Suppose that G has an edge $e = \{a, b\}$ that does not belong to T. Since T is a depth-first search tree, one of the two ends must be an ancestor of the other — say a is an ancestor of b. Since T is a breadth-first search tree, the distance of the two nodes from u in T can differ by at most one.

But if a is an ancestor of b, and the distance from u to b in T is at most one greater than the distance from u to a, then a must in fact be the direct parent of b in T. From this it follows that $\{a, b\}$ is an edge of T, contradicting our initial assumption that $\{a, b\}$ did not belong to T.

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[1]ex374.652.223