Sunny Ka Patel
SDK438
11267665
CMPT280.Final.Q2

Part A:

1. **Hash Table:**

Pros:
- Using a good hashing function and a low load factor, we can look up for any ship's detail in constant time (i.e., O(1)) on average, given its name.

Cons:
- Collisions make hash tables ineffective and look up for any ship's detail approaches linear time (i.e., O(n)) in the worst case.

2. **Graph:**

Pros:
- None

Cons:
- Graphs are not suitable for storing key-value pairs.

3. **AVL Tree:**

Pros:
- As AVL Trees are self-balancing, look up for ship's detail can be done in logarithmic time (i.e., O(log(n))) both in the average and worst case.

Cons:
- AVL Trees are not effective in case when the ships in the fleet change a lot.

4. **Union-find:**

Pros:
- None

Cons:
- Union-find is not suitable for the purpose of storing key-value pairs.

Conclusion:

➔ Hash tables would be the best option for the given task of looking up a ship's information using it name as key because they offer searching in constant time on average and the problem of collisions can be prevented using methods like open addressing and separate chaining.

Part B:

1. **Hash table:**

Pros:
- Using the ship's name we can look up to which task force the particular ship belongs to in constant time (i.e., O(1)).
- As ships' name are going to be unique, there is no chance of collisions.

Cons:

- None

2. **Graph**:

Pros:

- Graphs can relate each ship with its corresponding task force, and we are able to look up which task force a ship is in using either breath-first search or depth-first search.

Cons:

- Graphs takes lot of memory to store.

3. **AVL Tree:**

Pros:

- AVL Tree offer searching in logarithmic time (i.e., O(log(n))) in the worst as well as the average case.

Cons:

- AVL Tree are less effective when the ships in a task force changes frequently.

4. **Union-find:**

Pros:

- Using the find method of Union-find, we can look up in which task force a ship belongs to.

Cons:

- None

Conclusion:

➔ Union-find is the best option for the given task of looking up in which task force a ship is in because it provides the ability to group all the ships belonging to a particular task force using its union function in a disjoint set and also to look up in which task force it belongs to given its name.