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**SYSE 5150**

**Final Project**

The final project is worth 40%.

I encourage you to come up with your own project. The requirement is that it should be a

somewhat practical problem related to optimization. The project should include the detailed

problem description, optimization formulation, and what you obtained as a result of the solution.

The solution procedure and results should be clearly presented. The results should be

discussed.

For example, the project could be: “Structural optimization of a helical gear” or “Optimization of

an airfoil shape for specific flight conditions using CFD methods” or “Optimization of the mutual

fund investments”, etc.

Reliability based on different distances

Removing nodes one at a time retreiving buoys

Chances of retreiving all the nets

Constrainst:

Distance from one another –> signal strength

Variables:

Paths between nodes

Drift net fishing is a popular type of commercial fishing that involves leaving nets in the ocean for a period of time to become productive. In an effort to reduce the cost of lost nets, the cost of searching for difficult to find nets, the operational costs of placing nets that become lost, and to minimize the environmental and regulatory concerns of other stakeholders, it is necessary to attach radio beacons to the nets to ensure successful retreival.

Another consideration is ruducing the power consumption required to transmit data over long distances. The beacon design will be both a transmitter and receiver. The beacons will receiver gps location data then transmit the data over the network of beacons. These lower power transmitions will allow the battery to last longer in locations with low day light levels that limit solar power generation.

The model in this case usese at network of 10 buoys that are connected. Once a buoy receives a transmission it is unecessary to send the message back to the sending buoy; therefore, the graph is directed.

**The Problem**

Drift net fishing is a popular type of commercial fishing that involves leaving nets in the ocean for a period of time to become productive. In an effort to reduce the cost of lost nets, the cost of searching for difficult to find nets, the operational costs of placing nets that become lost, and to minimize the environmental and regulatory concerns of other stakeholders, it is necessary to attach radio beacons to the nets to ensure successful retreival. We will implement a model that will represent the beacons with a combination of receivers and transmitters known as transceivers. We will then determine the chances of a successful transmission from the furthest beacon (Node 1) to the beacon receiver (Node 10). Additionally, a variation of the model will be created and experimented upon. The variation will examine the chances of successful relay transmission to the beacon receiver while considering the probabilities of the path it took before arriving at each node along the way.

**Design Variables**

The design variables are the edges or arcs between the nodes that represent the path of the signal. The variables are binary in this model.

**Objective**

The objective is to maximize the probability of successful transmission of the signal. Two objectives will be compared. The first objective will be the maximizing the sum of the probabilites along the possible paths. The second objective is that will be examined, will be to maximize the sum of probabilities, but while considering the probabilities of the path it took before arriving at each node along the way.

