Constraint Based Analysis

Question 1. Let `edge` be the input relation containing all edges in a directed graph. Let the relation `path` be defined as follows:

```
path(n1, n2) :- edge(n1, n2).
path(n1, n2) :- path(n1, n3), path(n3, n2).
```

a. Is the following Datalog relation `path2` equivalent to the above relation `path` (do they always produce the same output given the same input edge relation)?

```
path2(n1, n2) :- edge(n1, n2).
path2(n1, n2) :- edge(n1, n3), path2(n3, n2).
```

b. Write a Datalog relation `R` that outputs each node `n` that has at least one incoming edge.

```
R(n) :- ?
```

c. Write a Datalog relation `S` that outputs each pair of nodes `n1`, `n2` that occur in the same cycle. Your answer may use `edge` and/or `path` as necessary.

```
S(n1, n2) :- ?
```

Question 2. State two benefits of writing a static analysis in Datalog instead of Java.