

## Data structures - practice exam

*You can always make helper classes, helper functions, helper variables or helper parameters with default values, etc. Anything that does not change the way the base functionality is called.*

Any python functionality can be used unless explicitly disallowed.

*Limitations when doing array problems should be known to students.*

Use the exam base to solve the exam, then re-zip that folder structure and submit it back into the assignment (no actual assignment for practice exam).

25% multiple choice.

- There are not multiple choice questions written specifically for the practice exam.

75% programming problems.

1. **15%**

Implement the operation ***average\_of\_list*** that takes a singly-linked list with numeric values and returns the average of the values in the list.

Full marks for *recursive solution*

2. **15%**

Implement the ***remove*** function in the class `ArrayList`.

It removes a value at a specific index.

Array problem limitations apply here (*only [], no built in list functionality, etc.*)

3. **15%**

Implement the private functionality `remove_node` in the `BST_Set` class, so that the `remove` operation works correctly.

4. **15%**

Implement the class `HashMap` so that the test code works. Implement the ***\_\_setitem\_\_***, ***\_\_getitem\_\_***, ***\_\_delitem\_\_*** and ***\_\_len\_\_*** operations. Use the given ***Bucket*** class.

*The hash table can be fixed at 16 buckets.*

The built-in python dict (Dictionary) can not be used!

**When *\_\_getitem\_\_* is called for item that doesn't exist, return None.**

**When *remove* is called for item that doesn't exist, do nothing.**

5. **15%**

Implement the class ***AutoKeyContainer***. It should have the operations ***insert(value)***, ***get(key)*** and ***remove(key)***. When a value is inserted the ***insert*** operation should return an *automatically generated key*, that can then be used to access that value through ***get*** and ***remove***. When `get` or `remove` are called for a key value that is not in the collection, `get` should return `None`, `remove` should do nothing.