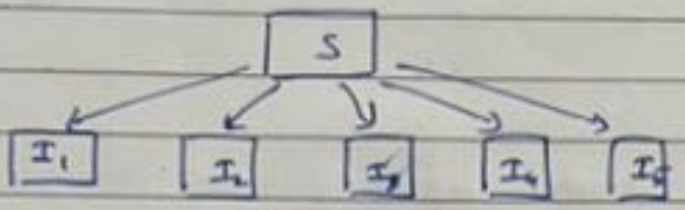
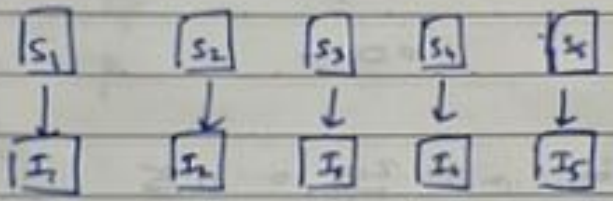
ASSIGNMENT - 2

CASE STUDY 1:

a) Scenario 1:



Scenario 2:



b) Likelihood in Scenario 1 = $\frac{1}{2}$ since all dots are the same object and their probability of moving up/down = $\frac{1}{2}$

c) Since all dots are separate objects and each has a prob = $\frac{1}{2}$ of moving up/down, total probability:

$$\frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} = \frac{1}{32}$$

d) They do not add up to 1. The reason is that the 2 likelihoods are not complementary. If they were, it would mean that they were dependent on each other. However,

the likelihood of scenario 1 does not impact the likelihood of scenario 2 or vice versa.

e) The likelihood of an observation given a scenario would imply the probability of an observation being true given a state of the world. However, we know that there could be multiple observations (separate for separate hypothesized states) and here, the implication is that there is only one observation.

f) Since the ratio is 2:1 for the 2 scenarios,

prior for scenario 1 = $\frac{2}{3}$

prior for scenario 2 = $\frac{1}{3}$

g) product = $\frac{2}{3} \times \frac{1}{2} = \frac{1}{3}$

h) product = $\frac{1}{3} \times \frac{1}{32} = \frac{1}{96}$

i) No

j) sum = $\frac{1}{3} + \frac{1}{96}$

$= \frac{32 + 1}{96} = \frac{33}{96} = \frac{11}{32}$

the probabilities now become:

$$\frac{1/3}{11/32} = \frac{32}{33} = 0.97$$

$$\frac{1/32^3}{11/32} = \frac{1}{33} = 0.03$$

As we can notice, the probabilities add up to 1 as well.

∴ Bayes' Theorem applied.

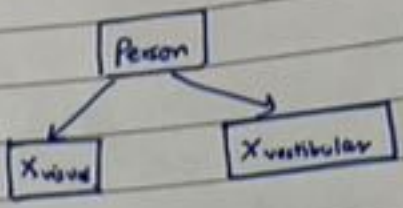
k) Given our calculations, we can notice that Scenario 1 has the highest posterior probability which states that the dots were perceived as one object. This is consistent with Gestalt's law of common fate.

l) Working with a generative model based on Bayes' Theorem gives us a detailed account of the likelihood of a scenario/state of the world, the prior probabilities of the scenario and the ~~likelihood of~~ and posterior probabilities. Thus, while Gestalt's law simply states a law, the Bayesian framework helps to quantify it and show us the probabilities of different aspects of the hypothesis.

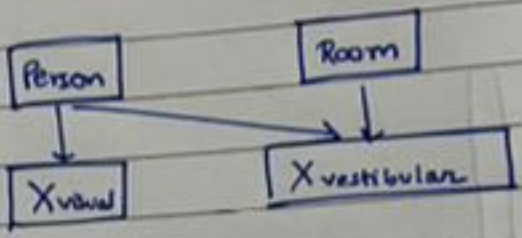
CASE 2

a) Generative models:

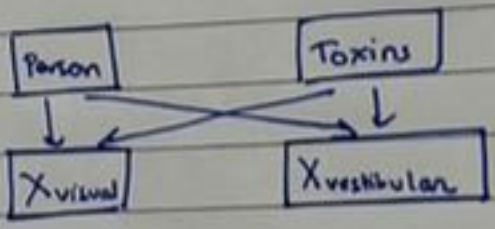
Scenario 1:



Scenario 2:



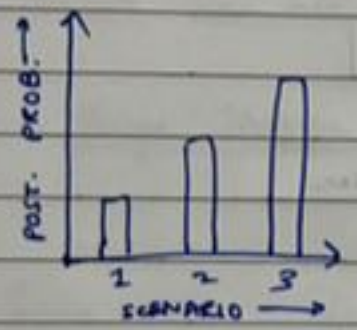
Scenario 3:



b)

c)

d)



e) Example:

prior in (a) (0.8, 0.1, 0.3)

likelihood in (b): (0.1, 0.5, 0.5)

posterior probability in e): (0.2, 0.3, 0.4)

f) We know that scenario 1 is slightly improbable. Between scenario 2 and 3, scenario 3 has a higher posterior probability. Thus if we have ingested toxins, we might vomit as a defense mechanism.