More trees

The EVB for each single-action update (i.e., taking action a^* at belief state b) is calculated as:

$$\text{EVB}(ba^*) = p(b_\rho \rightarrow b \mid \pi) \times \left(\mathbb{E}_{b' \sim p(b' \mid b, a^*)}\left[v(ba^*)\right] - v(b)\right) \tag{1}$$

Where $p(b_\rho \rightarrow b \mid \pi)$ is the Need term – i.e., the probability of reaching belief b from the root of the tree, b_ρ, when following policy π. The policy π here is i) softmax of the MF Q-values at the root of the tree, b_ρ; and ii) softmax of the immediate reward at every other node within the tree.

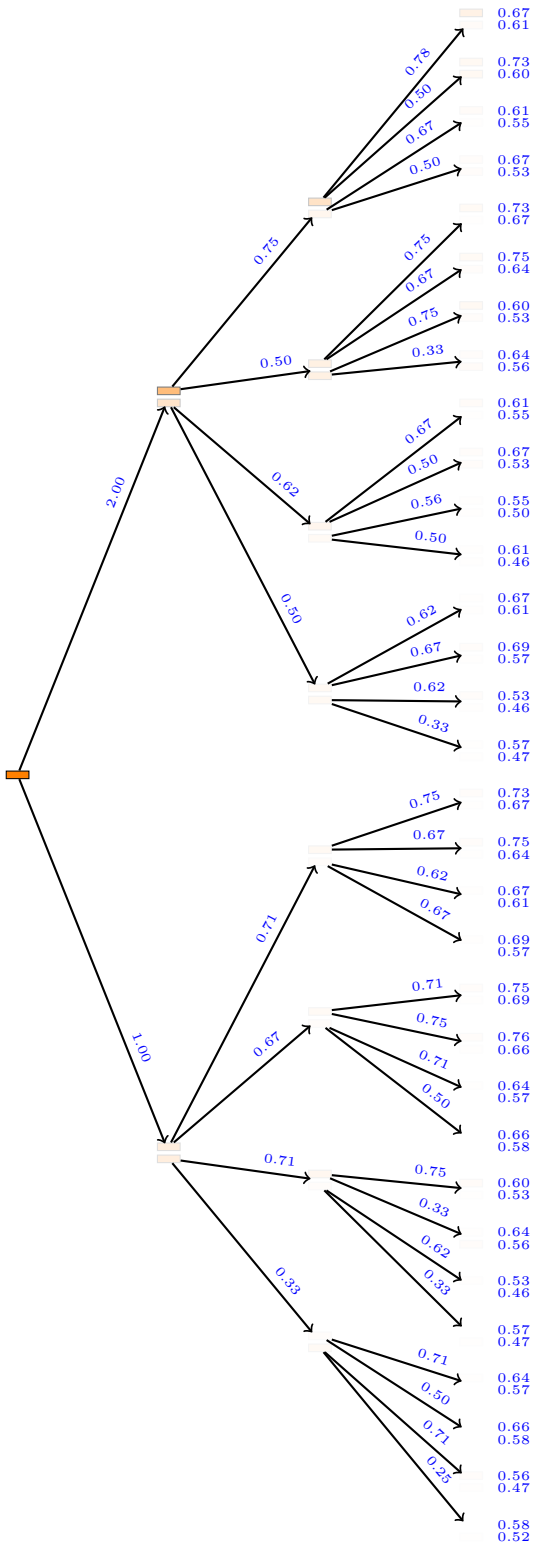
In the trees, each action has a blue number written above it – these are the Q-values. Each orange square is a belief state, and the opacity of each belief state is proportional to the Need term from equation 1. When belief states appear in pairs, the top belief state is always the one which results from obtaining a reward from the corresponding action, whilst the bottom belief state corresponds to zero reward.

Updates in the tree are always highlighted by red arrows.

Example 1

Belief at the root in this example is:

