17.3.3
Shortest path in the weighted case using BFS
Special case: All edge lengths are 1.

1. Run BFS($s$) to get shortest path distances from $s$ to all other nodes.
2. $O(m + n)$ time algorithm.

Special case: Suppose $\ell(e)$ is an integer for all $e$? Can we use BFS? Reduce to unit edge-length problem by placing $\ell(e) - 1$ dummy nodes on $e$. 
Single-Source Shortest Paths via BFS

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2. **Special case:** Suppose \(\ell(e)\) is an integer for all \(e\)? Can we use **BFS**? Reduce to unit edge-length problem by placing \(\ell(e) - 1\) dummy nodes on \(e\).
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Example of edge refinement
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Shortest path using BFS

Let \( L = \max_e \ell(e) \). New graph has \( O(ml) \) edges and \( O(ml + n) \) nodes. BFS takes \( O(ml + n) \) time. Not efficient if \( L \) is large.
Why does BFS kind of works?

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**BFS** explores nodes in increasing distance from *s*
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Why does **BFS** work?

**BFS**(s) explores nodes in increasing distance from *s*
THE END

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(for now)