Introduction to AI – Bayes Networks

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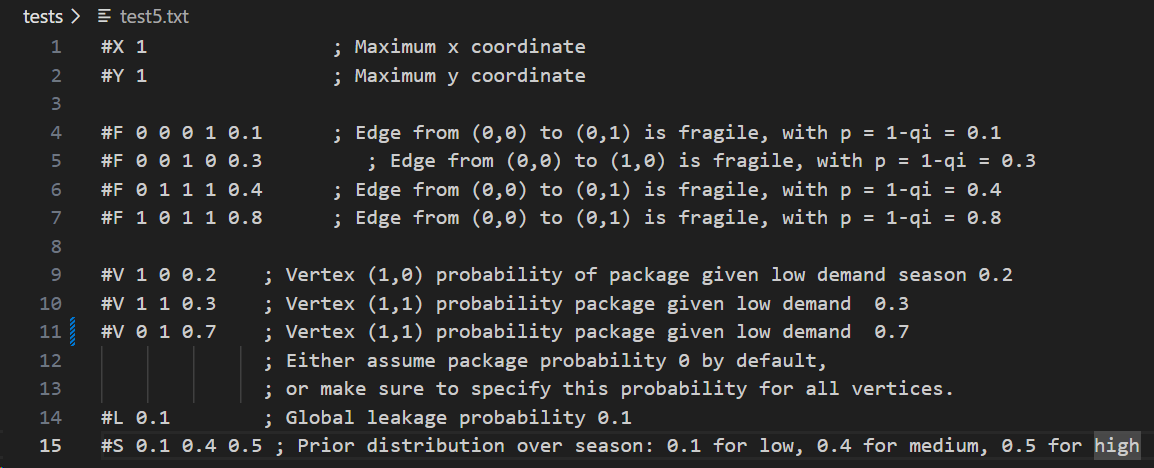
Amit Zulan 207299033

Bayes Network:

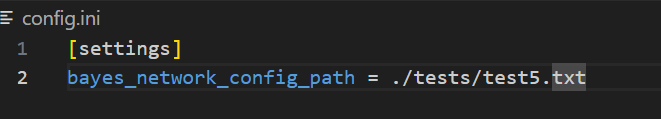
* To create the Bayes Network we modeled it as a graph (can be seen below) of the library nx.Graph.
* The root of the network is the season, it’s sons are all the nodes in the grid, and each of the nodes sons are the edges they are connected to for each node at least two sons (corners, 3 for edge nodes and 4 for middle nodes) and two parents for each edge (the nodes which are connected by the edge).
* We included blocked edges in the network with probability 1 to be blocked.
* We included nodes (vertex) that have no probability that a package would appear there with CPT of 0 for each season.

The reasoning algorithm:

* We used the Enumeration Algorithm.
* We implemented EnumerationAsk and EnumerationAll.
* To answer the 5 questions (3 must and 2 bonus) we made encapsulation functions:
  + EnumerationAskAll to query All nodes in the BN given the evidence. (1, 2, 3)
  + EnumerationAskSet to query multiple nodes given the evidence +  
    AllSimplePathEdges and AllSimplePathsStartToEndEdges in order to find all paths probabilities. (4)
  + FindNonBlockedPath, find the highest probability non blocked path between two nodes. (5)

Examples:

Input file:



Output:

* A screenshot of a computer code

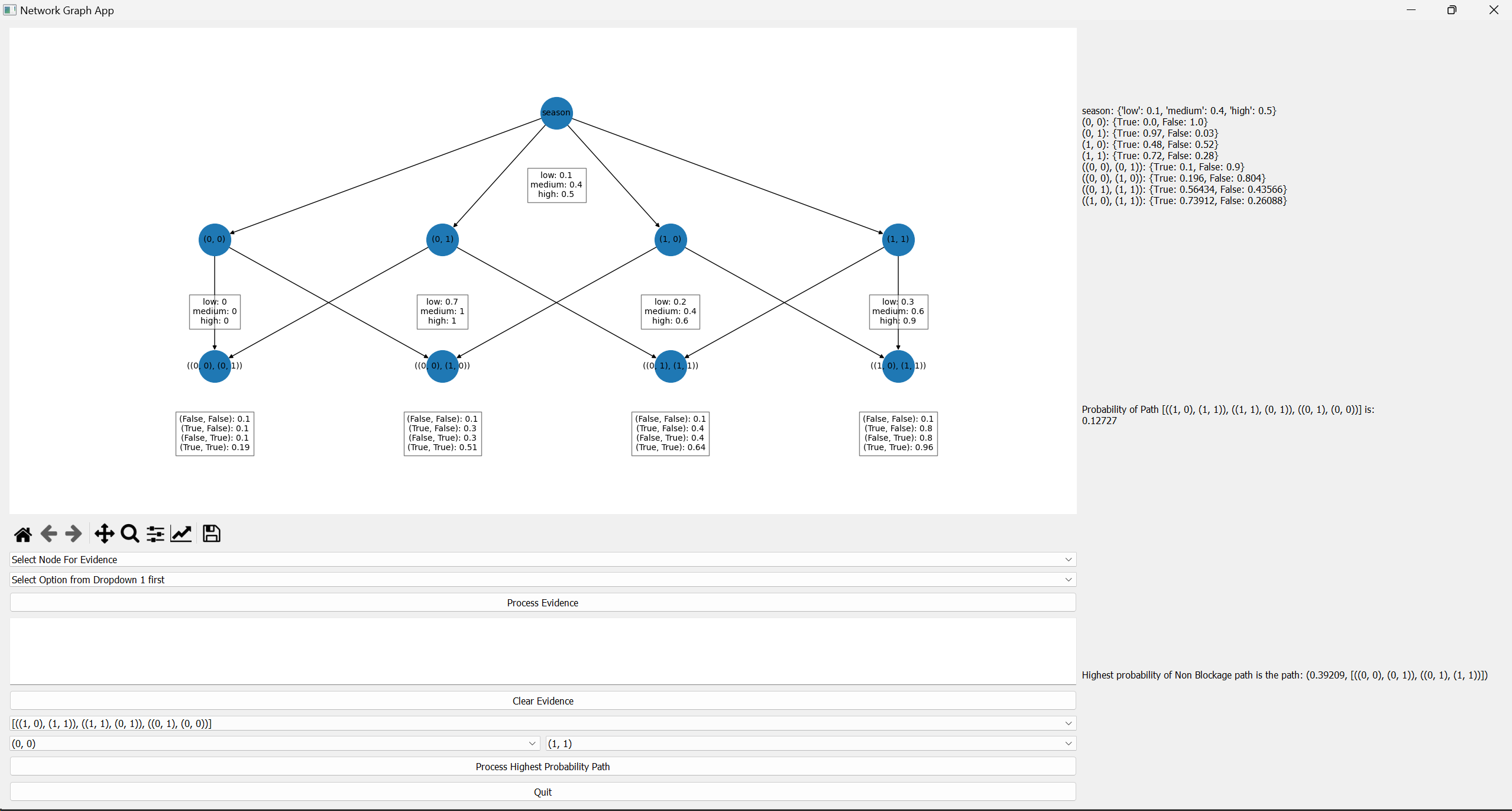
  Description automatically generatedGiven Nothing the probabilities of all nodes are:



* A number of text on a white background

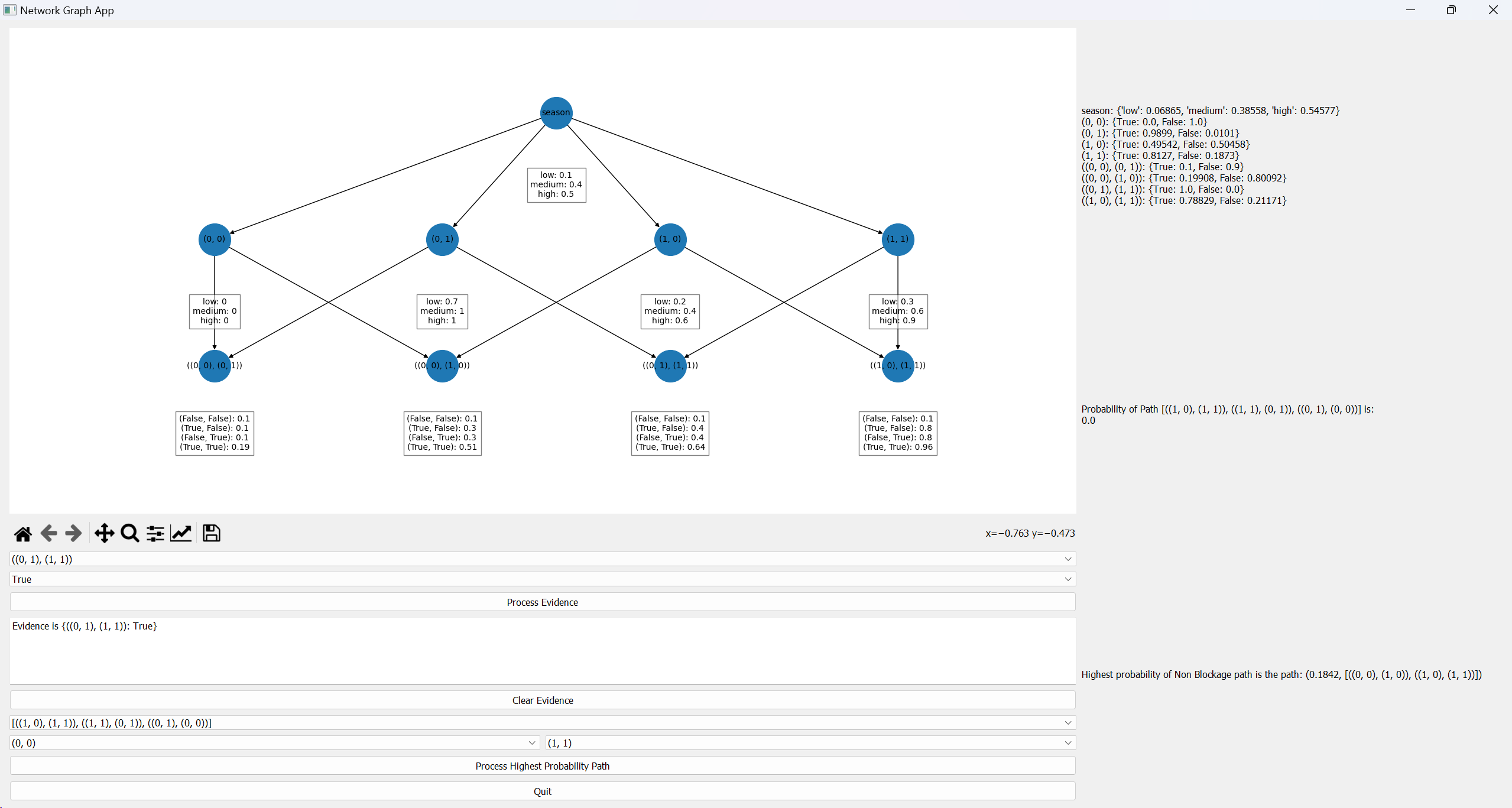
  Description automatically generatedQuering the path
* Asking for the highest probability of non blocked path between (0,0) to (1,1):

And we can see all that in the below GUI:

