Q.1b)

The Iterator design pattern is used to make it more flexible to iterate over user defined elements.

Using this pattern in the program allowed to design an iterator for the user defined class so that it could be used to loop over the elements as we wanted it to. The implementation of the iterator differed from a general iterator since we wanted to check the bits that were set in the BitVector and not just loop over all the bits. It provided an abstraction to access the elements of the BitVector sequentially without exposing how it was represented internally. We can traverse the elements sequentially and get the next element without exposing the fact that it is actually stored in the form of bits in an integer array.

Q.3b)

The adapter design pattern was used in this question. The NodeSet delegates all the requests to add, remove, contains methods to the adaptee, BitVector.

The functionality provided by BitVector class was similar, hence we used the adapter pattern to adapt the Node function to that performed by BitVector. The iterator used for the NodeSet was implemented using the BitVector adaptee, the functions for adding and iterating were already implemented in the BitVector, hence using adapter made more sense to adapt the old components to the new system since underlying functionality was similar. We did not have to implement the same functionality again which would just increase work, instead we reused the old componenet and adapted it to the current requirements.

Q.4d)

Using the visitor design pattern allowed us to determine the type of node being created or visited and also the type of visitor being accepted. The ASTNodeCountVisitor allowed us to keep track of the number of nodes of a particular type that were created in the client function.

The ASTSearchVisitor allowed us to search for specific string in specific types of nodes.

The common method visit allowed us to accept the visitor object at runtime. Here we created two separate visitor objects of different types which allowed us to access the node count functionality and search functionality using the visitor interface.