$$\alpha_0 = 5 \quad \beta_0 = 2$$
$$\alpha_1 = 1 \quad \beta_1 = 1$$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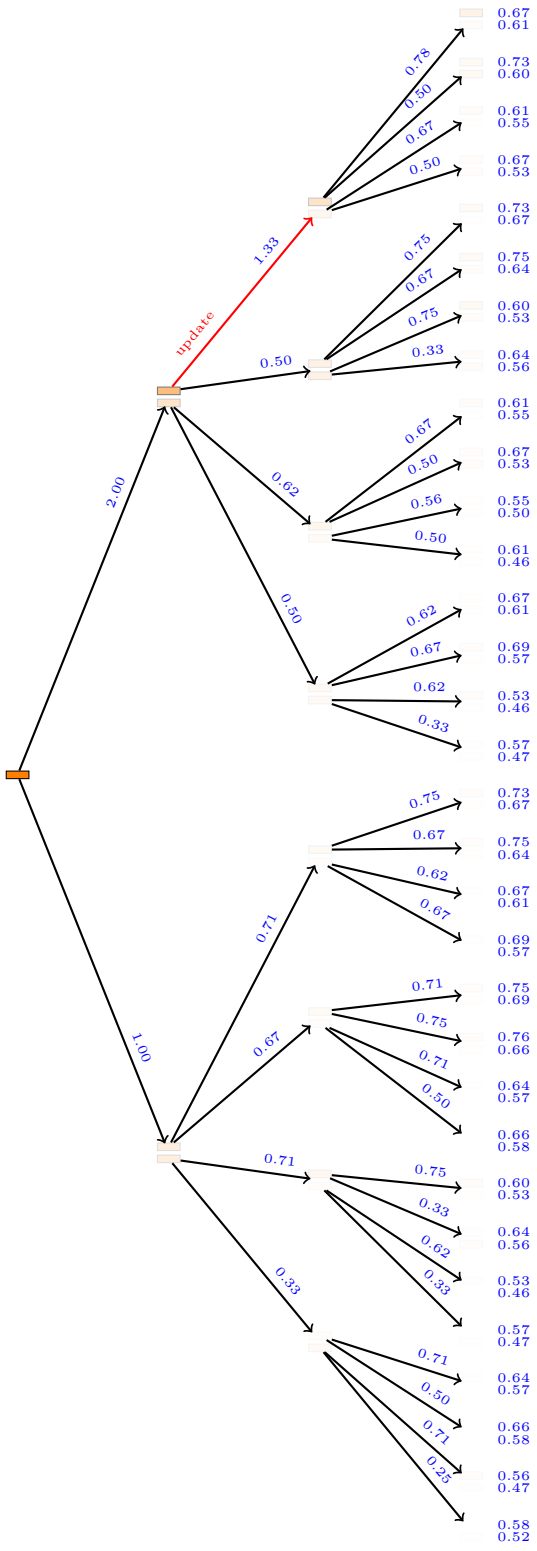
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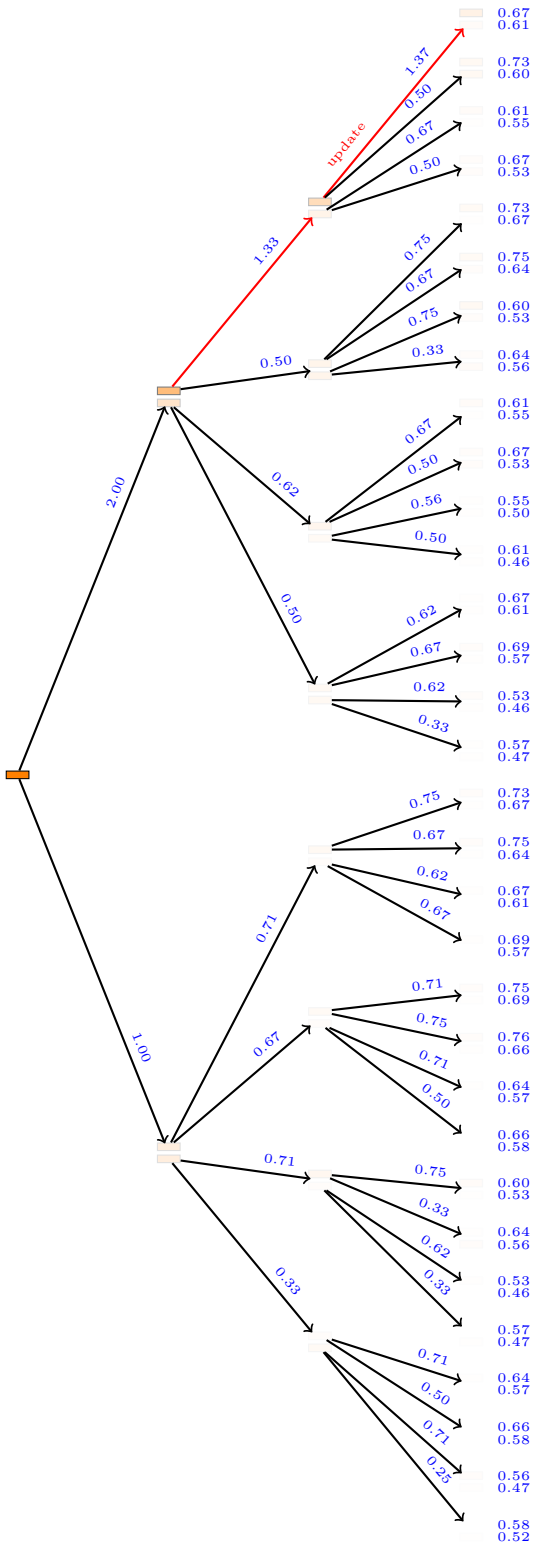
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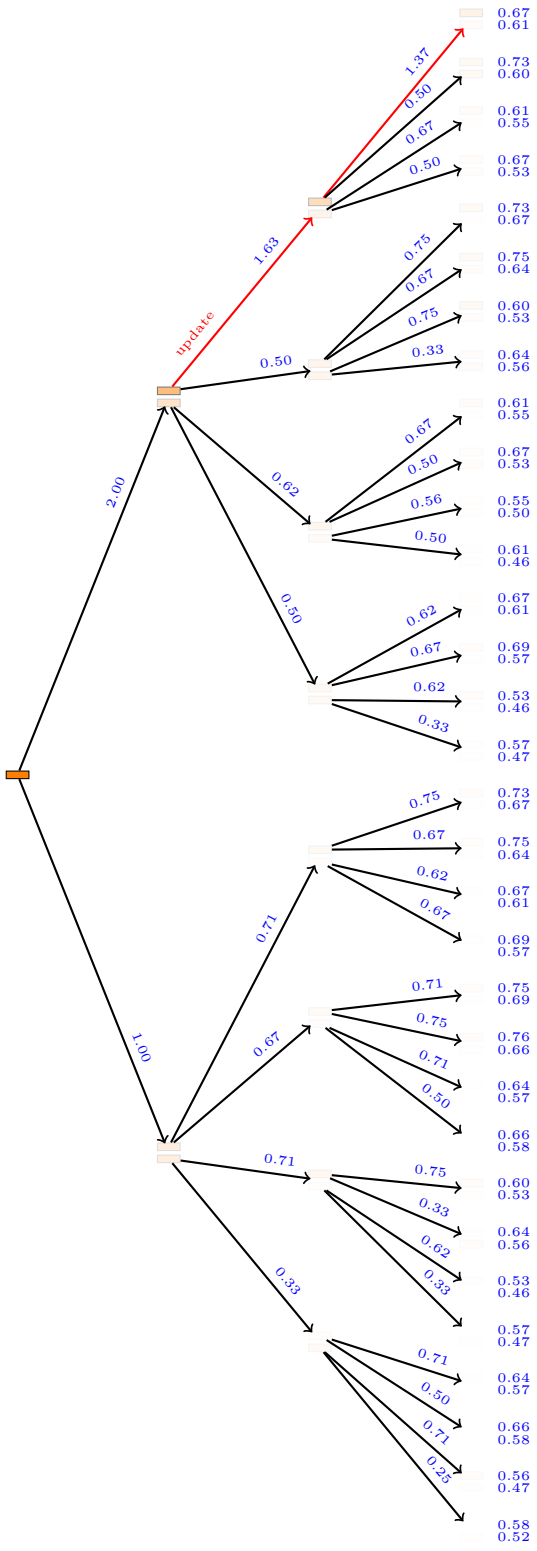
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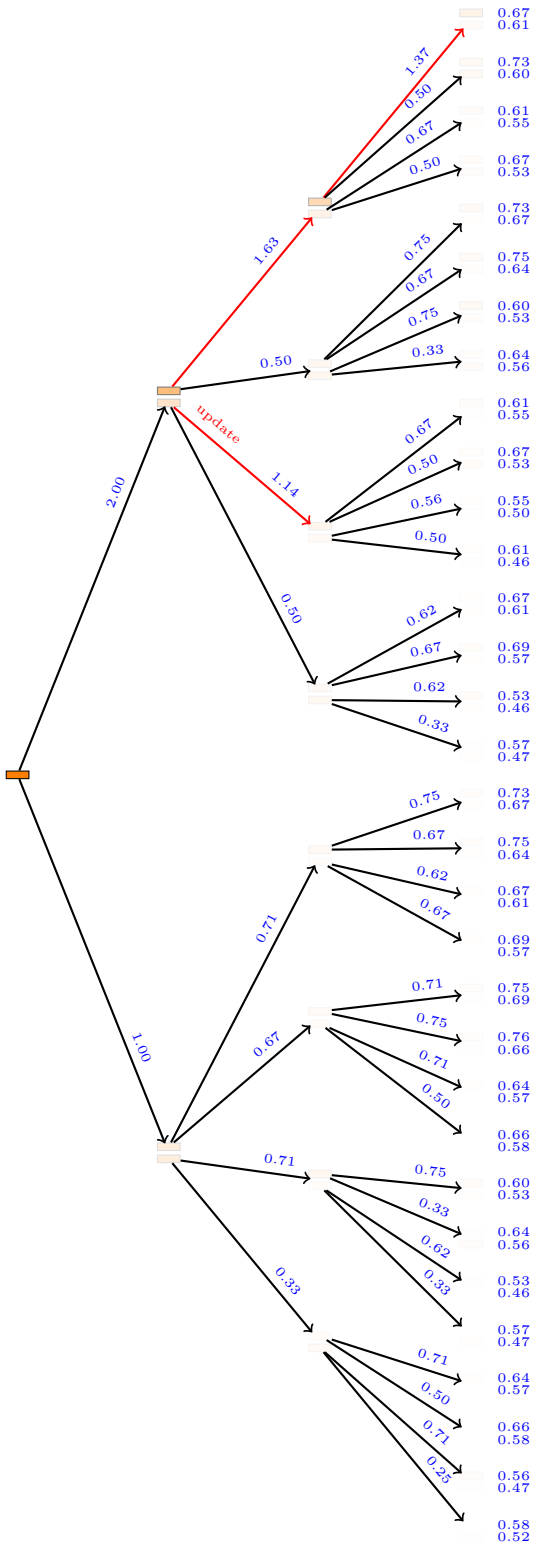
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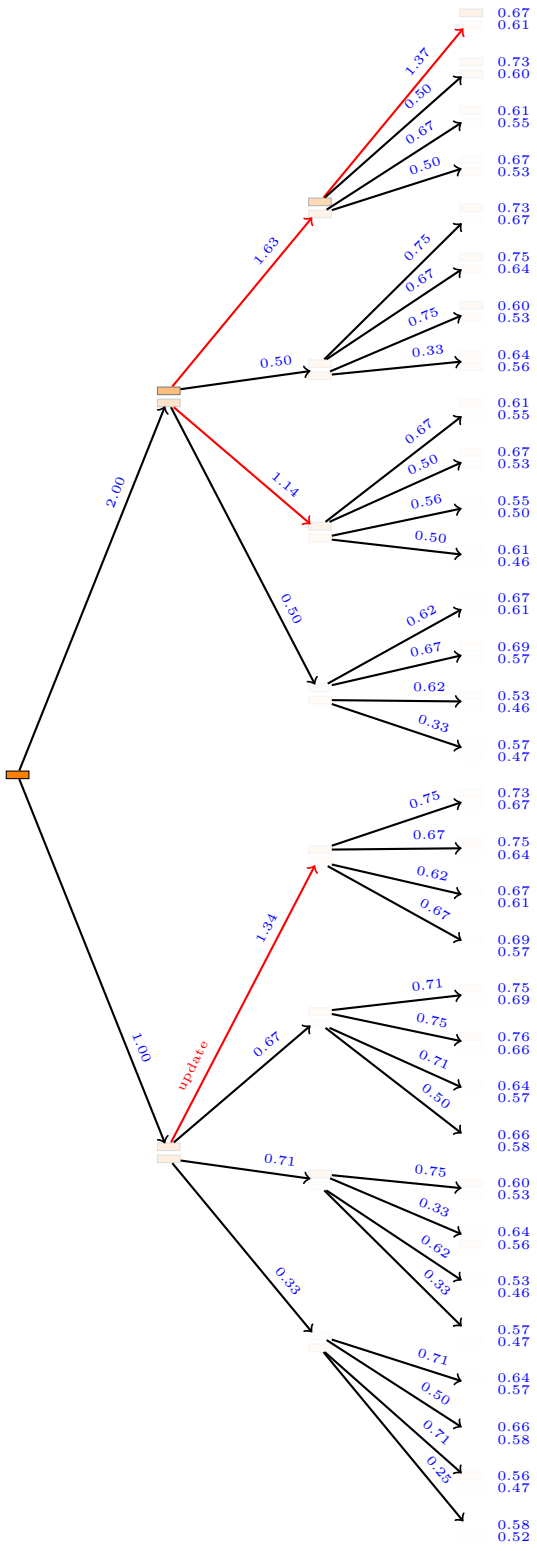
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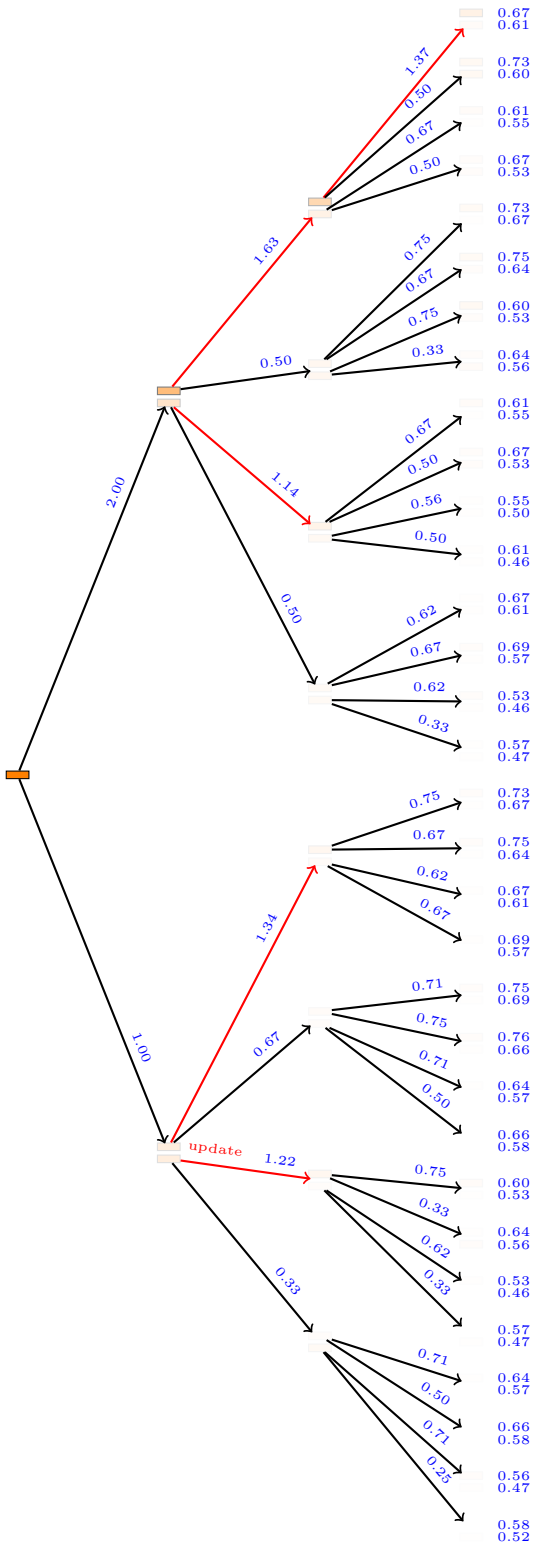
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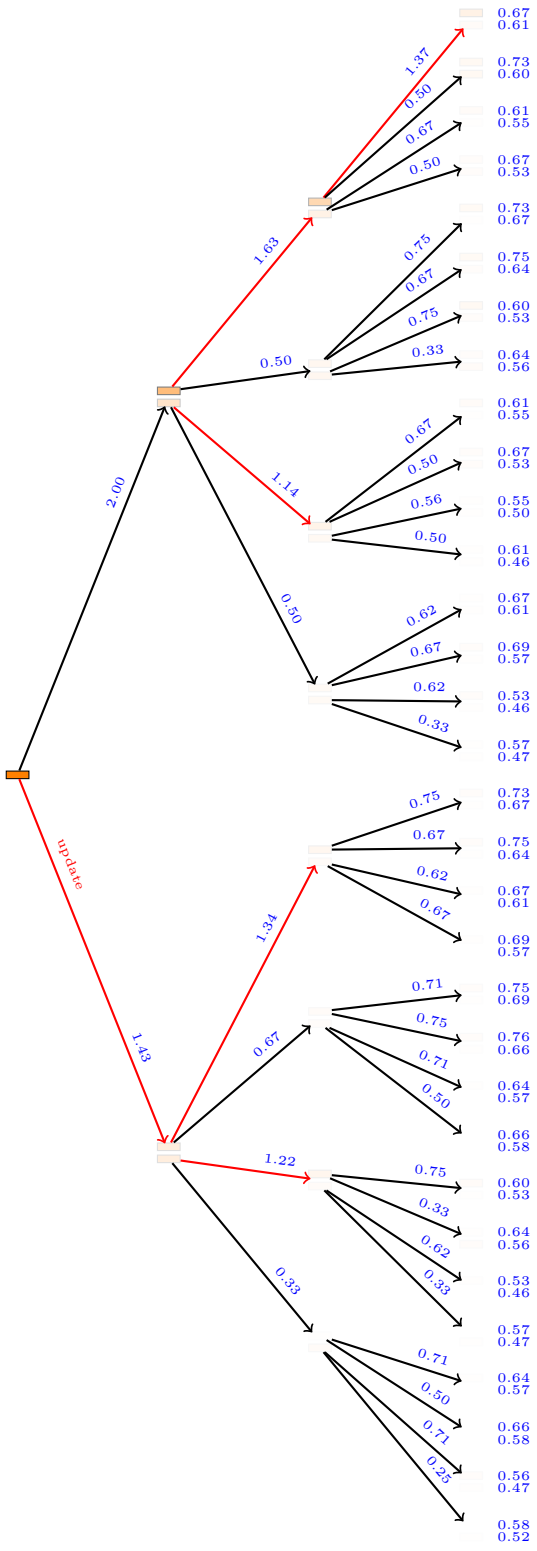
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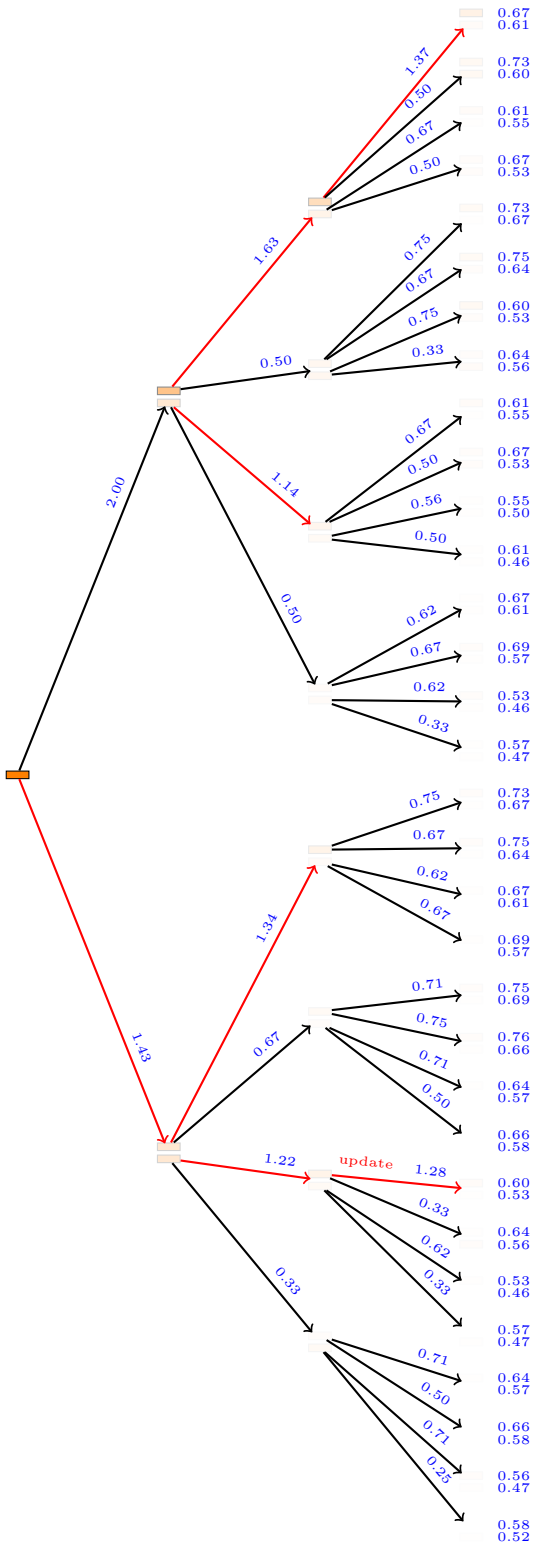
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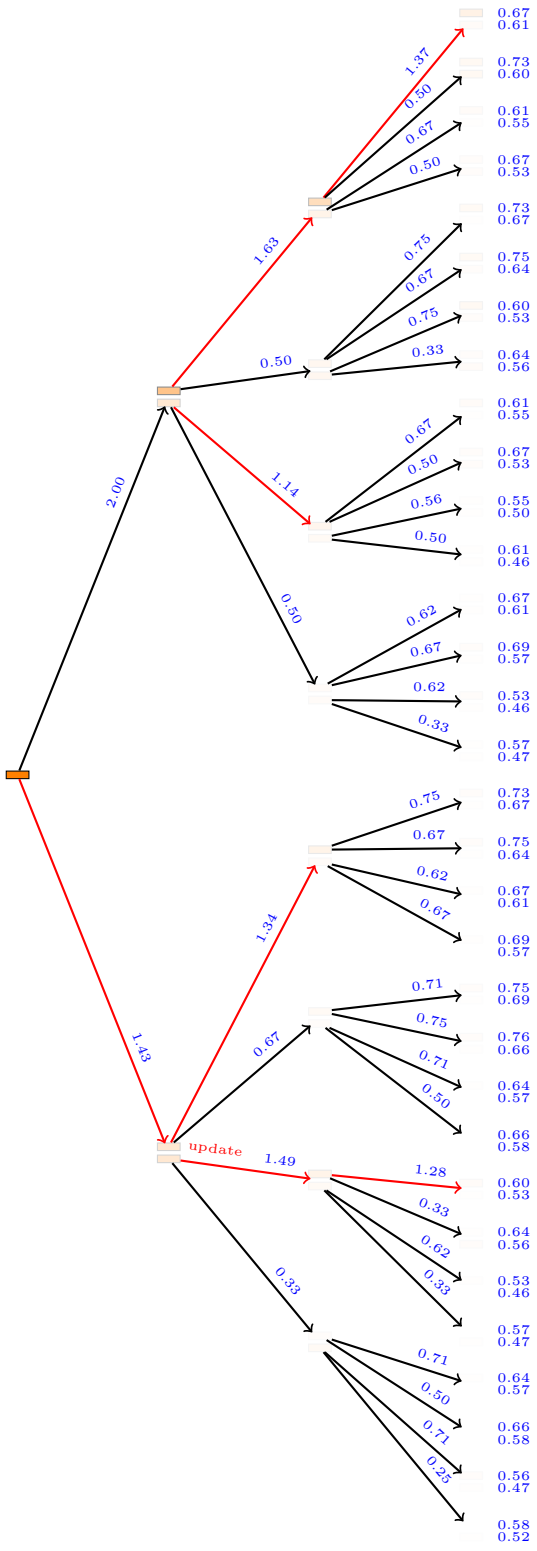
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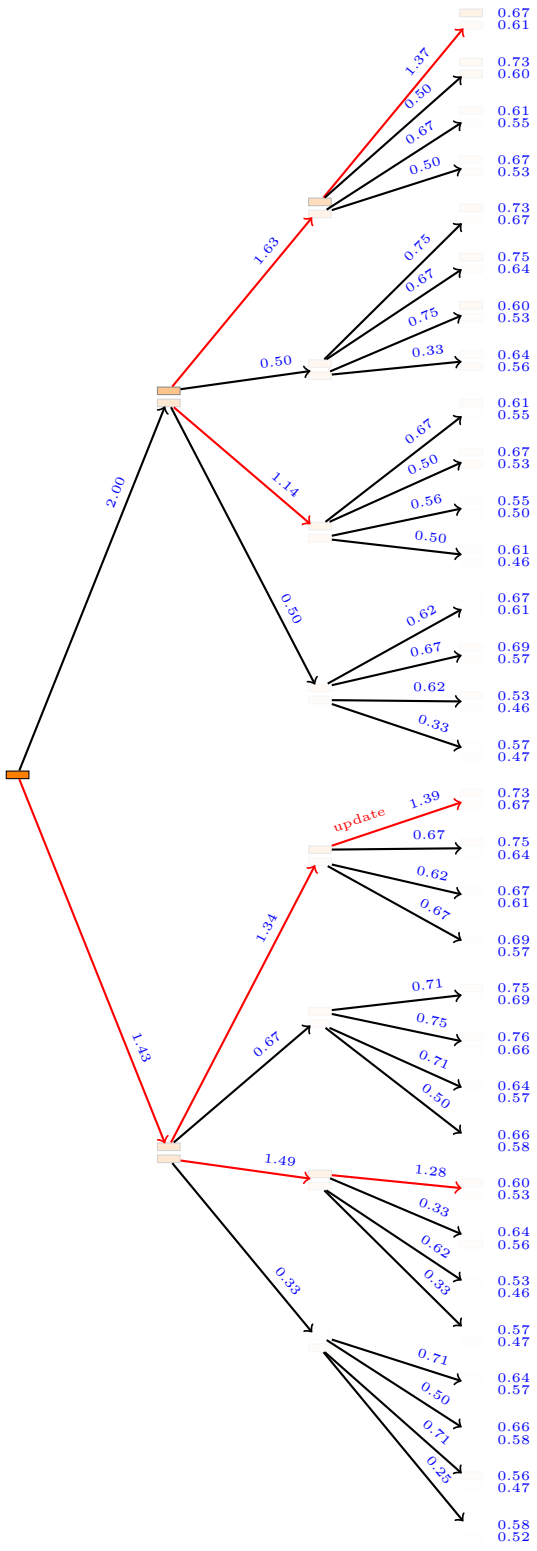
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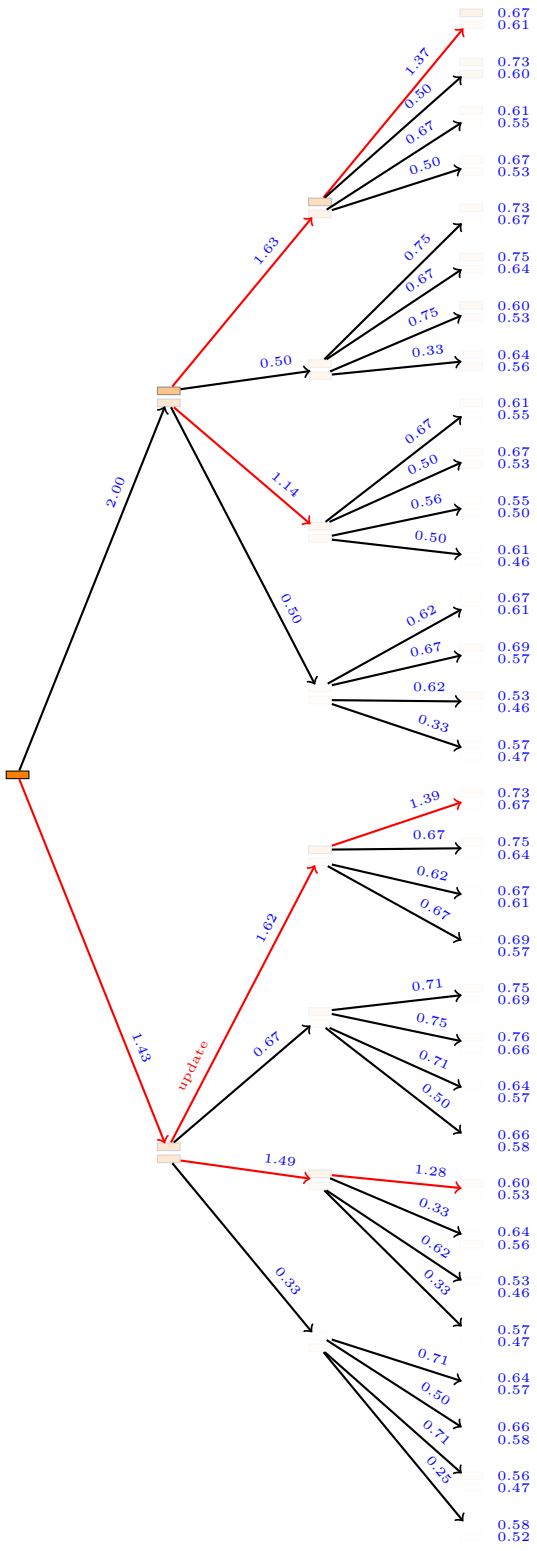
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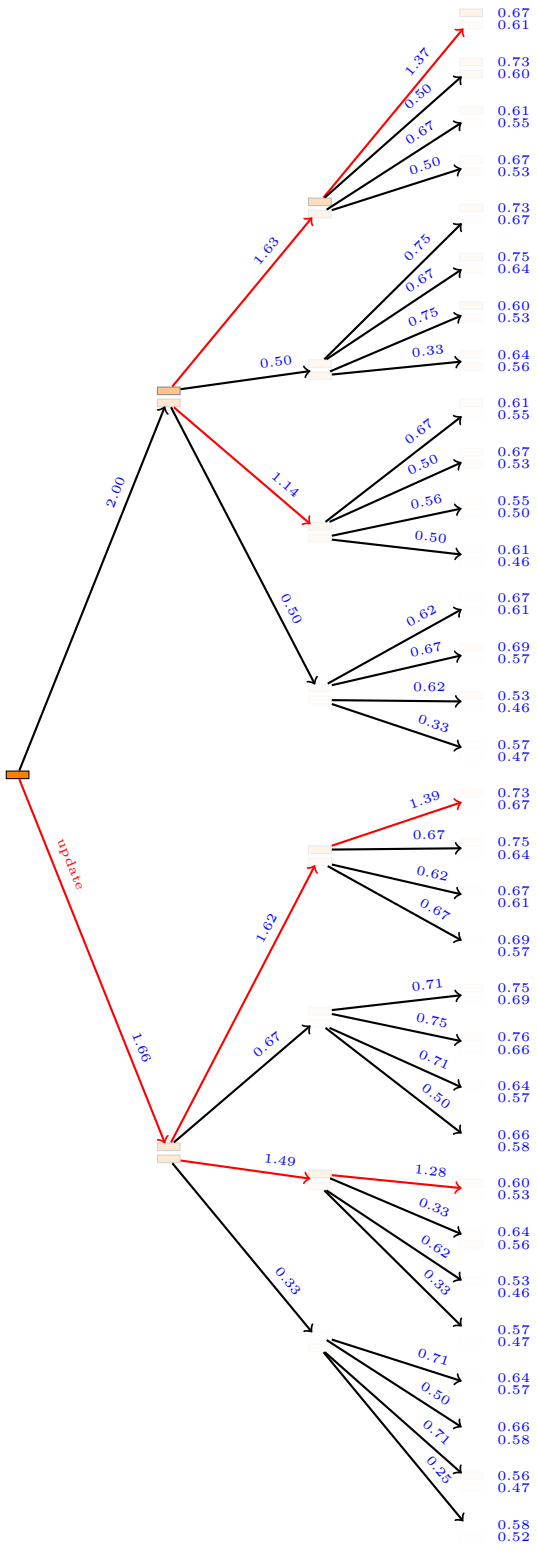
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0.64
0.75
0.60
0.53
0.33
0.64
0.56
0.67
0.50
0.61
0.55
0.56
0.50
0.67
0.53
0.55
0.50
0.50
0.61
0.46
0.62
0.67
0.67
0.61
0.62
0.69
0.57
0.33
0.53
0.46
0.57
0.47
1.39
0.67
0.73
0.67
0.62
0.75
0.64
0.67
0.67
0.61
0.69
0.57
0.71
0.75
0.69
0.75
0.76
0.66
0.71
0.64
0.50
0.57
0.66
0.58
1.28
0.33
0.60
0.53
0.62
0.64
0.56
0.33
0.53
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0.47
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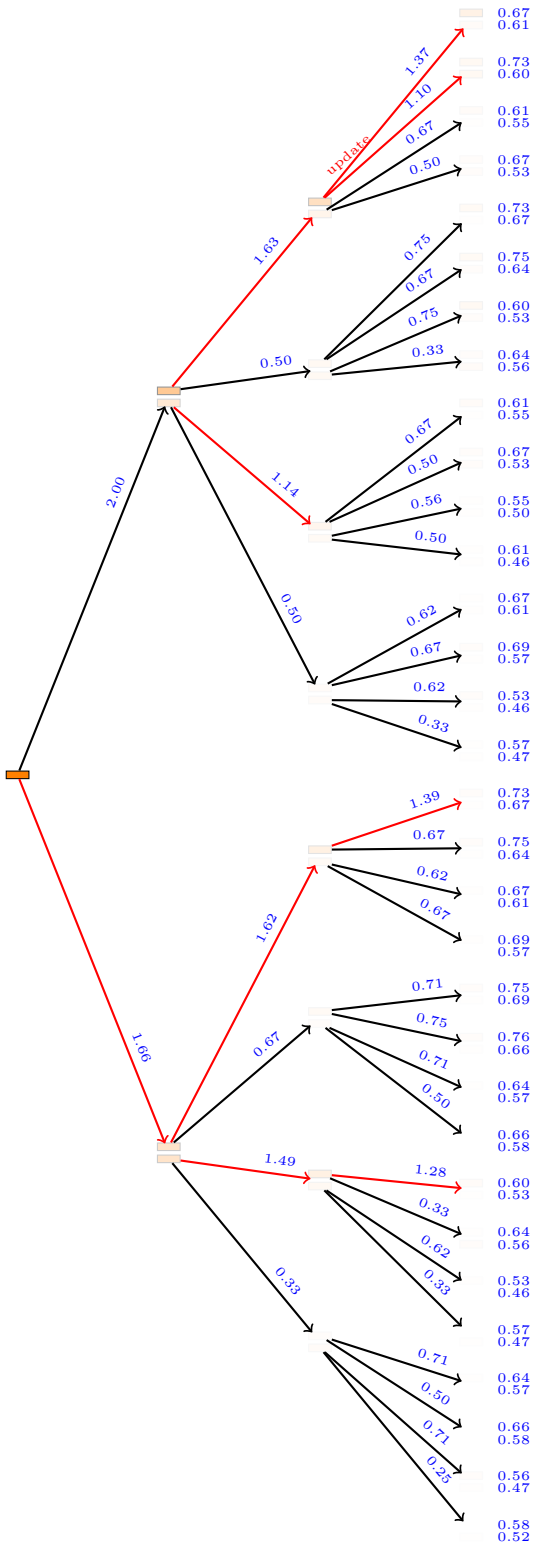
0.52