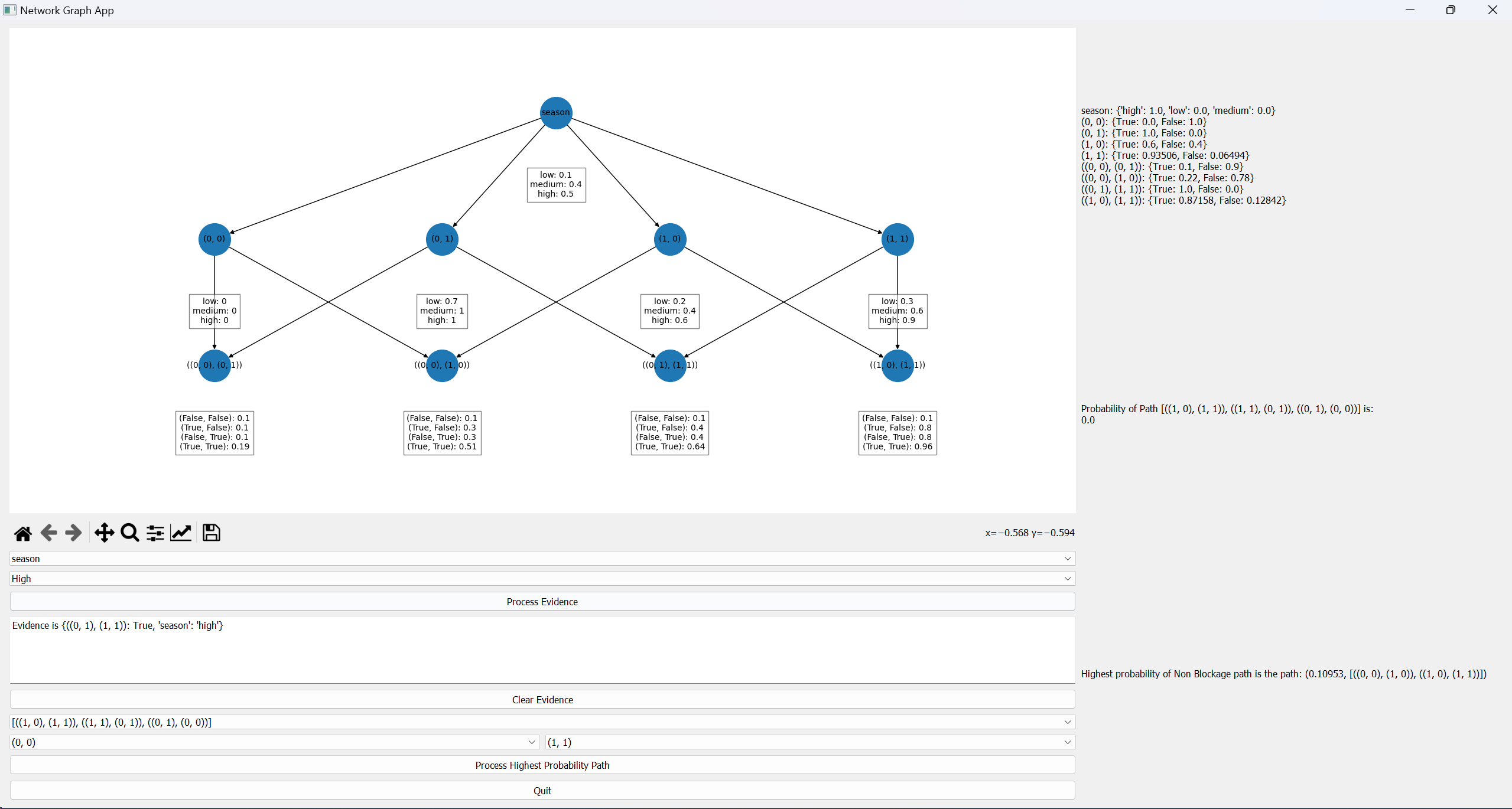


If we add to the evidence: {((0,1),(1,1) : True} we are blocking that edge causing the probability of the path chosen to be unblocked to be – 0,

And the path with the highest probability of being non blocked has changed and it’s non blockage probability is lower than the last which makes sense because otherwise it would have been the best path even before the change of the evidence.

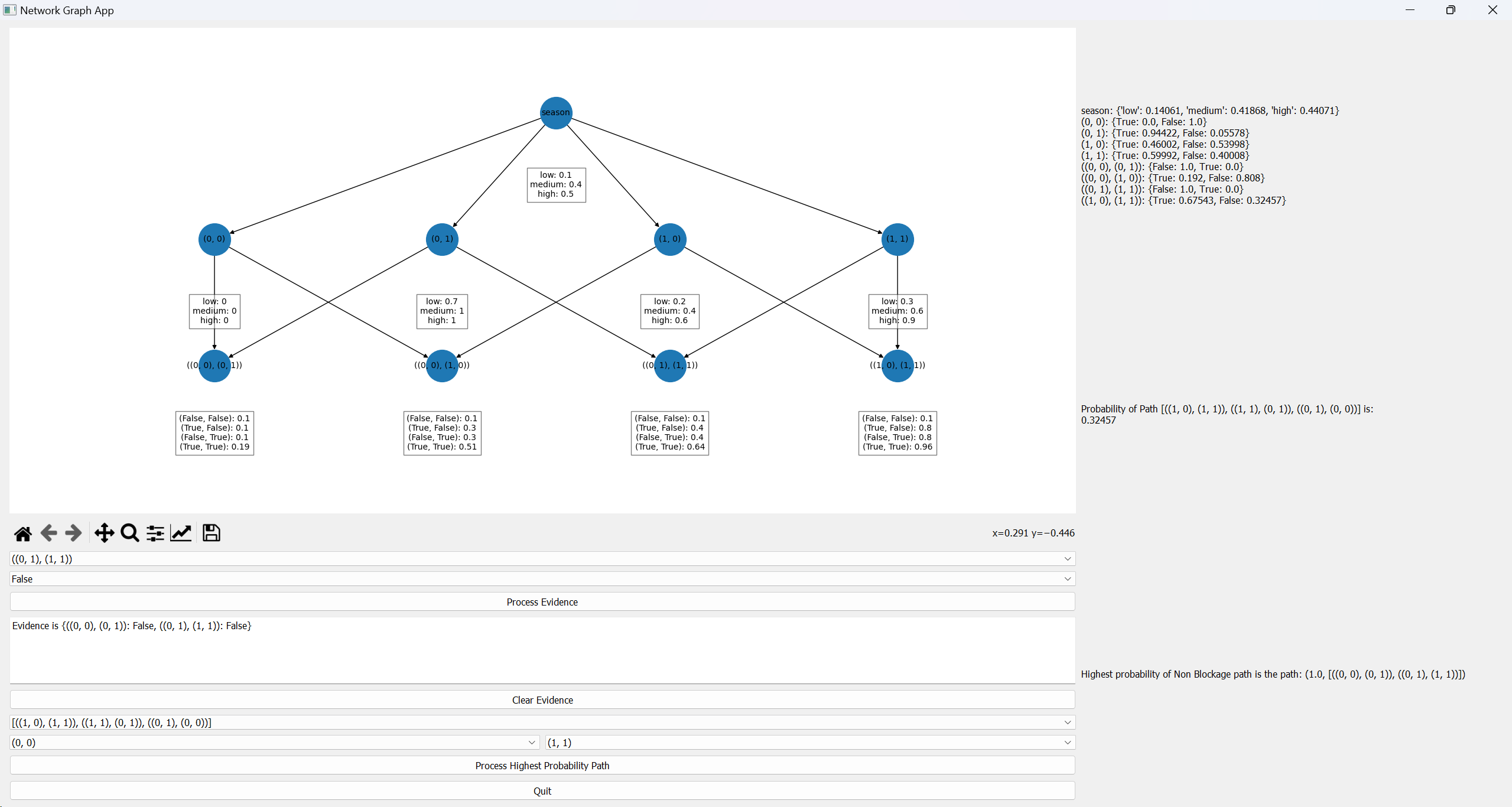


If we add a season: ‘high’ to evidence:



We can see that all edges probability has dropped since vertices now have more probability to own a package.

Let us change the evidence:



Now there is a path from (0,0) to (1,1) that is clear given the evidence so we have a probability of 1.

Also, the probability of the path has increased: