Useful concepts, data structures, algorithms, and math for CS and especially AI Competitions (Halite and Battlecode).

**Variables; Data Types / Primitives; Fundamental Control Flow and Control Statements (if, else, while, for), Logical Operators (AND, OR, NOT); Arrays and basic manipulation of them (Selecting an element, subarray, adding and removing elements), Use of % / modulus, Basic Operators (+, -, \*, /, +=, -=, \*=, /=, ++, --)**

**Linear Search; Summations in Code (e.g. sum of all elements in an array); Minimum, Max, Average, Median of elements in an array; Concept of Classes;**

**Object Oriented Programming (OOP); Error Handling (Try and Catch); Queues (FIFO); Stacks (LIFO); Linked List; Pushing, popping from an array;** Basic Sorting Algorithm: Insertion Sort, Selection Sort; **Bitwise Shift operators (<<, >>); Dynamic Programming**

Trees; **Hash Maps, Hash Tables (I believe I used this, not sure);** **Heaps (Max-heap, min-heap);** **Priority Queues;** Binary Search; **Recursive Algorithm & Backtracking; Divide and Conquer;** **Merge Sort**, Quick Sort; **Heap Sort** (needed to build a heap); **Mathematical Recursion;**

**Breadth First Search (BFS) and Depth First Search (DFS)** on binary trees (Trees where each node has two children); Count Sort; Radix Sort;

**Extending BFS and DFS to a grid (useful for halite and Battlecode with 2d grid maps);**

Pathing algorithms using DFS, BFS, and Dijkstra’s;

**A\* (A star) Pathing Algorithm;**

Hungarian Algorithm (useful according to other halite players)