4. (a). 4096 bytes long.

56+8 = 64 → bytes of each pair of (key, value).

since it is a leaf page, let x = # of (k,v)

$64x + 3 \times 8 = 4096$

pointer to parent, left&right sibling

$x = 63$,

every leaf page is required to have an even data entries.

therefore, we take $x = 62$ ($x = 64$ would exceed max. byte per page).

overall 200,000 data entries

max. 62 data entries per page.

so $\lceil 200{,}000 / 62 \rceil = 3226$.

we need 3226 leaf pages.

b). Let max. # keys per internal page = x.

$64x + 3 \times 8 + 8 = 4096$

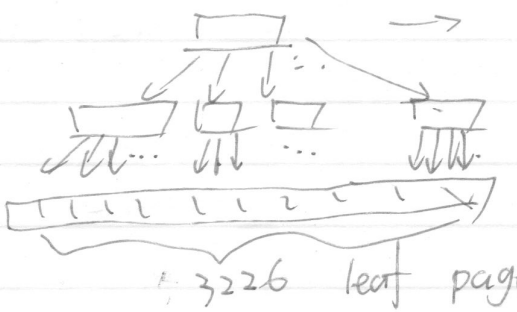
$x = 63$,

since x is even, we take $x = 62$.

max. # children per internal page is (62+1) = 63

$32 \leq$ # children ≤ 63.

$\lceil 3226 / 63 \rceil = 52$.



→ root, has 51 key (52 children).

→ 52 node, each has 62 key / 63 children

3226 leaf pages.

Therefore, we have 53 internal nodes.