Derivation of Algorithms Week 8 CA 2018

Question
Derive a solution for the following program specification:

|[

    <u>con</u> N:int; {N ≥ 0}
    f: array [0..N) of char;

    <u>var</u>
    freq: int;

    S

    {freq = #i: 0 ≤ i < N: f.i = 'A'}
]|

Note: When counting the frequency of things we usually start at zero. When splitting off with # we add on the cardinality of the term we are looking for. Remember that **#(True)** is **1** and **#(False)** is **0** (see summary sheet on MOODLE). So for the loop body you should end up with

freq = freq + #(f.n = 'A')

If **f.n = 'A'** then **#(f.n = 'A') will be 1**. If **f.n ≠ 'A'** then **#(f.n = 'A') will be 0**. So effectively we will be adding 1 or 0 to the frequency depending on the value of f.n. In order to determine which action to take you will need to carry out case analysis and then develop an if..fi block. **End note.**

Your solution should contain the following parts:

1. Write down invariants P0 and P1
2. Write down an outline solution
3. Derive S0;
4. Derive S1;
5. Prove termination
6. Write down a complete solution