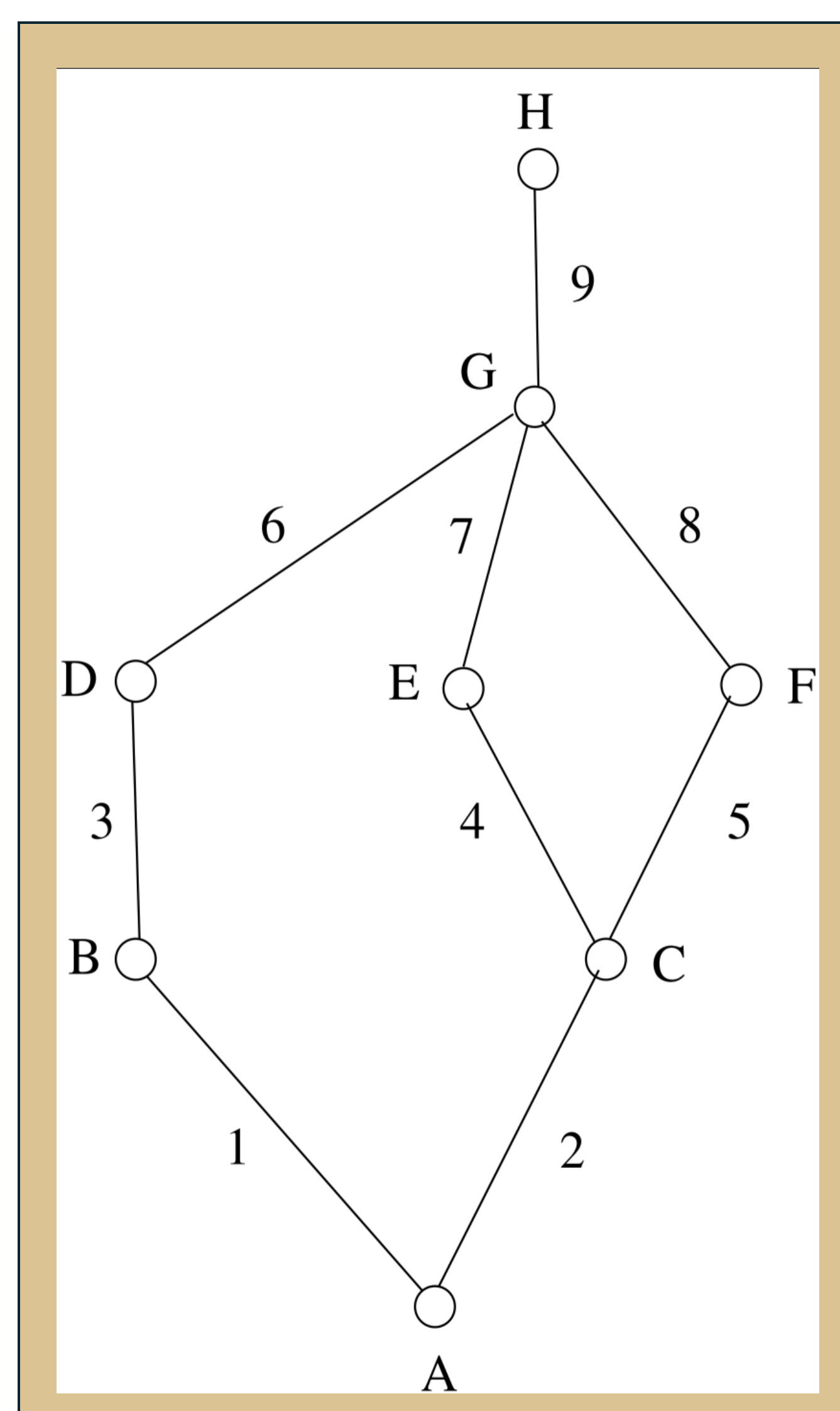


*What program and algorithm can be designed to evaluate the possibility of different routes given obstacles and their probabilities, while moving beyond subjective measures?*

## Purpose

- Design and implement a program capable of identifying the “best” route among a set of alternatives, given a series of predefined factors and their probabilities.
- In his paper “A Concept of Possibility for Real-World Events”, Dr. Schwartz explains that possibility does not simply ask *what could happen*, but instead *what can most realistically be achieved given constraints*. This project will take that theoretical distinction as its foundation and will develop it into a working model to apply it to realistic scenarios.
- Expand code provided by Dr. Schwartz to real-world scenarios with variable input.
- Aim to advance the field of possibility theory and illustrate its value in real-world problem-solving.