**Constraints**

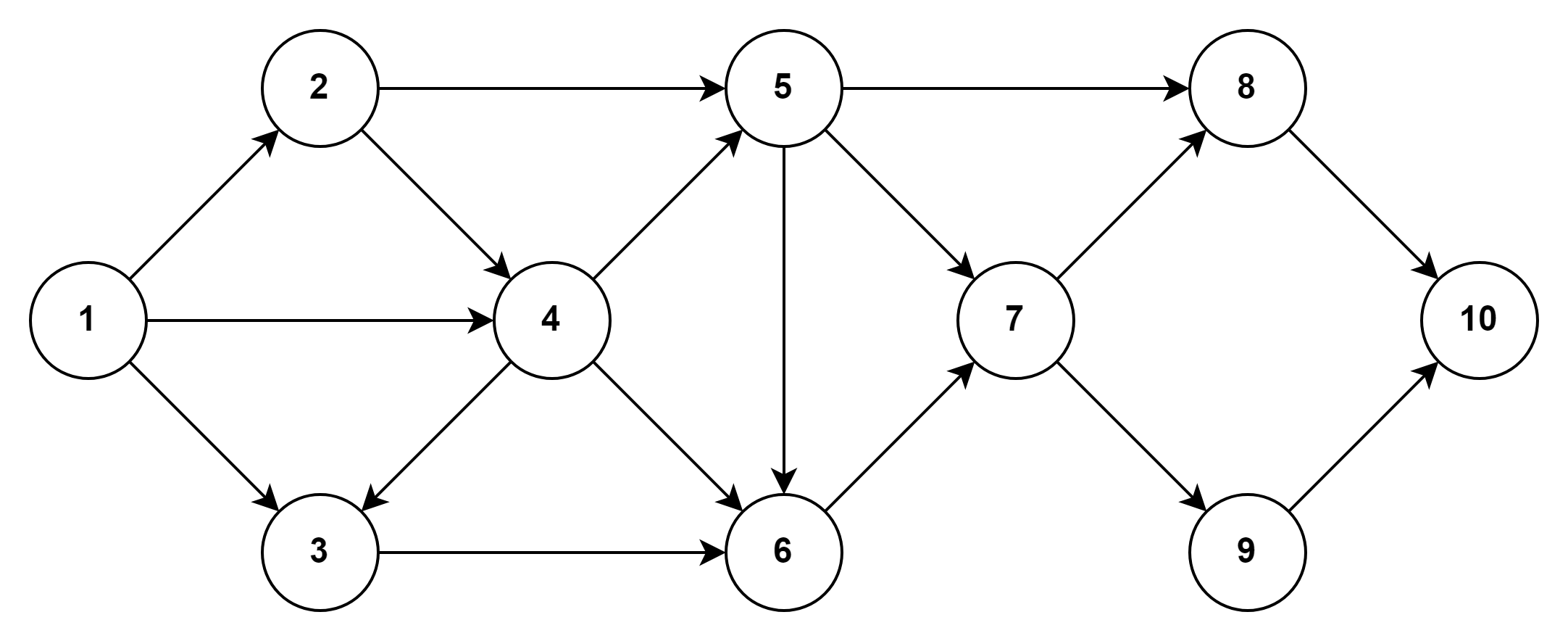
1. The first constraint will be that the edges that represent the path must be binary in nature. Either the path is taken between two nodes is taken or it is not.

2. The second constraint is that each edge can only be used once. This prevents the model from summing the path repeadatly to obtain a larger value.

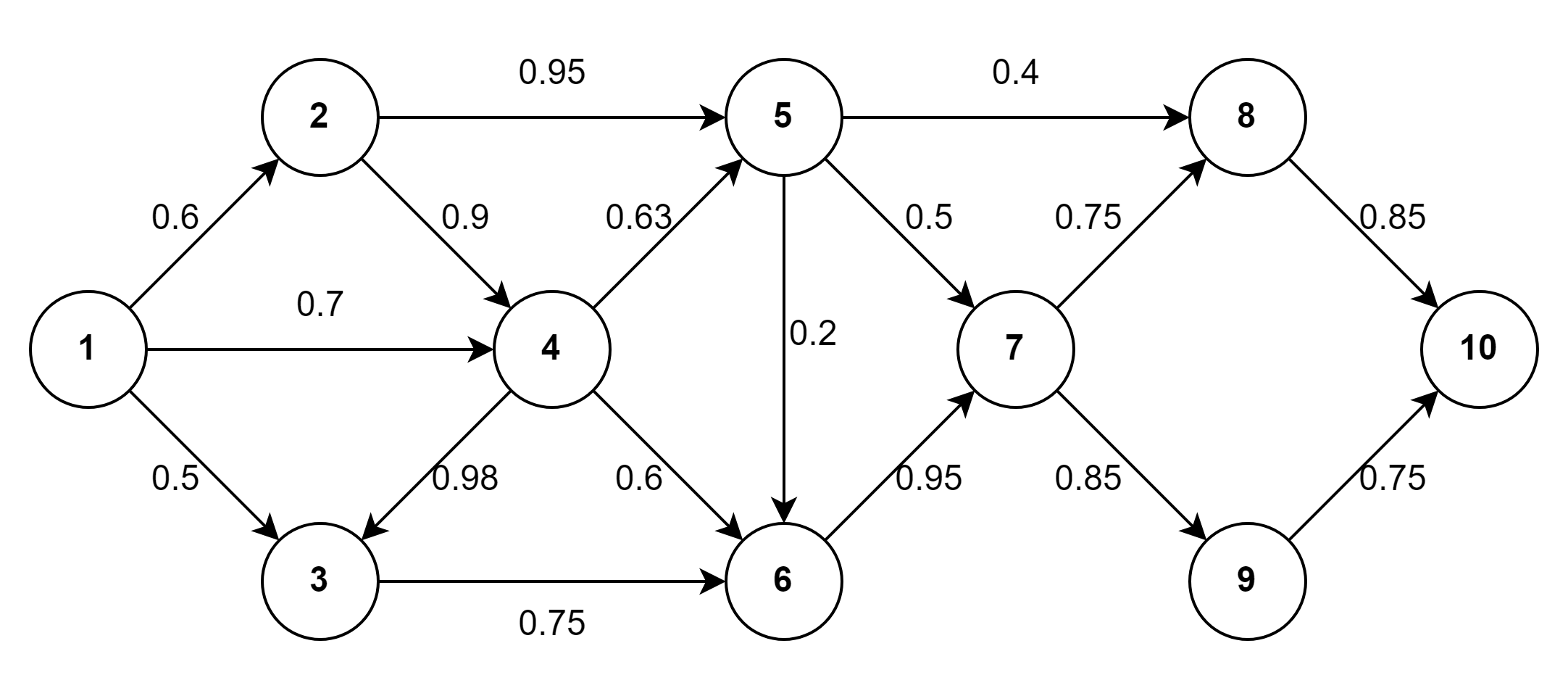
3. The third constraint is that the path starts at node one and terminates at node 10.

