Correctness:

Theorem:

For any binary tree G with n vertices the algorithm prints the left view of G

Proof (by induction on n):

Let $G=(V,E)$ be a binary tree s.t $|V|=n$ and G's root $=r$

Base case:

Assume $n=1$.

We have: $max\_level = -1 < curr\_level = 0$, therefore we'll enter line 2 and print the key of r, which is the left view of G

induction step:

Assume $1<n$

(1) Assume that the induction hypothesis holds for any subtree $G'=(V',E')$ of G s.t $|V'|=n'<n$

(2) Take all the nodes at the last level of G and remove them and all the edges that touches them

From (1) we know that the algorithm print the left view of G'

Now attach back what was removed at (2) and run the algorithm again.

Let us look at the first recursive iteration were we

(3) entering for the first time to the last level of G, say ℓ

Because of line 3 we know that the first node we'll encouter at the last level is belong to the left view of G.

From here and (3) we can conclude that

$max\_level = curr\_level - 1 < curr\_level = \ell$

see (3)

therefore we'll print the left most node in level ℓ

End of induction

Now we need to show that the algorithm prints only the left view of G.

Let i be any level of G.
Let k_i be the first recursive call we entered level i
Let $k > k_i$ be any recursive call for which we entered level i again.

claim:
$\forall v \in V$ s.t v belongs to level i if v is encoutered in the k's recursive call then key[v] don't gets printed.

proof (by contradiction)
Let $v \in V$ belong to level i
Assume that we visit v at the k recursive call and
(3) key[v] gets printed
We know that the left most node of level i got printed in the k_i'th recursive call, therefore max_level was updated to i in this recursive call, so in the k'th recursive we'll have $i \leq$ max_level and curr_level $= i$,
therefore curr_level $\leq$ max_level and we'll skip line 2.
Ofcourse that we got a contradiction to (3) and therefore our assumption is not correct.
as required.