update
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1.62
0.67
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0.33
0.50
1.37
1.10
0.67
0.50
0.75
0.67
0.75
0.33
0.67
0.50
0.56
0.50
0.62
0.67
0.62
0.33
1.39
0.67
0.62
0.67
0.71
0.75
0.71
0.50
1.28
0.33
0.62
0.33
0.71
0.50
0.71
0.25
0.67 0.61
0.73 0.60
0.61 0.55
0.67 0.53
0.73 0.67
0.75 0.64
0.60 0.53
0.64 0.56
0.61 0.55
0.67 0.53
0.55 0.50
0.61 0.46
0.67 0.61
0.69 0.57
0.53 0.46
0.57 0.47
0.73 0.67
0.75 0.64
0.67 0.61
0.69 0.57
0.75 0.69
0.76 0.66
0.64 0.57
0.66 0.58
0.60 0.53
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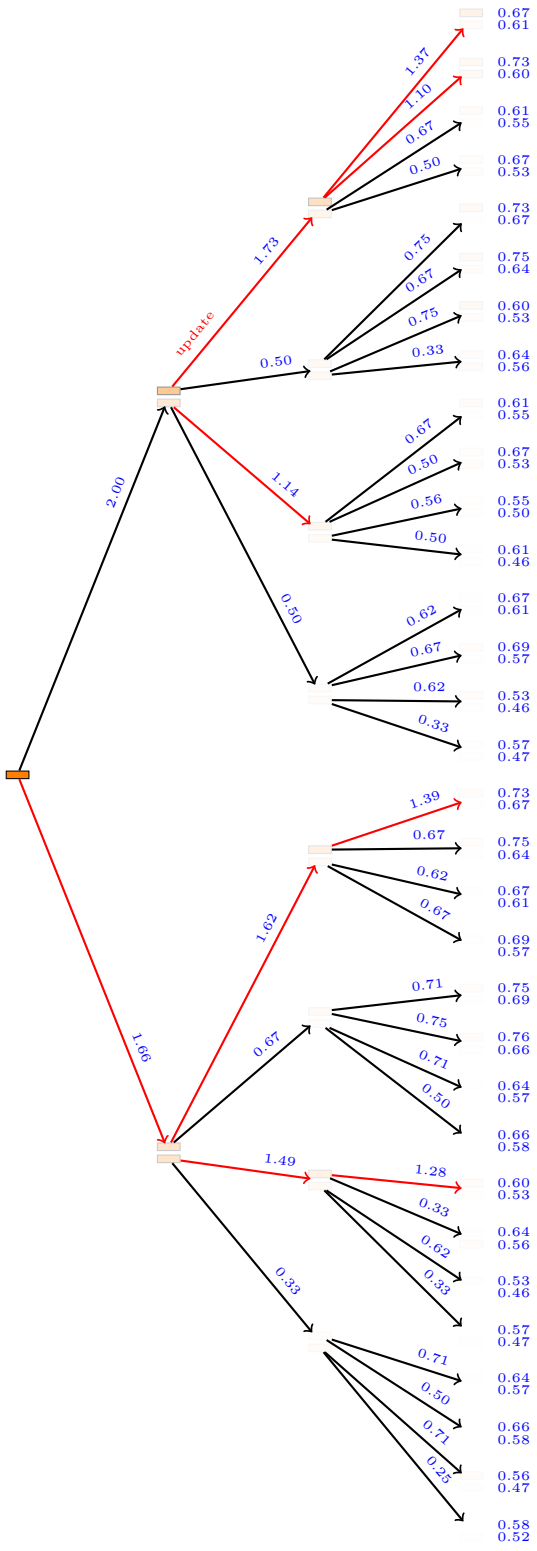
0.66 0.58
0.56 0.47
0.58 0.52


update
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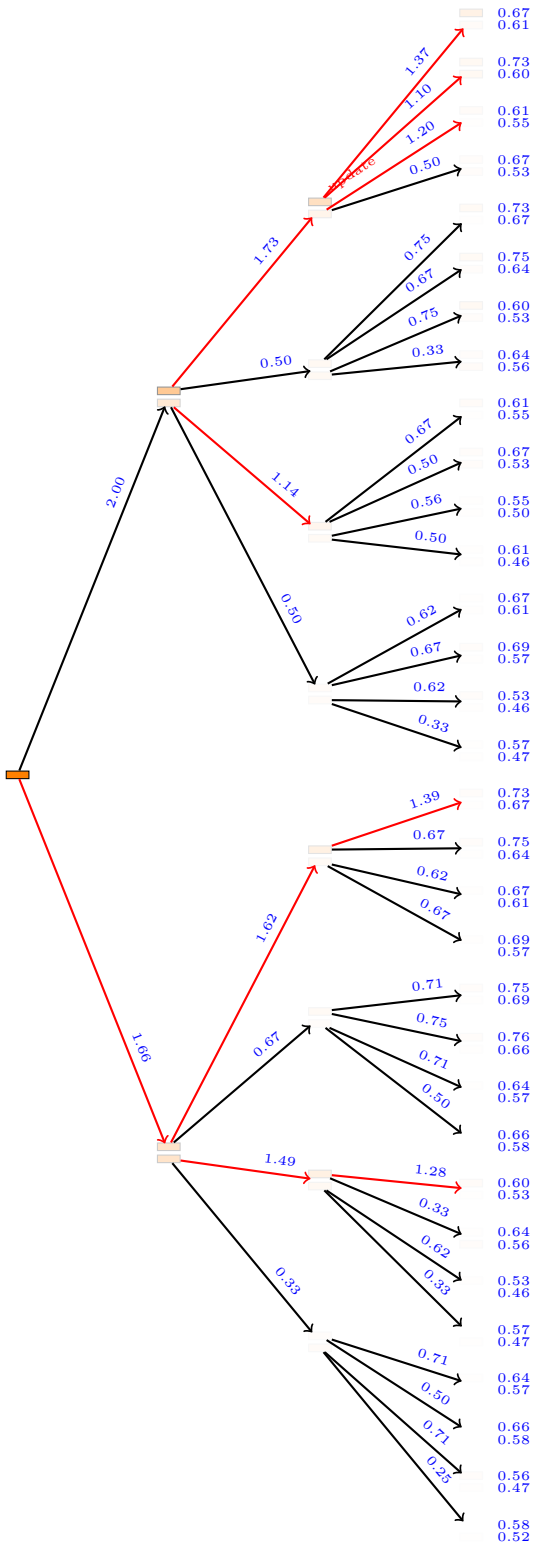
1.49
0.33
1.37
1.10
0.67
0.50
0.75
0.67
0.75
0.33
0.67
0.50
0.56
0.50
0.62
0.67
0.62
0.33
1.39
0.67
0.62
0.67
0.71
0.75
0.71
0.50
1.28
0.33
0.62
0.33
0.71
0.50
0.71
0.25
0.67 0.61
0.73 0.60
0.61 0.55
0.67 0.53
0.73 0.67
0.75 0.64
0.60 0.53
0.64 0.56
0.61 0.55
0.67 0.53
0.55 0.50
0.61 0.46
0.67 0.61
0.69 0.57
0.53 0.46
0.57 0.47
0.73 0.67
0.75 0.64
0.67 0.61
0.69 0.57
0.75 0.69
0.76 0.66
0.64 0.57
0.66 0.58
0.60 0.53
0.64 0.56
0.53 0.46
0.57 0.47
0.64 0.57
0.66 0.58
0.56 0.47
0.58 0.52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0.50
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0.67
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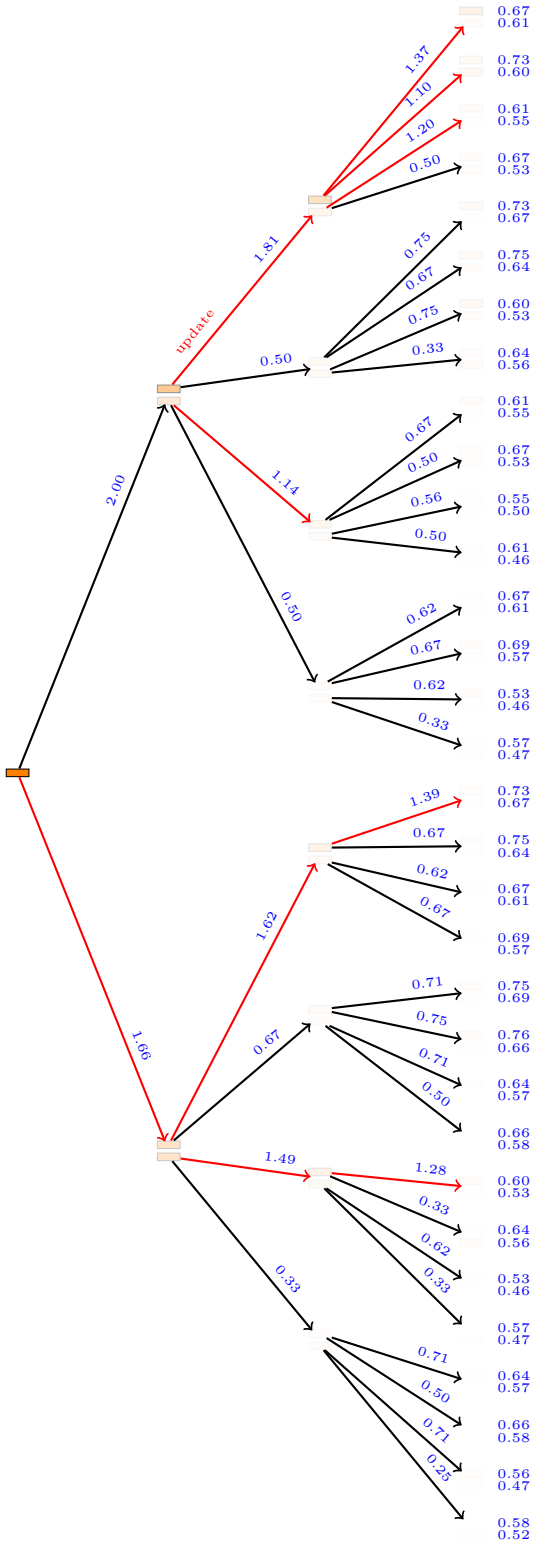
0.33
1.37
1.10
1.20
0.50
0.75
0.67
0.75
0.33
0.67
0.50
0.56
0.50
0.62
0.67
0.62
0.33
1.39
0.67
0.62
0.67
0.71
0.75
0.71
0.50
1.28
0.33
0.62
0.33
0.71
0.50
0.71
0.25
0.67 0.61
0.73 0.60
0.61 0.55
0.67 0.53
0.73 0.67
0.75 0.64
0.60 0.53
0.64 0.56
0.61 0.55
0.67 0.53
0.55 0.50
0.61 0.46
0.67 0.61
0.69 0.57
0.53 0.46
0.57 0.47
0.73 0.67
0.75 0.64
0.67 0.61
0.69 0.57
0.75 0.69
0.76 0.66
0.64 0.57
0.66 0.58
0.60 0.53
0.64 0.56
0.53 0.46
0.57 0.47
0.64 0.57
0.66 0.58
0.56 0.47
0.58 0.52


update
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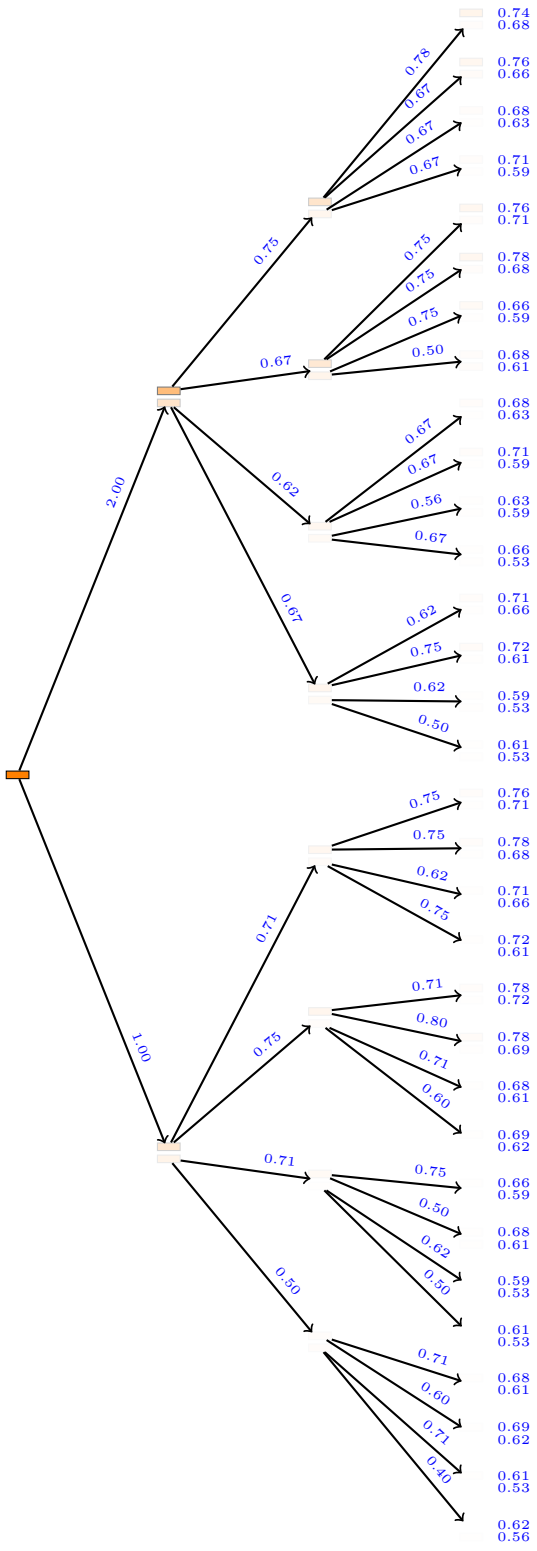
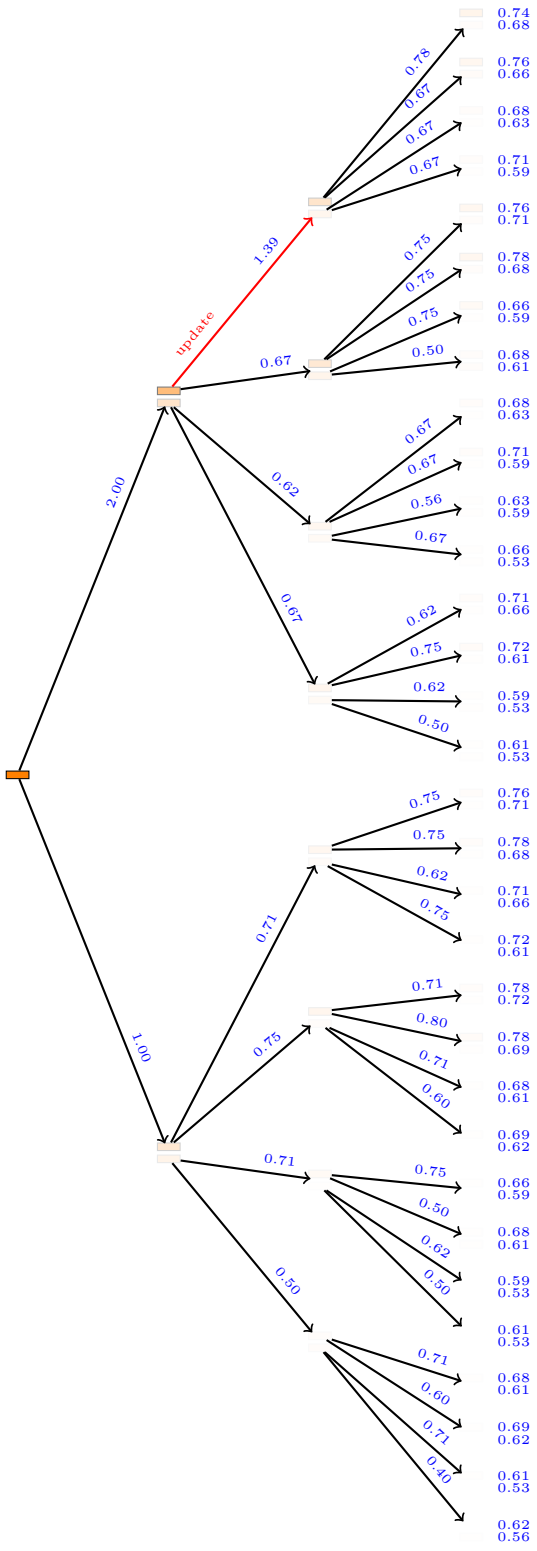
1.14
0.50
1.62
0.67
1.49
0.33
1.37
1.10
1.20
0.50
0.75
0.67
0.75
0.33
0.67
0.50
0.56
0.50
0.62
0.67
0.62
0.33
1.39
0.67
0.62
0.67
0.71
0.75
0.71
0.50
1.28
0.33
0.62
0.33
0.71
0.50
0.71
0.25
0.67 0.61
0.73 0.60
0.61 0.55
0.67 0.53
0.73 0.67
0.75 0.64
0.60 0.53
0.64 0.56
0.61 0.55
0.67 0.53
0.55 0.50
0.61 0.46
0.67 0.61
0.69 0.57
0.53 0.46
0.57 0.47
0.73 0.67
0.75 0.64
0.67 0.61
0.69 0.57
0.75 0.69
0.76 0.66
0.64 0.57
0.66 0.58
0.60 0.53
0.64 0.56
0.53 0.46
0.57 0.47
0.64 0.57
0.66 0.58
0.56 0.47
0.58 0.52

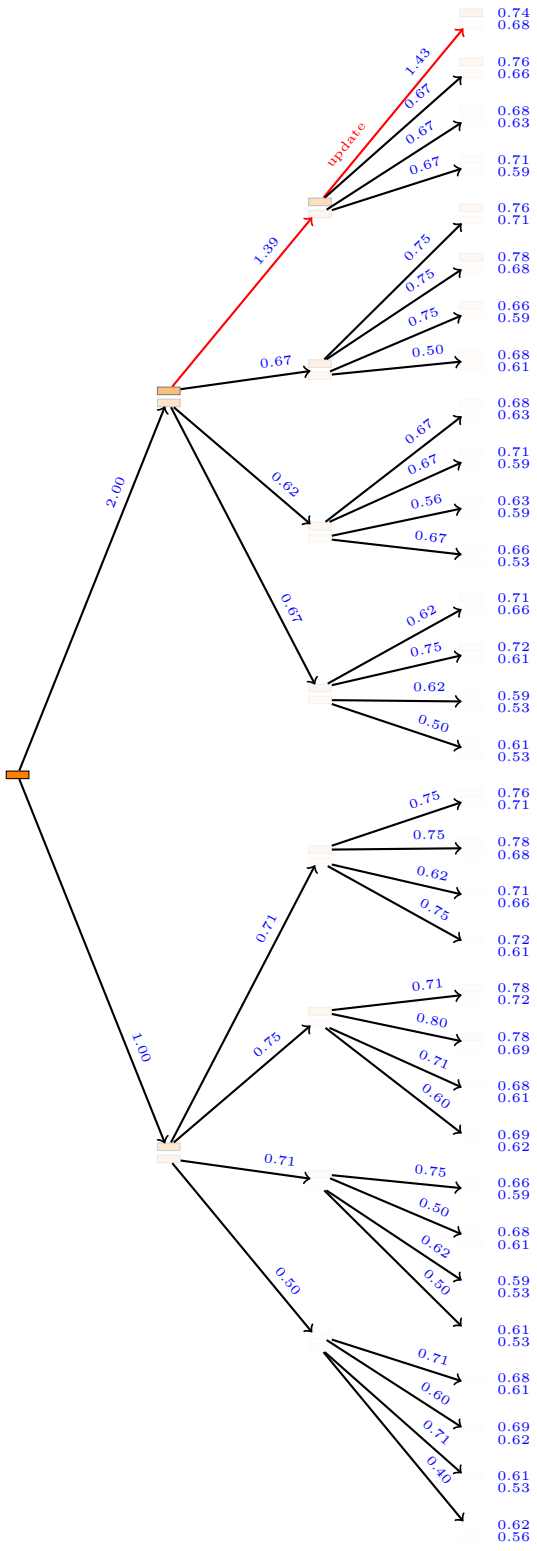
Example 2

Belief at the root in this example is:

$$\alpha_0 = 5 \quad \beta_0 = 2$$
$$\alpha_1 = 2 \quad \beta_1 = 1$$


2.00
1.00
0.75
0.67
0.62
0.67
0.71
0.75
0.71
0.50
0.78
0.67
0.67
0.67
0.75
0.75
0.75
0.50
0.67
0.67
0.56
0.67
0.62
0.75
0.62
0.50
0.75
0.75
0.62
0.75
0.71
0.80
0.71
0.60
0.75
0.50
0.62
0.50
0.71
0.60
0.71
0.40
0.74 0.68
0.76 0.66
0.68 0.63
0.71 0.59
0.76 0.71
0.78 0.68
0.66 0.59
0.68 0.61
0.68 0.63
0.71 0.59
0.63 0.59
0.66 0.53
0.71 0.66
0.72 0.61
0.59 0.53
0.61 0.53
0.76 0.71
0.78 0.68
0.71 0.66
0.72 0.61
0.78 0.72
0.78 0.69
0.68 0.61
0.69 0.62
0.66 0.59
0.68 0.61
0.59 0.53
0.61 0.53
0.68 0.61
0.69 0.62
0.61 0.53
0.62 0.56


update
1.39
2.00
1.00
0.67
0.62
0.67
0.71
0.75
0.78
0.67
0.67
0.67
0.67
0.74
0.68
0.76
0.66
0.68
0.63
0.71
0.59
0.75
0.75
0.75
0.50
0.76
0.71
0.78
0.68
0.66
0.59
0.68
0.61
0.67
0.67
0.56
0.67
0.68
0.63
0.71
0.59
0.63
0.59
0.66
0.53
0.62
0.75
0.62
0.50
0.71
0.66
0.72
0.61
0.59
0.53
0.61
0.53
0.75
0.75
0.62
0.75
0.76
0.71
0.78
0.68
0.71
0.66
0.72
0.61
0.71
0.80
0.71
0.60
0.78
0.72
0.78
0.69
0.68
0.61
0.69
0.62
0.75
0.50
0.62
0.50
0.66
0.59
0.68
0.61
0.59
0.53
0.61
0.53
0.71
0.60
0.71
0.40
0.68
0.61
0.69
0.62
0.61
0.53
0.62
0.56


update
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1.00
1.39
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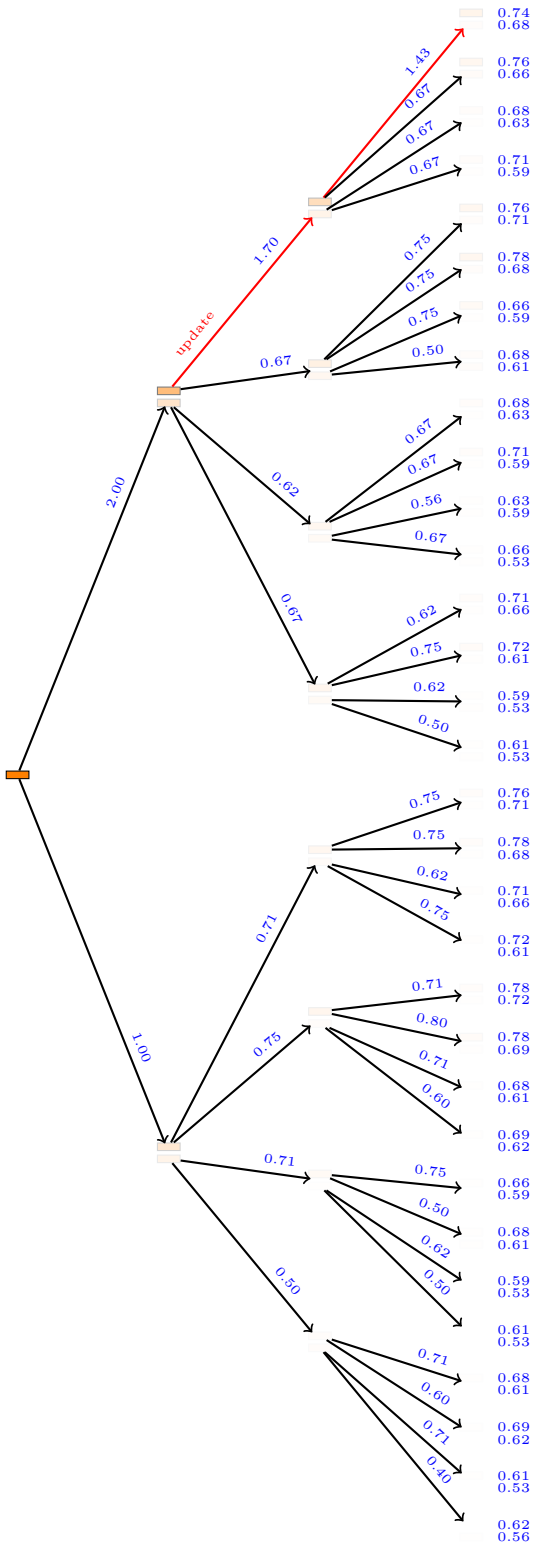
0.62
0.67
0.71
0.75
1.43
0.67
0.67
0.67
0.75
0.75
0.75
0.50
0.67
0.67
0.56
0.67
0.62
0.75
0.62
0.50
0.75
0.75
0.62
0.75
0.71
0.80
0.71
0.60
0.71
0.75
0.50
0.62
0.50
0.71
0.60
0.71
0.40
0.74 0.68
0.76 0.66
0.68 0.63
0.71 0.59
0.76 0.71
0.78 0.68
0.66 0.59
0.68 0.61
0.68 0.63
0.71 0.59
0.63 0.59
0.66 0.53
0.71 0.66
0.72 0.61
0.59 0.53
0.61 0.53
0.76 0.71
0.78 0.68
0.71 0.66
0.72 0.61
0.78 0.72
0.78 0.69
0.68 0.61
0.69 0.62
0.66 0.59
0.68 0.61
0.59 0.53
0.61 0.53
0.68 0.61
0.69 0.62
0.61 0.53
0.62 0.56


update
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1.43
0.67
0.67
0.67
0.74
0.68
0.76
0.66
0.68
0.63
0.71
0.59
0.67
0.75
0.75
0.75
0.50
0.76
0.71
0.78
0.68
0.66
0.59
0.68
0.61
0.62
0.67
0.67
0.56
0.67
0.68
0.63
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0.59
0.66
0.53
0.67
0.62
0.75
0.62
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0.59
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0.61
0.53
0.71
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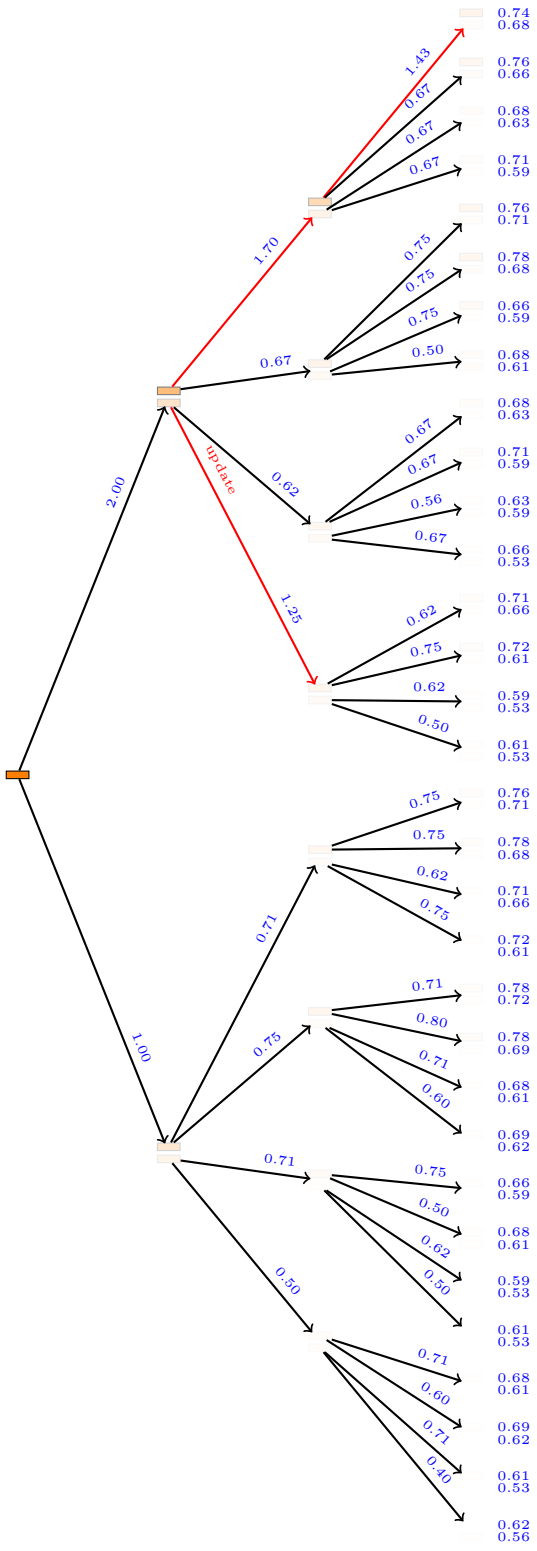
0.62
0.75
0.75
0.76
0.71
0.78
0.68
0.71
0.66
0.72
0.61
0.75
0.80
0.71
0.60
0.71
0.78
0.72
0.78
0.69
0.68
0.61
0.69
0.62
0.71
0.75
0.50
0.62
0.50
0.50
0.66
0.59
0.68
0.61
0.59
0.53
0.61
0.53
0.71
0.60
0.71
0.40
0.71
0.68
0.61
0.69
0.62
0.61
0.53
0.62
0.56


2.00
1.00
1.70
0.67
update
1.25
0.62
1.43
0.67
0.67
0.67
0.74
0.68
0.76
0.66
0.68
0.63
0.71
0.59
0.75
0.75
0.75
0.50
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0.59
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0.53
0.62
0.75
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0.50
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0.59
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0.61
0.53
0.71
0.75
0.62
0.75
0.75
0.71
0.80
0.71
0.60
0.76
0.71
0.78
0.68
0.71
0.66
0.72
0.61
0.78
0.72
0.78
0.69
0.68
0.61
0.69
0.62
0.75
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0.62
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0.66
0.59
0.68
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0.53
0.61
0.53
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0.61
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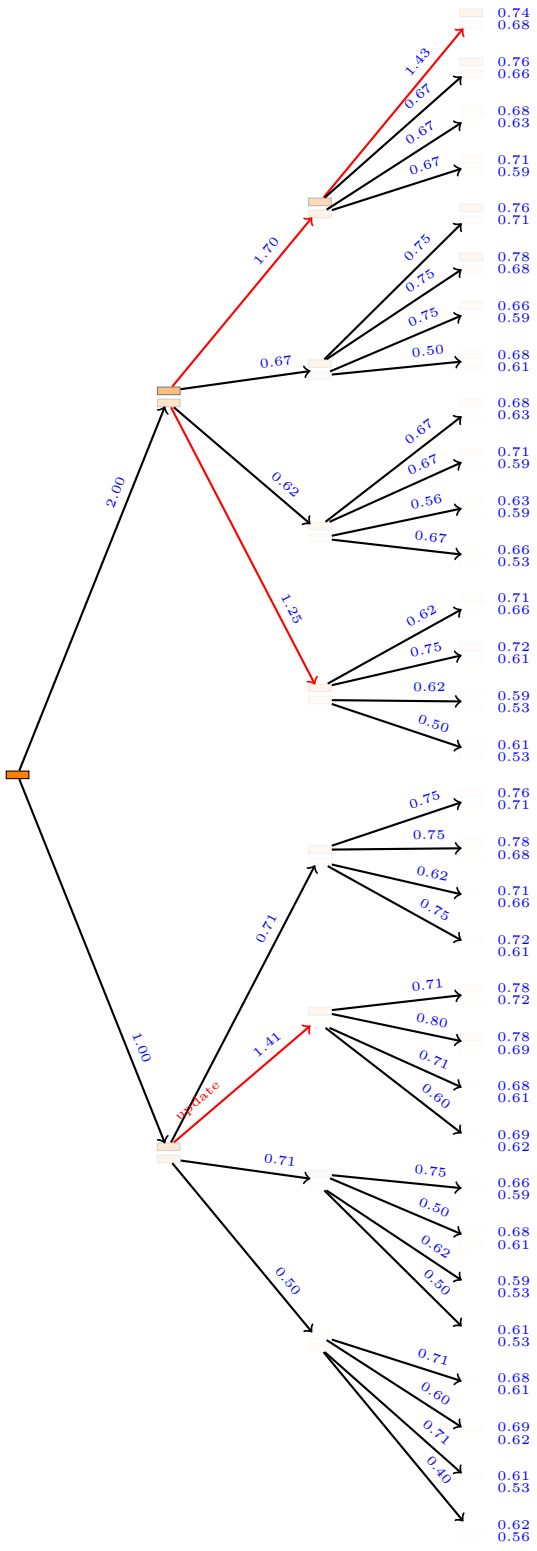
0.62
0.56


2.00
1.00
1.70
0.67
0.62
1.25
1.43
0.67
0.67
0.67
0.75
0.75
0.75
0.50
0.67
0.67
0.56
0.67
0.62
0.75
0.62
0.50
0.75
0.75
0.62
0.75
0.71
1.41
update
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0.60
0.71
0.50
0.62
0.50
0.50
0.71
0.60
0.71
0.40
0.74 0.68
0.76 0.66
0.68 0.63
0.71 0.59
0.76 0.71
0.78 0.68
0.66 0.59
0.68 0.61
0.68 0.63
0.71 0.59
0.63 0.59
0.66 0.53
0.71 0.66
0.72 0.61
0.59 0.53
0.61 0.53
0.76 0.71
0.78 0.68
0.71 0.66
0.72 0.61
0.78 0.72
0.78 0.69
0.68 0.61
0.69 0.62
0.66 0.59
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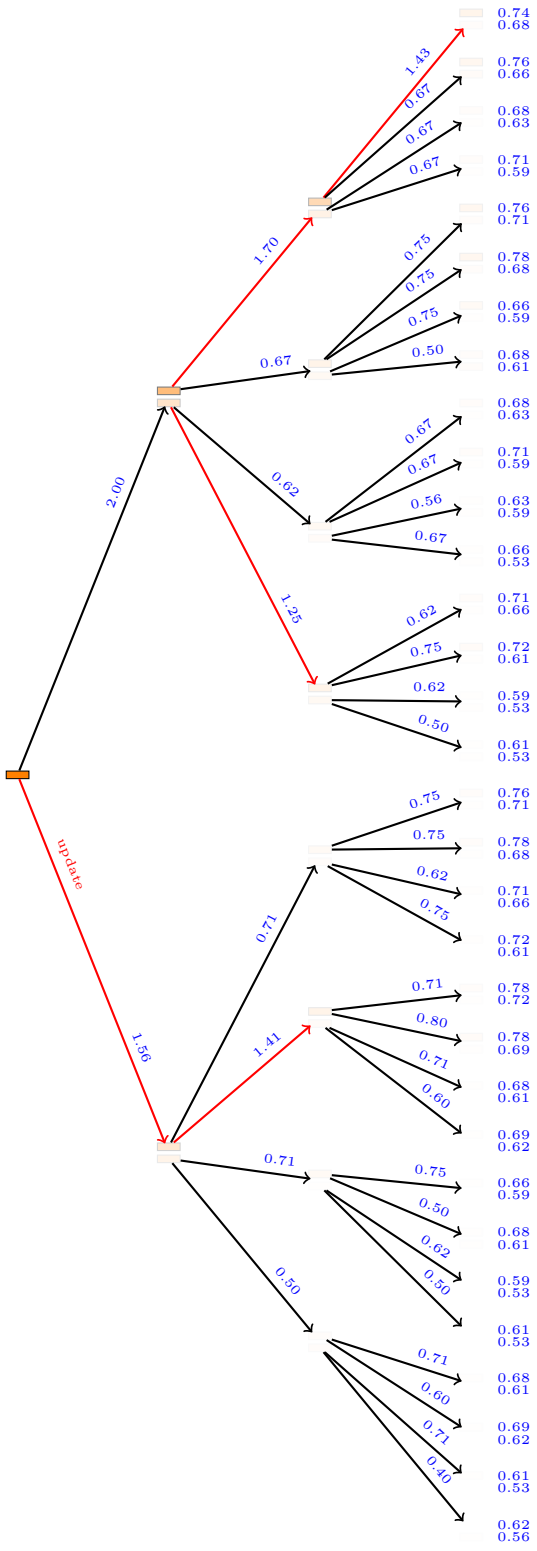
0.68 0.61
0.69 0.62
0.61 0.53
0.62 0.56


2.00
update
1.56
1.70
0.67
1.25
1.43
0.67
0.67
0.67
0.74
0.68
0.76
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0.63
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0.75
0.50
0.76
0.71
0.78
0.68
0.66
0.59
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0.61
0.62
0.67
0.67
0.56
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0.68
0.63
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0.72
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0.78
0.68
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0.60
0.78
0.72
0.78
0.69
0.68
0.61
0.69
0.62
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0.50
0.62
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0.53
0.61
0.53
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0.62
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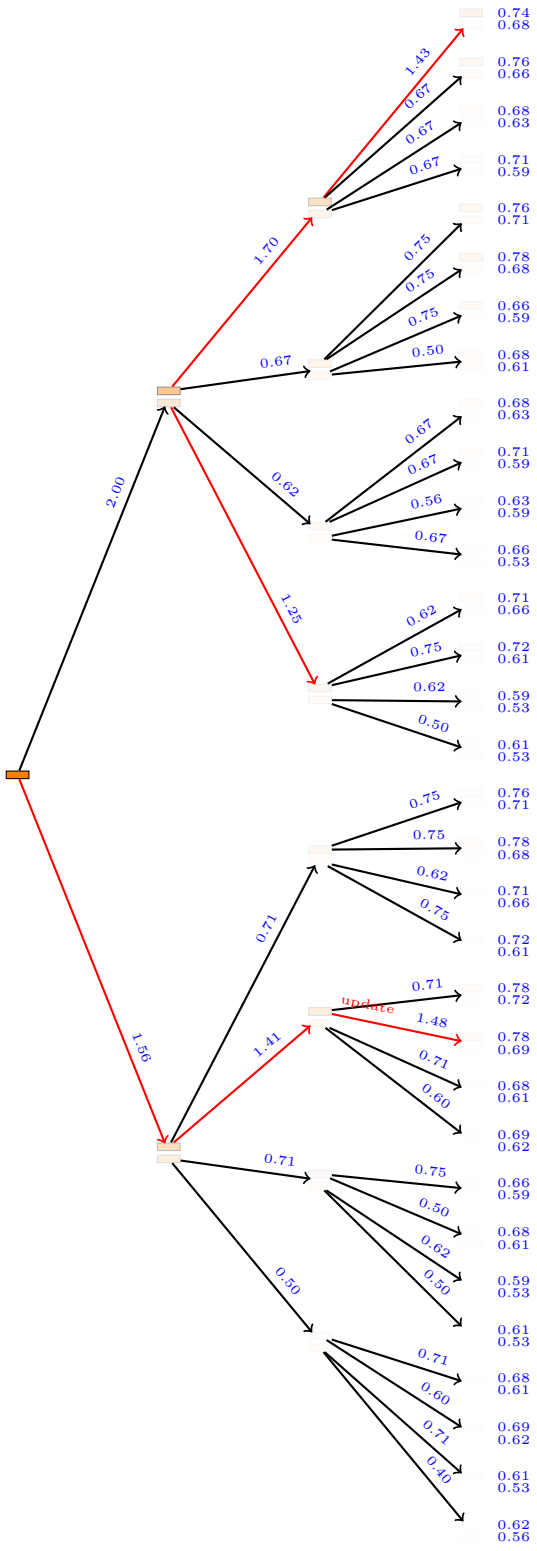
0.53
0.62
0.56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1.70
0.67
0.62
1.25
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1.41
0.71
0.50
1.43
0.67
0.67
0.67
0.75
0.75
0.75
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0.67
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0.67
0.62
0.75
0.62
0.50
0.75
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0.62
0.75
0.71
update
1.48
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0.60
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0.74 0.68
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0.78 0.72
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0.68 0.61
0.69 0.62
0.66 0.59
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0.61 0.53
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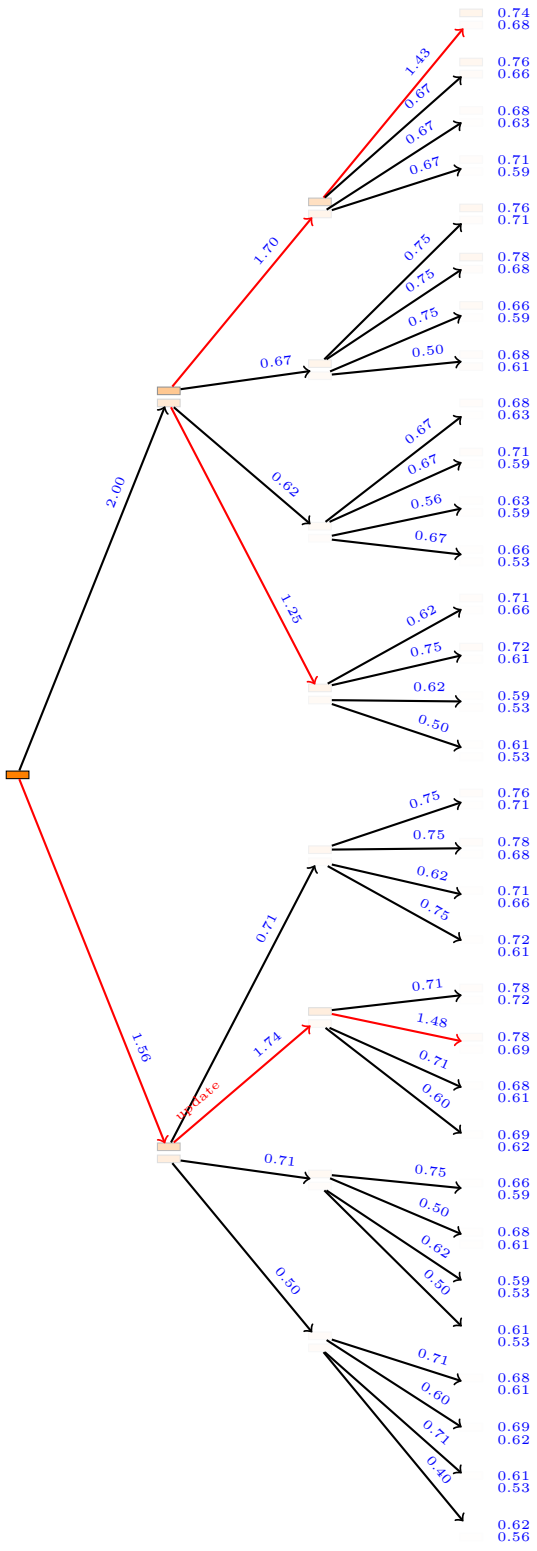
0.69 0.62
0.61 0.53
0.62 0.56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1.56
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0.67
0.62
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1.43
0.67
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0.75
0.75
0.75
0.50
0.67
0.67
0.56
0.67
0.62
0.75
0.62
0.50
0.75
0.75
0.62
0.75
0.71
1.74
update
0.71
1.48
0.71
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0.71
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0.74 0.68
0.76 0.66
0.68 0.63
0.71 0.59
0.76 0.71
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0.66 0.59
0.68 0.61
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0.72 0.61
0.59 0.53
0.61 0.53
0.76 0.71
0.78 0.68
0.71 0.66
0.72 0.61
0.78 0.72
0.78 0.69
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0.69 0.62
0.66 0.59
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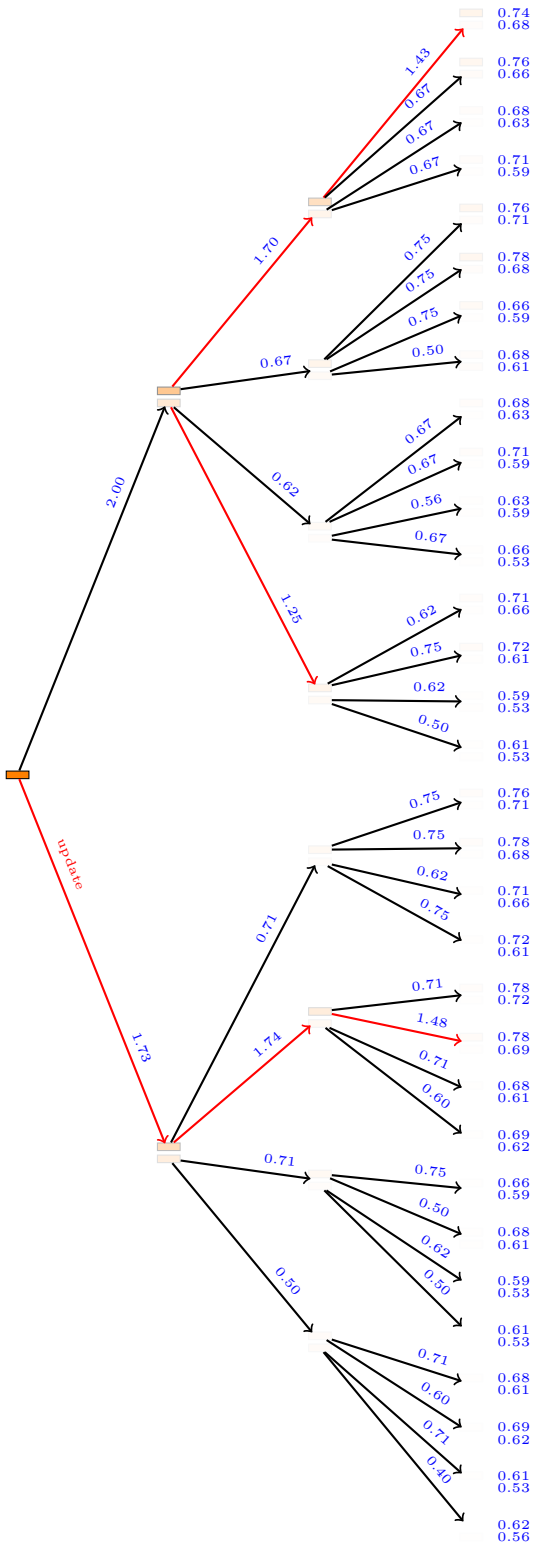
0.69 0.62
0.61 0.53
0.62 0.56


update
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0.61
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0.62
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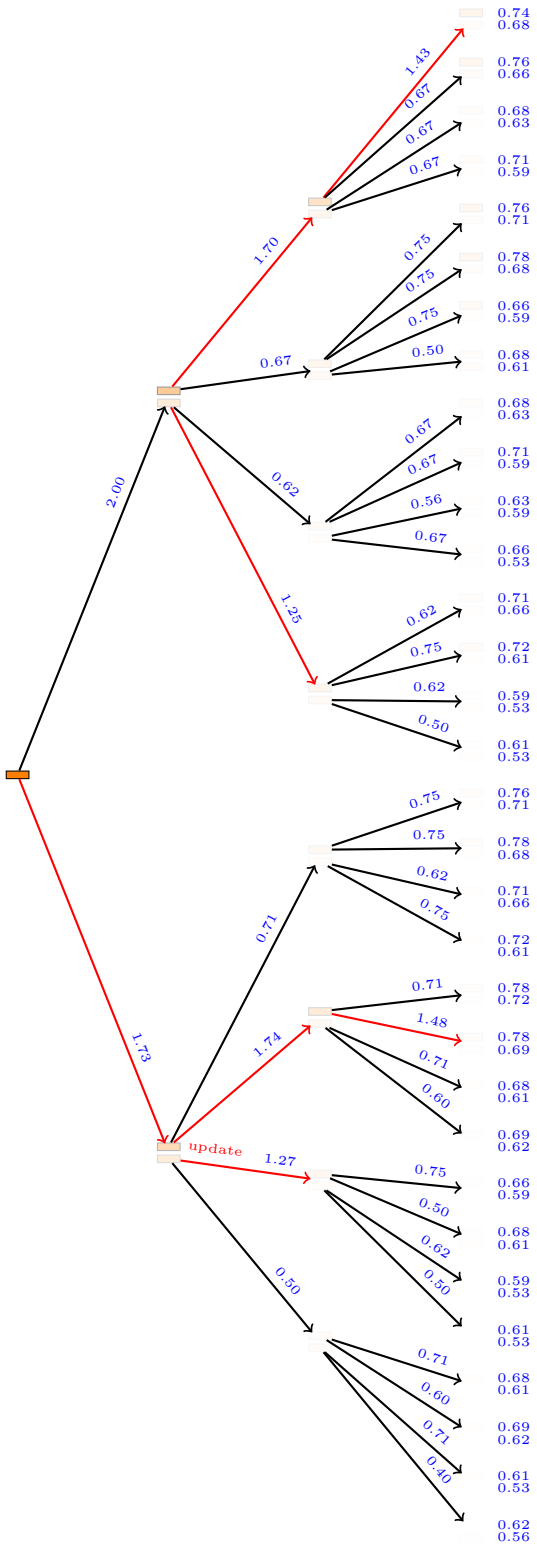
0.62
0.56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0.75
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0.62
0.75
0.71
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update
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0.72 0.61
0.78 0.72
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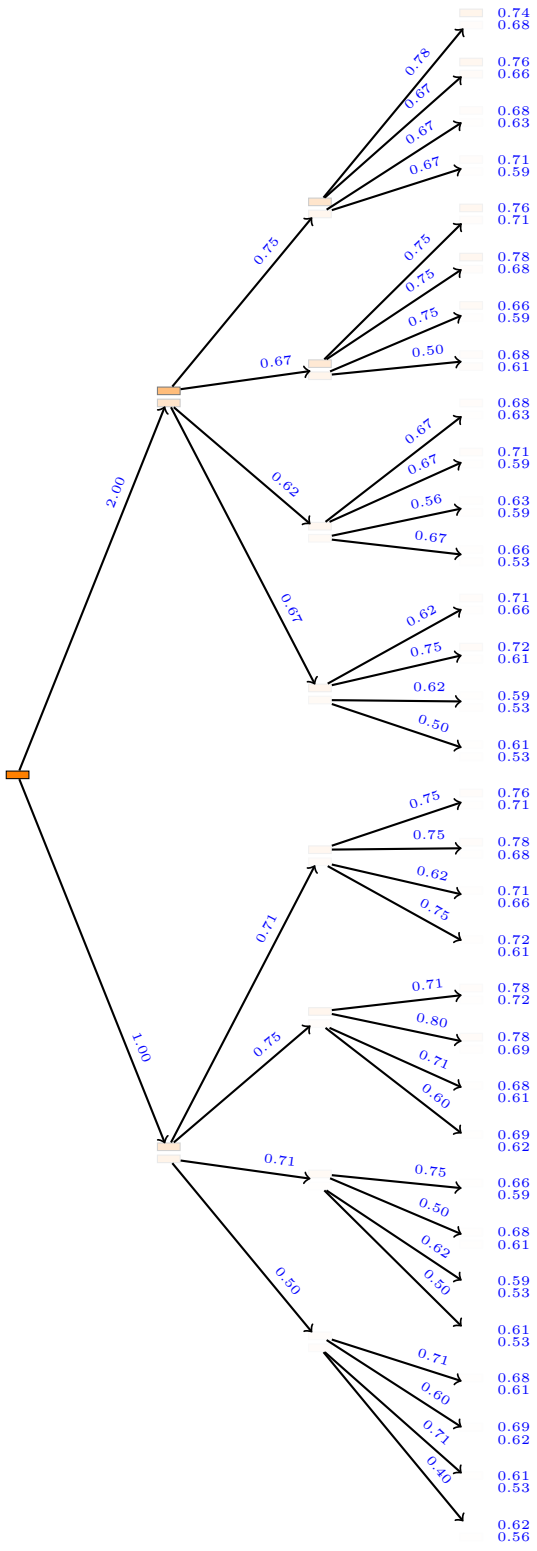
0.68 0.61
0.69 0.62
0.66 0.59
0.68 0.61
0.59 0.53
0.61 0.53
0.68 0.61
0.69 0.62
0.61 0.53
0.62 0.56

Example 3

Belief at the root in this example is:

$$\begin{array}{ll} \alpha_0 = 10 & \beta_0 = 4 \\ \alpha_1 = 2 & \beta_1 = 1 \end{array}$$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0.62
0.67
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0.75
0.71
0.50
0.78
0.67
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0.75
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0.75
0.50
0.67
0.67
0.56
0.67
0.62
0.75
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0.75
0.75
0.62
0.75
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0.80
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0.60
0.75
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0.62
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0.71
0.60
0.71
0.40
0.74 0.68
0.76 0.66
0.68 0.63
0.71 0.59
0.76 0.71
0.78 0.68
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0.69 0.62
0.66 0.59
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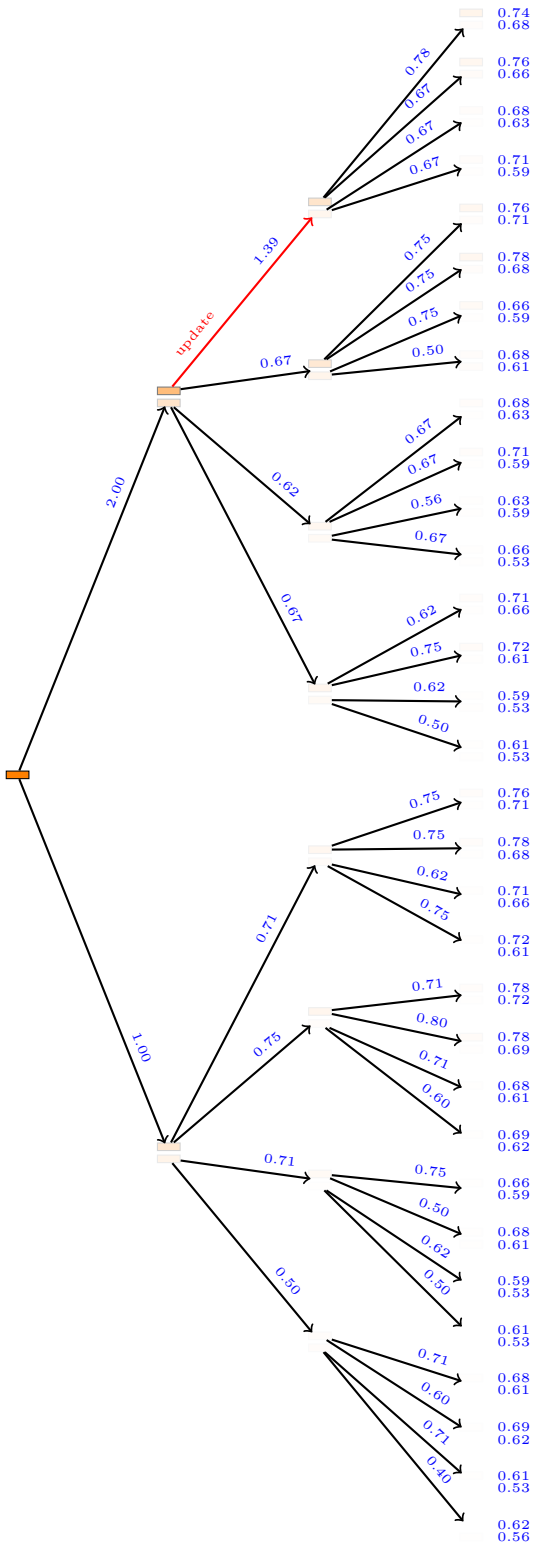
0.59 0.53
0.61 0.53
0.68 0.61
0.69 0.62
0.61 0.53
0.62 0.56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0.75
0.76
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0.71
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0.72
0.61
0.71
0.80
0.71
0.60
0.78
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0.61
0.69
0.62
0.75
0.50
0.62
0.50
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0.61
0.59
0.53
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0.60
0.71
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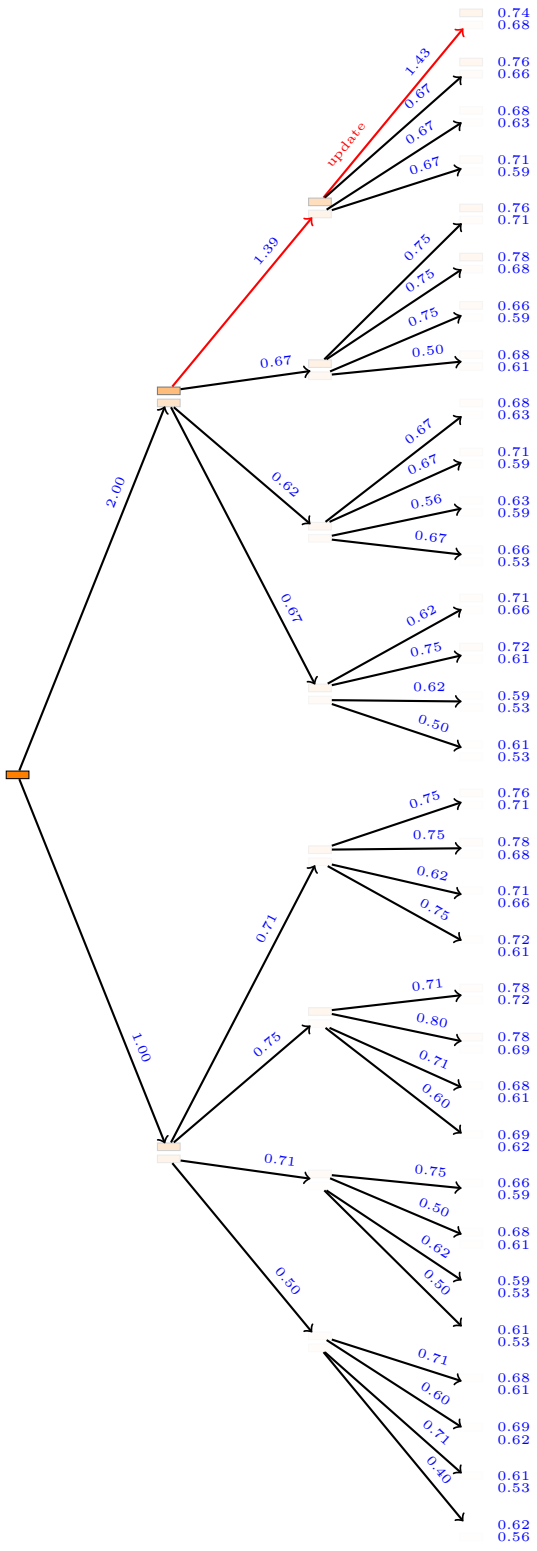
0.62
0.56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0.71 0.66
0.72 0.61
0.59 0.53
0.61 0.53
0.76 0.71
0.78 0.68
0.71 0.66
0.72 0.61
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0.78 0.69
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0.69 0.62
0.66 0.59
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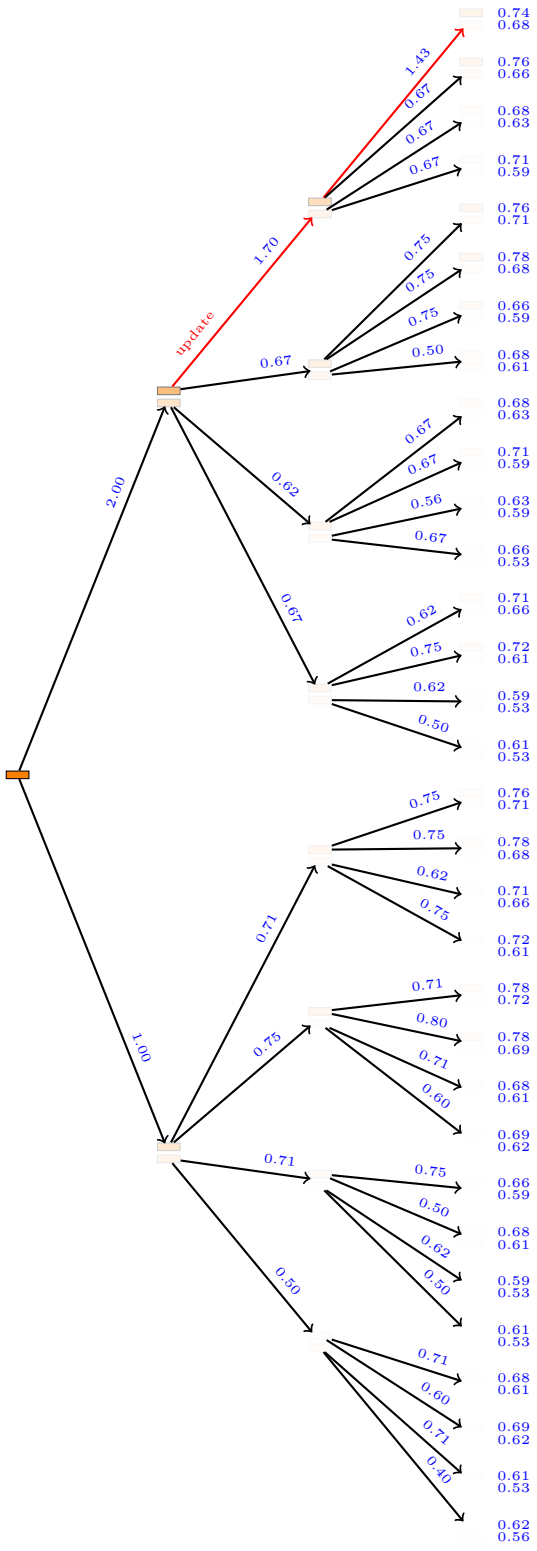
0.68 0.61
0.69 0.62
0.61 0.53
0.62 0.56


update
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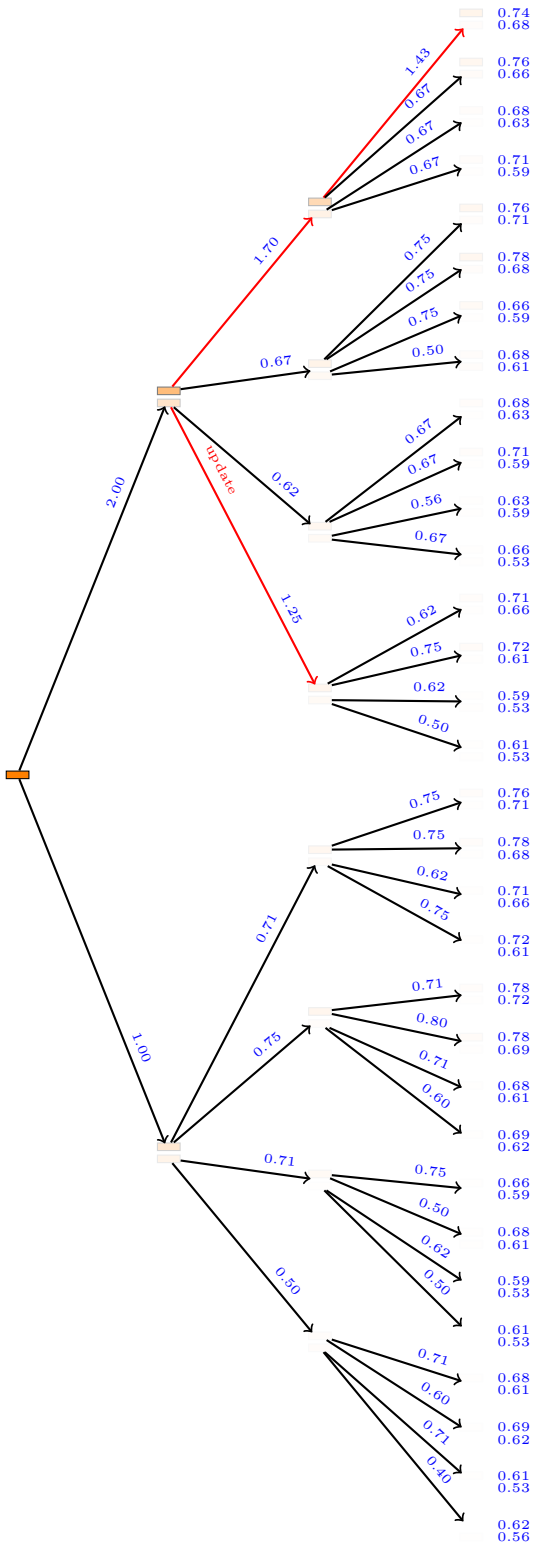
0.53
0.62
0.56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update
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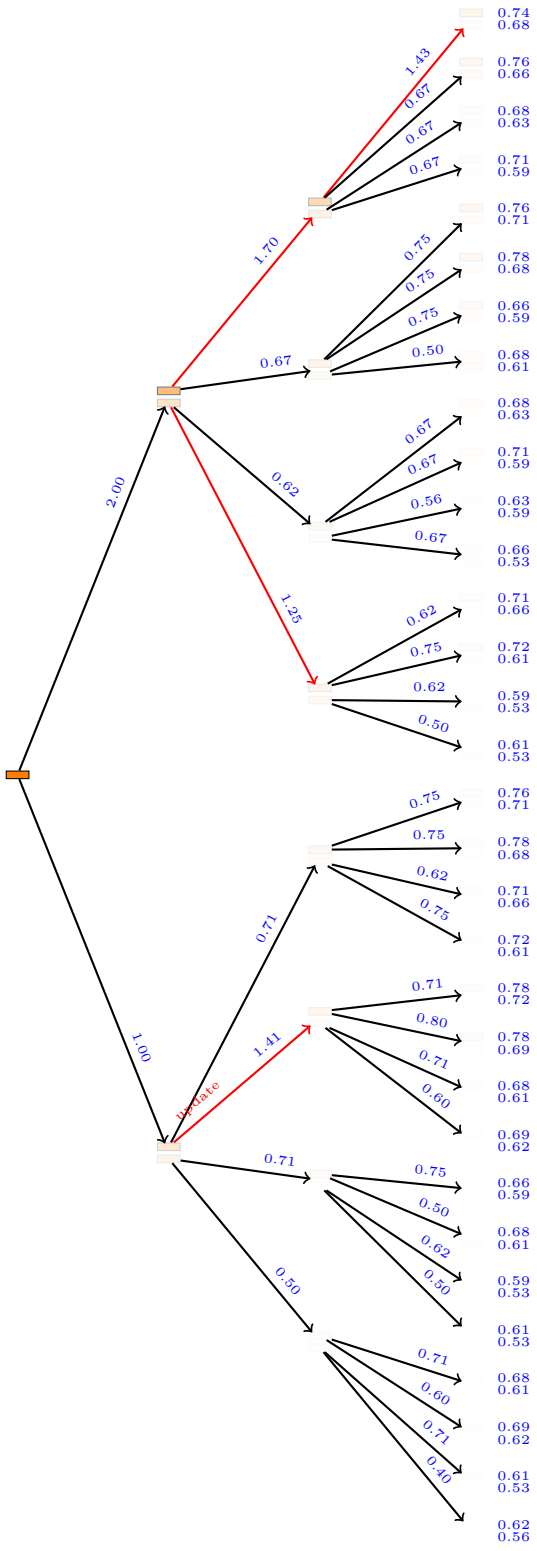
0.62 0.56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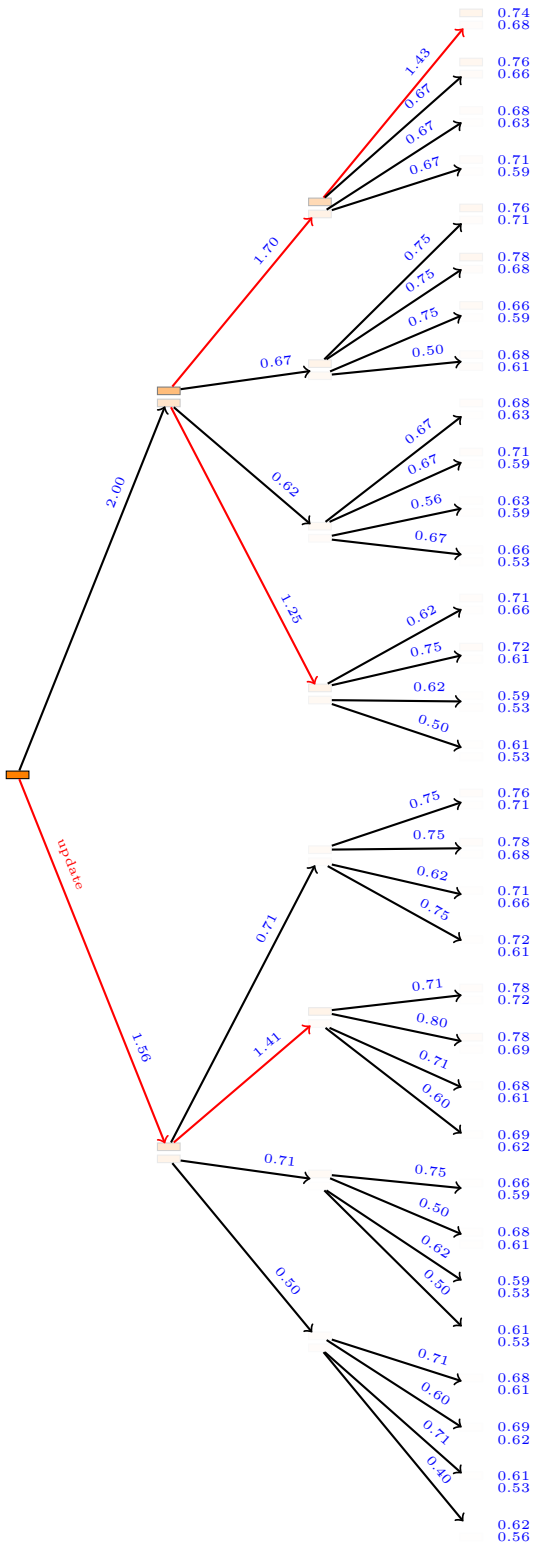
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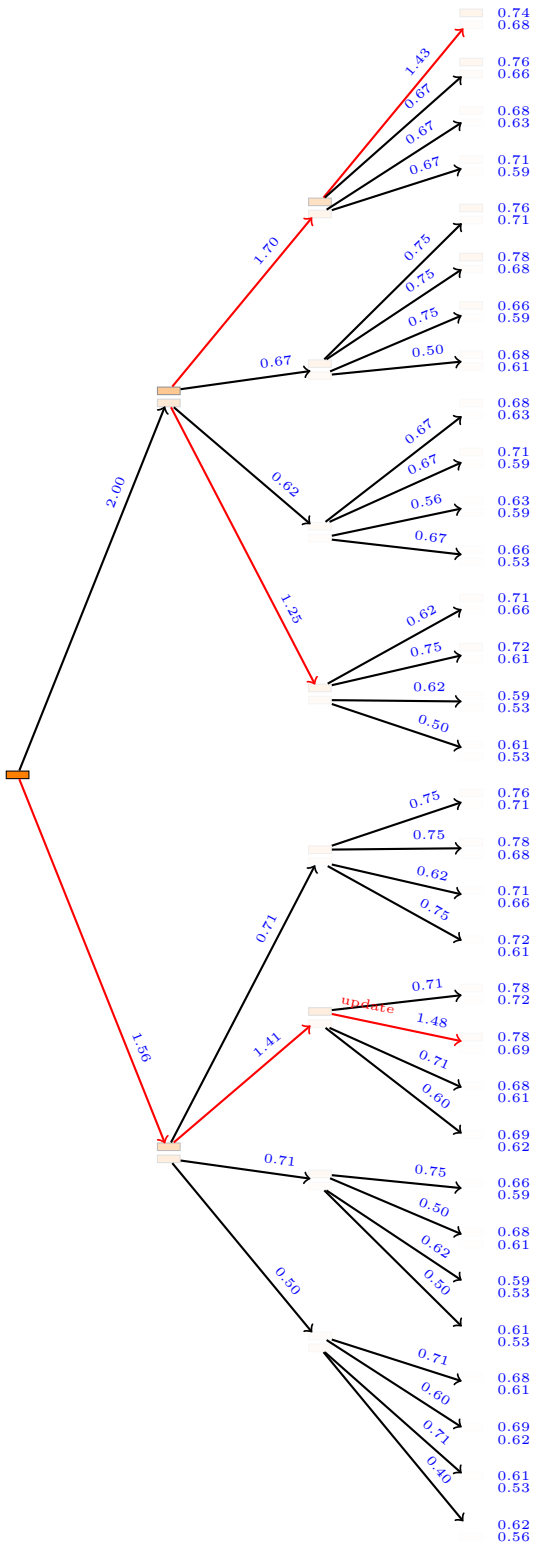
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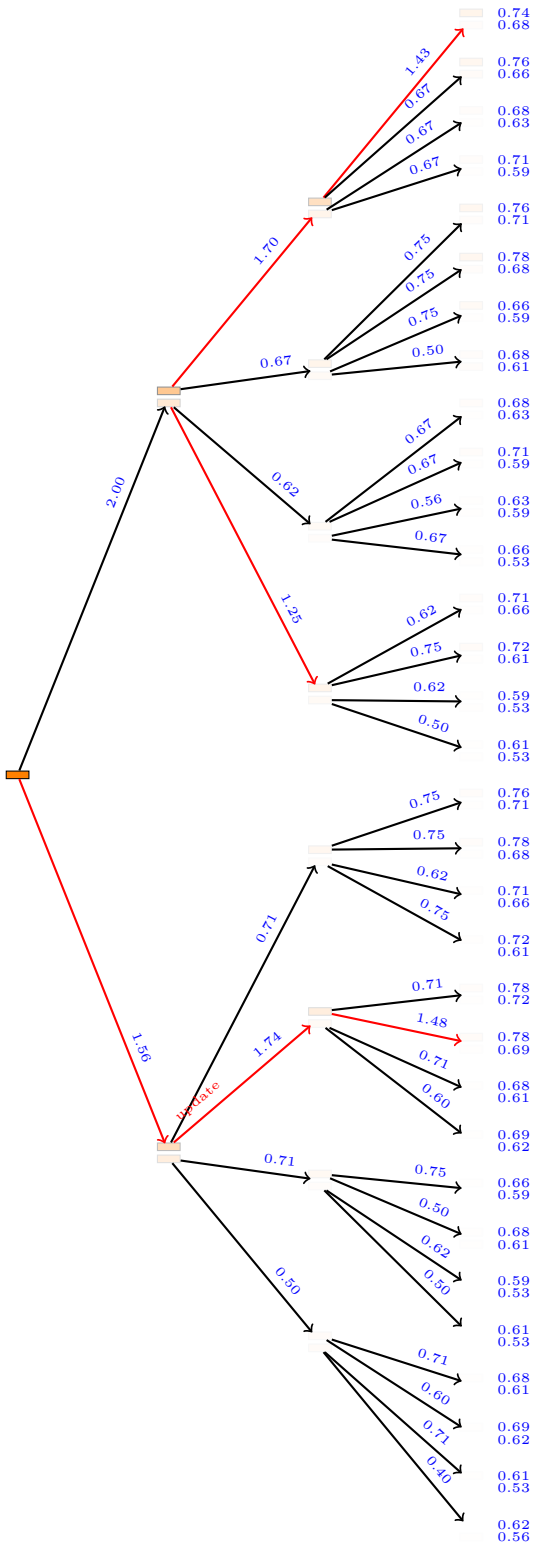
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0.53
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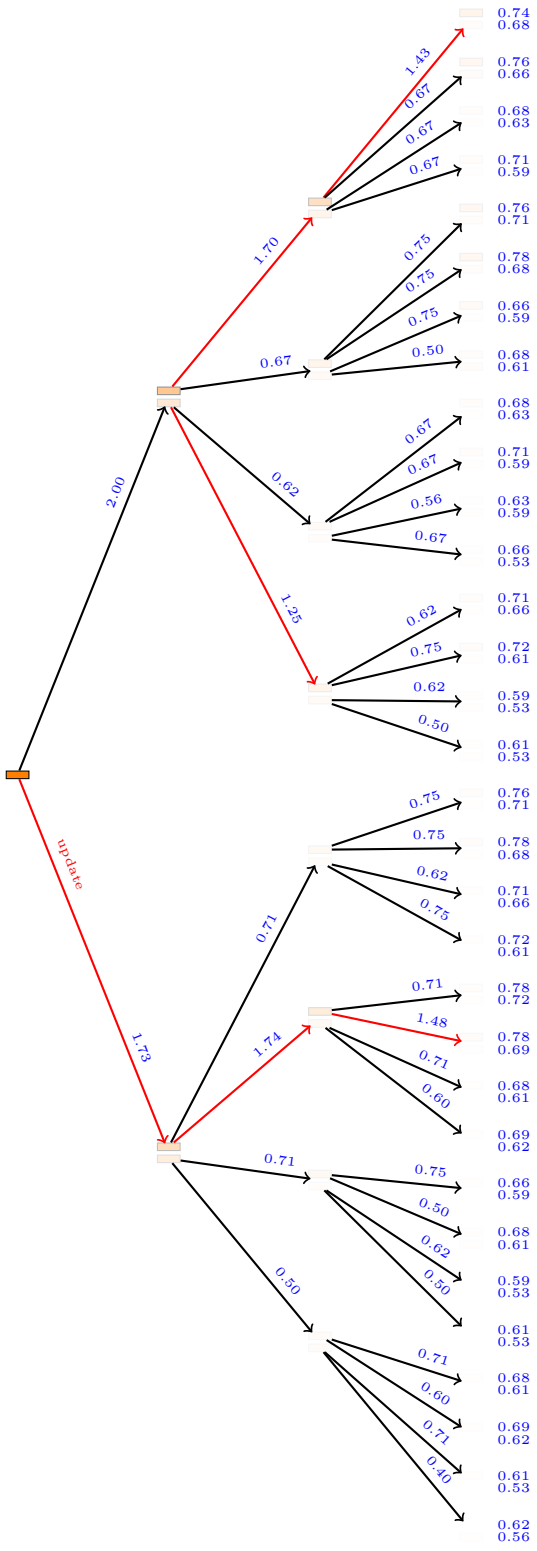
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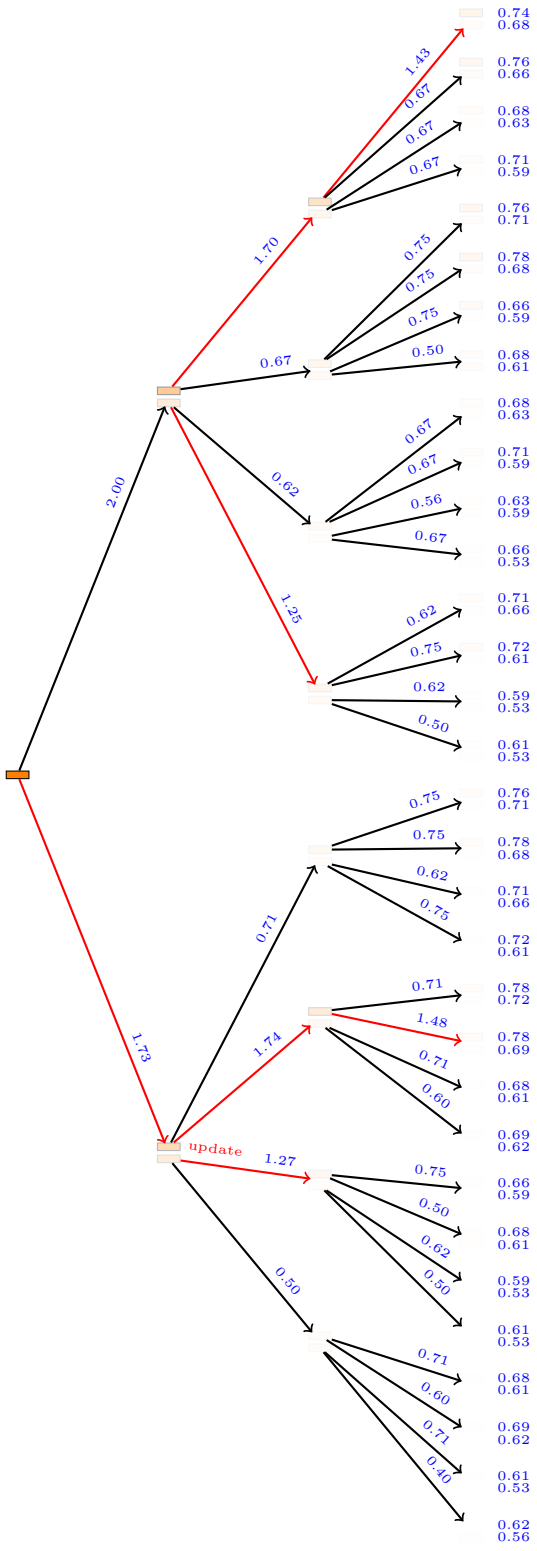
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