Chapter 6, Hash tables:

- General introduction; separate chaining (last week Friday)
- Open addressing (Today)
- Hash table performance (Monday after Thanksgiving)

Today:

- Review/finish hash table concepts
- Basic idea and example of open addressing
- Terminology, code, and invariant
- Probing strategies
- Deletion
Invariant (Class OpenAddressingHashMap)

1. *The table is not full; there exists* \( i \in [0, m) \) *such that* \( \text{table}[i] = \text{null} \).

2. *There are no breaks in the chain for any key in the table; for all* \( i \in [0, m) \) *such that* \( \text{table}[i] \) *contains key* \( k \),
   - if \( h(k) \leq i \), then for all \( j \in [h(k), i] \), \( \text{table}[j] \neq \text{null} \);
   - if \( i < h(k) \), then for all \( j \in [0, i] \cup [h(k), m) \), \( \text{table}[j] \neq \text{null} \).
ideal

gap

pos
Invariant (Loop of optimized remove in linear probing.)

For all positions $k \in (i, j)$, gap is the only position, if any, between its ideal place ($h(\text{keys}[k])$) and its actual place ($k$).
Coming up:

Do **Optimal BST** project *(suggested by Today, Nov 21)*

*Due today, Mon, Nov 21 (end of day)*
*Do Project 7.1 (as practice problem)*

*Due Mon, Nov 28 (end of day) (recommended to be done before break)*
*Read Section 7.3*
*Do Exercises 7.(4,5,7,8)*
*Take quiz*