

VARIABLES

- Mask: Whether a person wears a mask in public places
- Covid: Whether a person is infected with Covid-19
- Heart Attack: Whether a person has heart attack
- Chest Pain: Whether a person suffers chest pain
- Red eyes: Whether a person has red eyes

TYPES OF THE VARIABLES

All variables are binary. They can either be true or false. What each value for each variable represents is stated below:

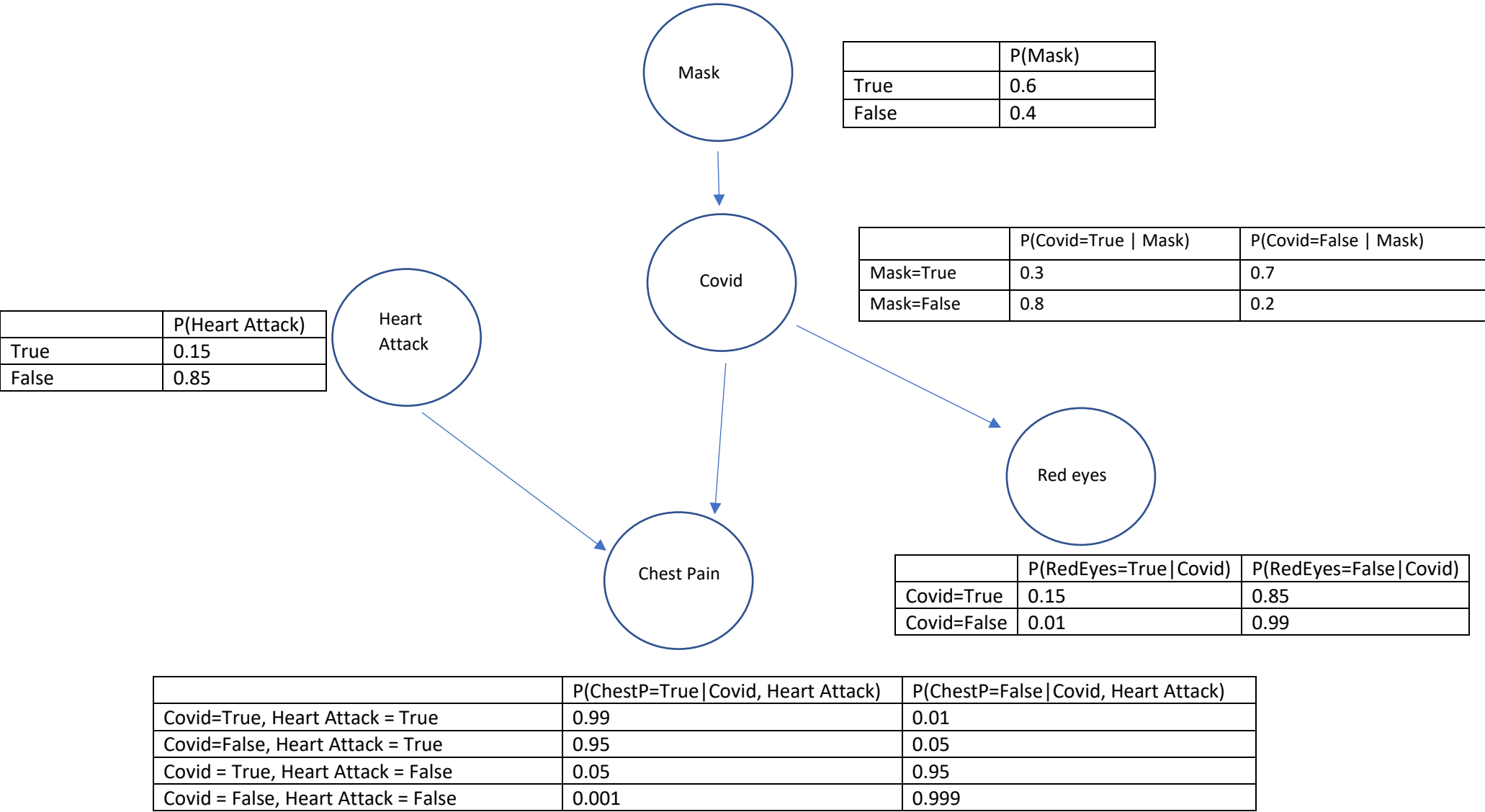
- Mask = True -> The person wears a mask in public places
- Mask = False -> The person does not wear a mask in public places
- Covid= True -> The person is infected with Covid-19 virus.
- Covid= False -> The person is not infected with Covid-19 virus.
- Heart Attack = True -> The person has heart attack
- Heart Attack = False -> The person does not have heart attack
- Chest Pain = True -> The person suffers chest pain
- Chest Pain = False -> The person does not suffer chest pain
- Red eyes = True -> The person has red eyes
- Red eyes = False -> The person does not have red eyes

EXPLANATION OF BAYESIAN NETWORK

Not wearing a mask in public places may cause to be infected with coronavirus. If one infected with Covid-19, he/she can suffer several results. Suffering eyes turning to red and having a chest pain are results included in my network. They have different probabilities. In addition to Covid-19, also a heart attack can cause chest pain.

TEST-1: A person has chest pain. How do the probabilities of Covid & Heart Attack change if we know she also has red eyes?

TEST-2: A person is infected with Covid-19. What is the probability that she does not wear a mask in public places?



TEST-1: A person has chest pain. How do the probabilities of Covid & Heart Attack change if we know she also has red eyes?

According to SAMIAM (when we apply MAP to calculate probabilities), if there is chest pain, the probability of having an heart attack is ~ 0.87 as can be seen below ($= P(\text{Heart Attack} \mid \text{Chest Pain})$). The probability of being infected by Covid-19 is ~ 0.57 in this case ($= P(\text{Covid} \mid \text{Chest Pain})$).

The screenshot shows the SamIAM software interface. On the left, a tree view displays the network structure with nodes categorized by their in-out degree: root (Heart Attack, Mask), internal (Covid), and leaf (Chest Pain, Red Eyes). Each node has a dropdown menu for its state (true/false). The 'Chest Pain' node is currently set to 'true'.

The main window displays the 'MAP Computation' dialog. The 'Exact' method is selected, and the 'Search Method' is set to 'Taboo Search'. The 'Initialization Method' is 'Sequential', and the 'Maximum Search Steps' is 25. The 'Time out (secs)' is set to 60. The 'Update' button is visible.

On the right, the results of the MAP computation are shown:

- $P(\text{MAP}, e) = 0,1455$
- $P(\text{MAP} | e) = 0,8703453175464388$
- Result is exact.

Variable	Value
Heart Attack	true

SamIam: Sensitivity Analysis, Modeling, Inference and More

File Edit Mode Query Tools View Preferences Window Help

shenoy-shafer

Query Mode - [C:\Users\sami\Desktop\bn.net]

in-out degree

root

- Heart Attack
 - true
 - false
- Mask
 - true
 - false

internal

- Covid
 - true
 - false

leaf

- Chest Pain
 - true
 - false
- Red Eyes
 - true
 - false

Network

MAP Computation

☐ Approximate

Search Method: Taboo Search

Initialization Method: Sequential

Maximum Search Steps: 25

☒ Exact

Time out (secs): 60

Update

MAP Variables

Covid

$P(\text{MAP}, e) = 0,0955$
 $P(\text{MAP} | e) = 0,571257579557972$
 Result is exact.

Variable	Value
Covid	true

If we know that the person also has red eyes -which is a result of Covid but not heart attack-, probability of Covid-19 increases to ~ 0.95 while probability of heart attack decreases to ~ 0.78 as seen below. This is a good example of explaining away phenomena.

The image displays two screenshots of the Samlam software interface, illustrating the effect of observing a variable on the probabilities of other variables in a Bayesian network.

Top Screenshot: The 'Query Mode' window shows the 'Network' tab. The 'MAP Computation' panel is set to 'Approximate' with 'Taboo Search' as the search method. The 'Maximum Search Steps' is 25, and the 'Time out (secs)' is 60. The 'MAP Variables' list contains 'Covid'. The 'Variable' table shows 'