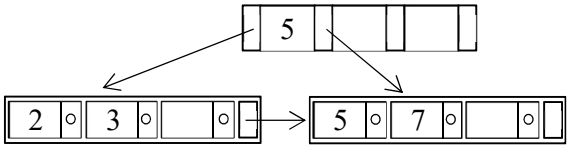
   - When the number of key value in leaf nodes is 3, a full leaf node of this B+ tree will look like:



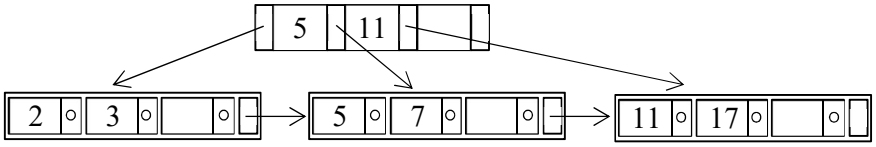
   - After inserting 2, 3, 5, the tree looks like



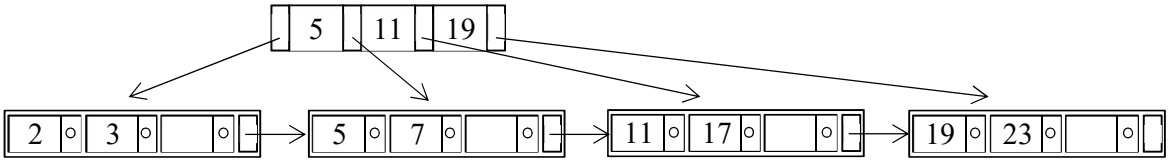
   - After inserting 7, the tree looks like



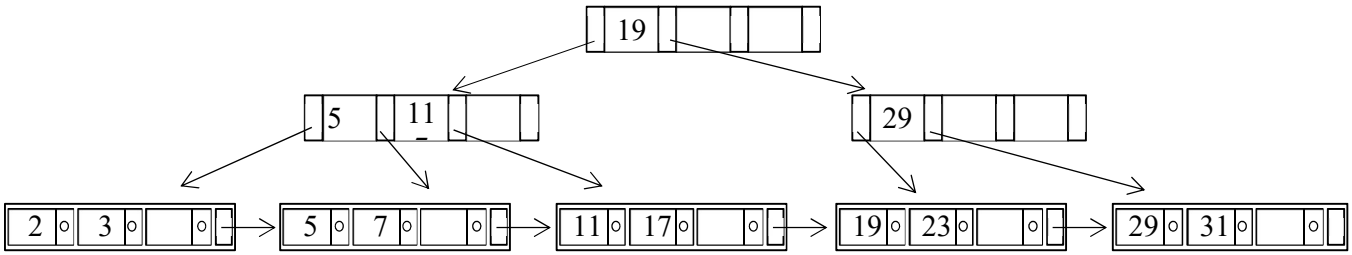
   - After inserting 11, 17, the tree looks like



   - After inserting 19, 23, the tree looks like

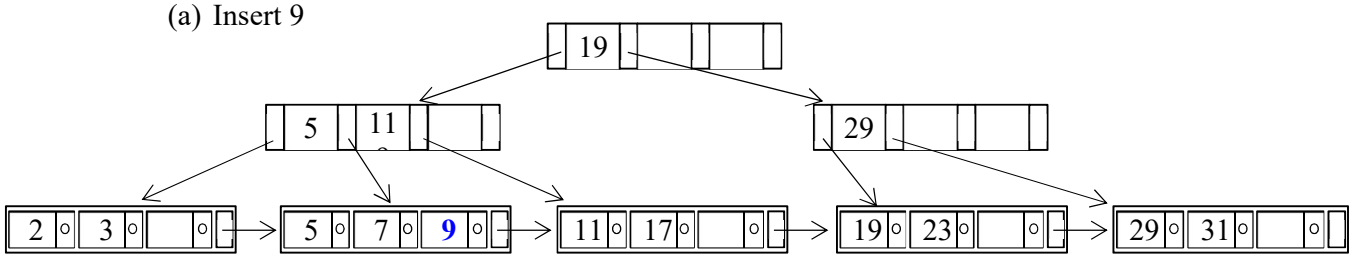


   - After inserting 29, 31, the tree looks like

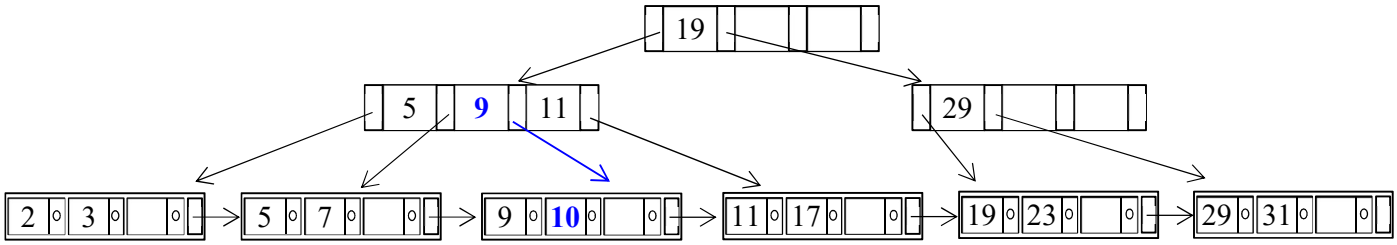


2. **Answer**:

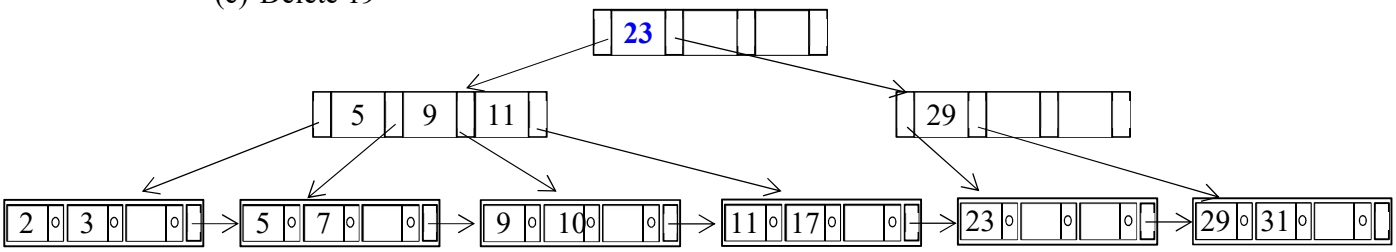
(a) Insert 9



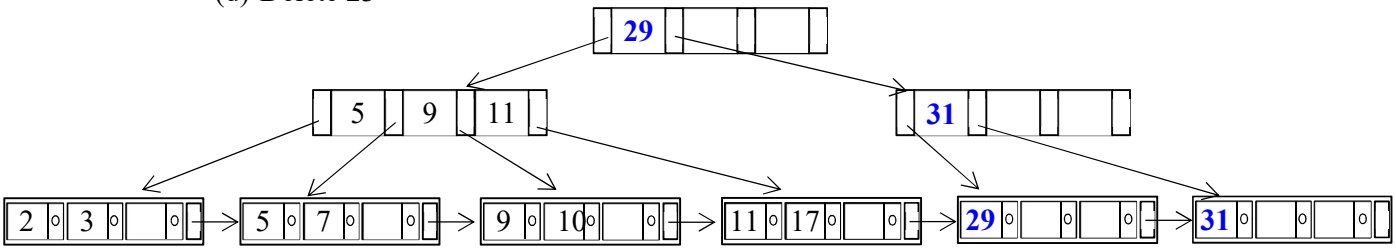
(b) Insert 10



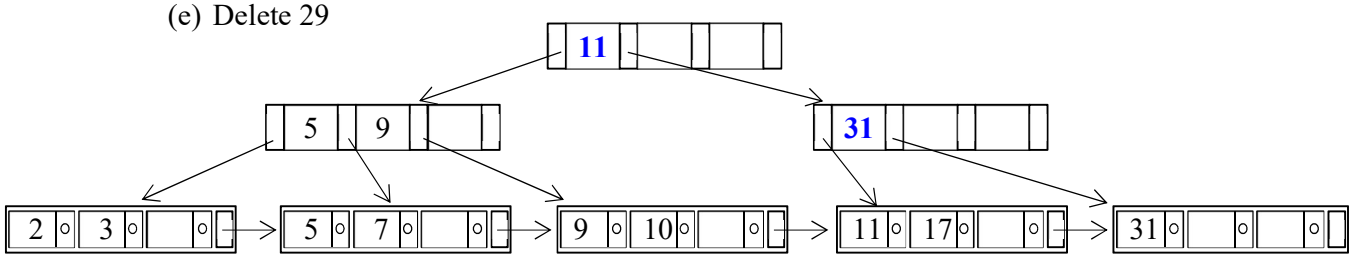
(c) Delete 19



(d) Delete 23



(e) Delete 29



3.

(a) Answer:
Record length R = 32 + 10 + 8 + 40 + 8 + 8 + 1) = 107 bytes
Blocking factor bfr = floor(B/R) = floor(512/107) = 4 records per block
Number of file blocks Nb= ceil(10,000 / 4) =2,500 blocks

(b)

Number of single-level index entries =number of file blocks Nb = 2,500 entries
Index entry size Ri = (V_ID+ P) = (10+ 6) = 16 bytes
Index blocking factor bfr_i = floor(B/R_i) = floor(512/16) = 32 entries per block
Number of index blocks Nb_i=ceil(Nb/bfr_i)= ceil(2,500 / 32) =79 blocks