Exercise 1  Consider the model $M$ given below. Find all states that satisfy CTL formula:

1. $\text{AF} p$
2. $\text{EG} p$

![Diagram of model M]

Exercise 2  Find the fixpoint to the following predicate transformer:

1. $\nu Z.p \land AXZ$
2. $\mu Z.\neg q \lor (p \land EXZ)$
3. $\mu Z.p \lor EXZ$
4. $\mu Z.p \lor AXZ$
5. $\mu Z.\neg q \lor (p \land AXZ)$
6. $\nu Z.\neg p \land EXZ$

Exercise 3  Find the appropriate predicate transformer for which the given CTL formula may be characterized as a fix point:

1. $\text{EF}(p \land q)$
2. $A[p \cup q]$
3. The formulas from exercise 1.

Exercise 4  Find the corresponding CTL formula (if it exists) for the $\mu$ calculus formula: $\nu Z.(\mu Y.p \lor EX Y) \land AX Z$.

Exercise 5  Consider the same model $M$ from exercise 1.

1. Evaluate (find all states that satisfy) the formula $(q \lor s) \land \neg p$.
2. Evaluate the $\mu$ calculus formulas from exercise 3.3.
3. Compare the results from Ex.5.2 and Ex.1.

Exercise 6  Translate the following CTL formulas into $\mu$-calculus formula: $\text{AF} AX (A(\neg q \cup p))$ and $AX EX (p \lor E(\neg p \cup q))$. Then, consider the following model:

![Diagram of another model]

Evaluate the obtained $\mu$ calculus formulas on the given model.