4. The fourth constrain will be that a node must have an edge or connecting path for it to continue the progression to the next node. A node can only continuie the path if the path has already led to it.

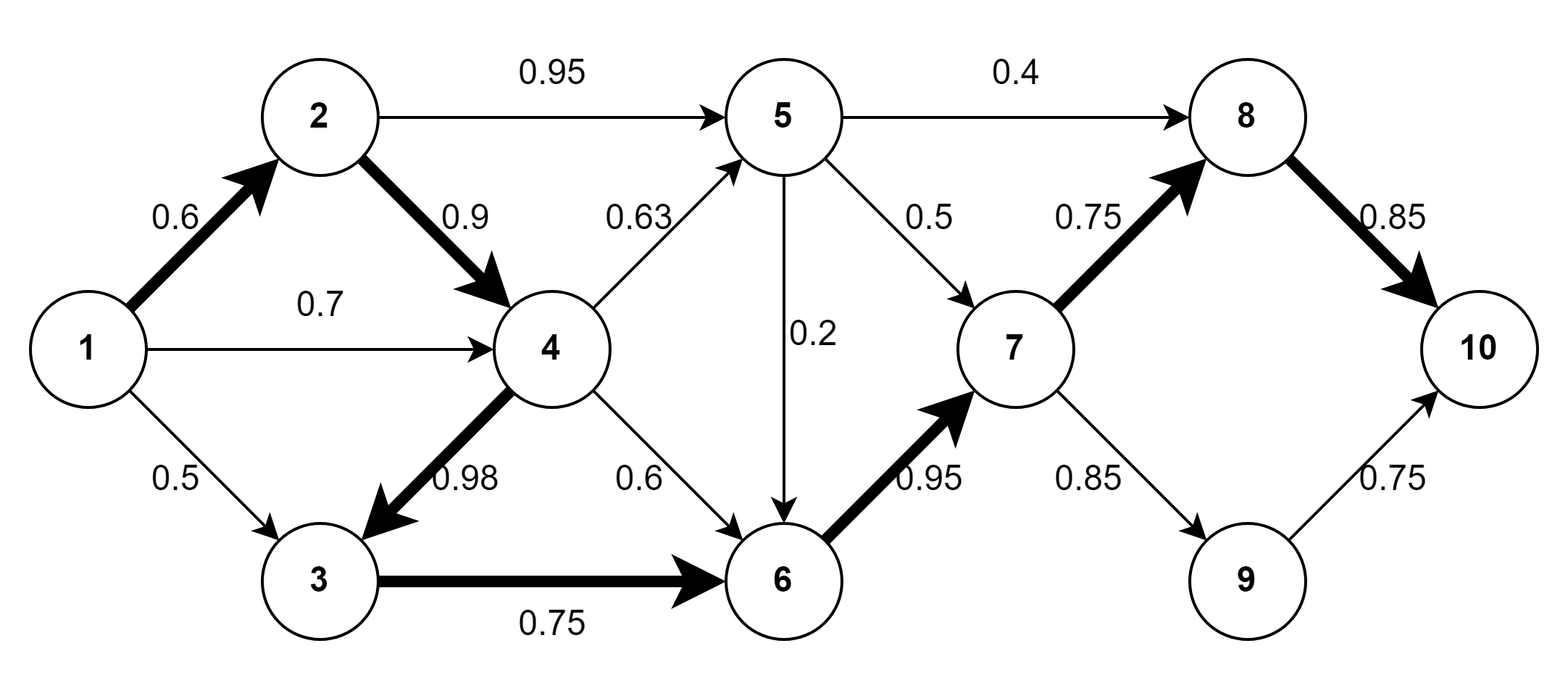
The constraints 2, 3, and 4 can be combined during the implementation with excel solver.



**The network graph with standard probabilities assigned**

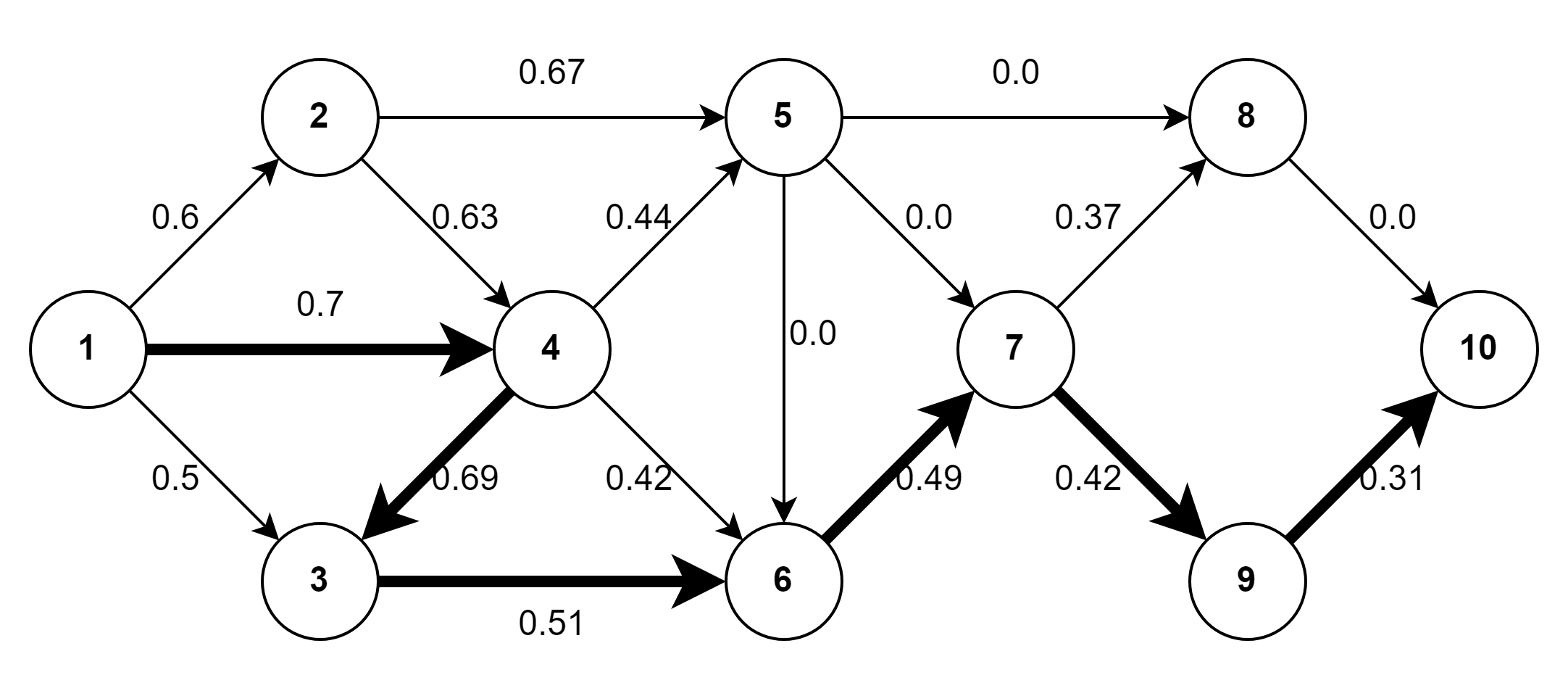


**The optimal path with standard probabilities assigned**



**The probability of successful reception of the signal is 0.2404 with standard probabilities assigned to the model.**

**The network graph with path-dependent probabilities assigned.**



**The probability of successful reception of the signal is 0.3116 with path-dependent probabilities assigned to the model.**