1 2022 Paper 1 Question 3

https://www.cl.cam.ac.uk/teaching/exams/pastpapers/y2022p1q3.pdf

(a) Advantages:

- Code is predictable, as the behaviour never changes and the state can only change because of the behaviour.
- They are more secure as state cannot be modified as all so references to the class can be used freely
- Immutable classes can be interned for faster access.

(c) (ii) The condition `isImmutable` would have to be checked at every point a static variable is accessed, which would require large amounts of code refactoring.

(iii) It would be better to have a separate class for static assets. This could have a shared parent class with the mutable version of the class, ensuring they can be used in collections together. The parent class would have all the methods from my implementation, except the setters for assets, which are only in the mutable child.

2 2022 Paper 1 Question 4

https://www.cl.cam.ac.uk/teaching/exams/pastpapers/y2022p1q4.pdf

(a) Type checking is used to ensure data is stored and operated on consistently in code. For example, `List<String>` declares a list of Strings, meaning the list can only store Strings. This prevents code like the following from compiling:

```
List<String> lst = new List<String>();
lst.add(1);
```

This is because the compiler recognises that 1 is not a string and hence cannot be added to the list.

(b) Type erasure is used as a way to implement generics. It deletes all type information in the compiler output. This ensures the bytecode remains backwards compatible.

(c) (i) True, as it "is-a" Number due to being a subclass

(ii) False, as this would allow adding any subclass of Number to the set after casting

(iii) True, as the wildcard specifies any child of Number

(iv) Unsure

(v) Unsure

(d) (i) would be a TreeSet of Objects. This means it is identical to (ii) and they will compile to the same thing. (iii) is a shorthand used in assignment to infer the type from the intialisation of a variable. (ii) should be used over (i) for the sake of clarity, as it makes it clear that the parameterised type is Object.

3 2025 Paper 1 Question 4

https://www.cl.cam.ac.uk/teaching/exams/pastpapers/y2025p1q4.pdf

(a) Make classes open to extension but closed to modification. This means modifying old code is unecessarily and therefore less likely to cause any problems.

(b) Encapsulation — restricts direct access to internal behaviour and state. This ensures that these can only be modified as intended by the developer. Additional functionality is added in the form of getters and setters.
Inheritance — building classes as children of other classes, copying their behaviour and state. This means that functionality can be added to a class by inhereting from it and adding anything new, rather than modifying the original Polymorphism — having methods override parent classes or take different arguments. This means that a method can be changed to allow new functionality or take new inputs, without modifying the original Abstraction — declaring abstract classes or interfaces can give structure to a child class. This makes it very useful to extend functionality by inheriting from these.

(c) (i) Yes, as n is a Number, being taken from the Numbers in numList

(ii) No, as the wildcard is upper bounded, so only Numbers can be added, and 6 is an int.

(iii) Yes, as the wildcard is lower bounded, so integers can be added.

(iv) No, as only Integers can be written to the list due to the lower bound

(v) No, as if intList contains parents of integer, they cannot be cast to Integer.