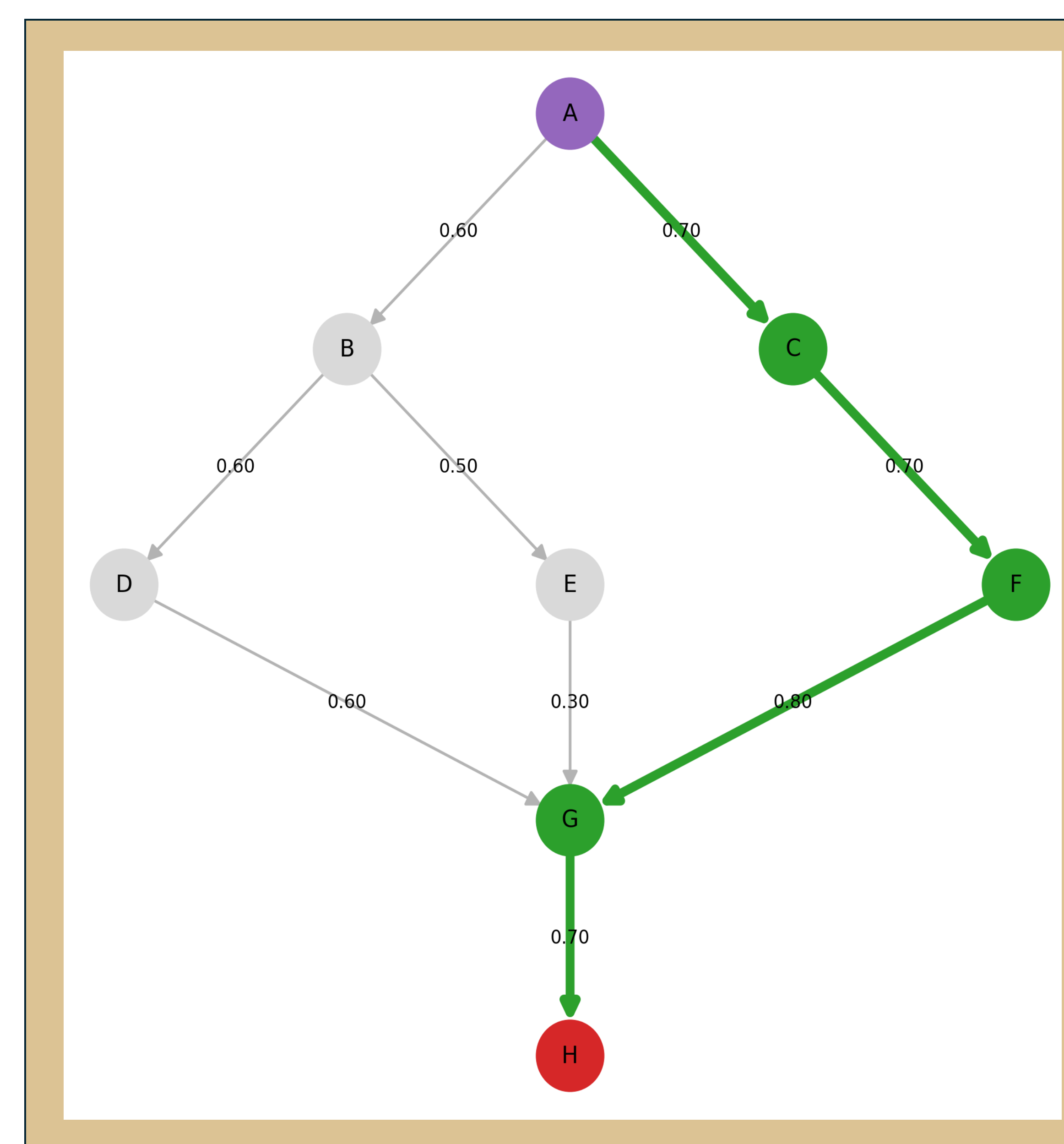
## Foundation



This project builds upon Python code provided by Dr. Schwartz, which is able to interpret static data, which has the potential to be built upon to create an algorithm complex enough to handle real-world examples. Now, the objective will be to make this code take in input variables, an arbitrary amount of constraints and prerequisites, and then identify the best path based on possibility. From Dr. Schwartz's paper, we can see this example mapping of a route. This functionality is what the new program should be able to output based on user input.

## Process and Results

1. Utilizing Python on the foundation code, a series of input variables first replaced the static data at the beginning. At first, this was added as command-line prompting for probability floats and constraint/obstacle numbers.
2. Next, based on the inputted number of "steps", or "nodes", the possibilities were calculated for each connection from the user-indicated origin letter to the destination letter, and outputted as the overall best route. This was done through the implementation of the functions `find_all_paths`, `calculate_possibility`, `calculate_path_possibility`, and `find_additional_paths`.
3. A later review of the project concluded that a better approach would be to utilize an input text file instead of input variables. To accomplish this, the function `read_input_file(filename)` was implemented, which allowed for an easier user experience, as prompts no longer asked for new numbers with each step, which would not have been effective in a test case of many nodes. This way also allowed for more real-world scenarios, since each factor was able to be named (ex. "red light" or "traffic").
4. Once the Python functions were changed to adapt to this new input-obtaining method, test cases were run by executing the program with different input files. The results showed successful, accurate results of the "best" route in standard output.
5. To display results in a manner more similar to the image of a map from Dr. Schwartz's paper, a further step was taken to generate a pdf image displaying the results from the algorithm. To do this, the OpenAI model ChatGPT was prompted with the prompt "create a visualization of this result through a pdf image".



## Conclusions & Future Studies

This study was able to broaden the application of the idea of possibility and create a new way to apply the concept to real-world applications. In future studies, a program that could pick-and-choose which prerequisites, constraints, or user choices could be combined to construct an alternative, superior route would be extremely beneficial. A different way to visualize the data would also be a useful next step. In this study, a visualization would have required further study of software needed to construct pdfs, which could be originally produced in similar projects.

## References

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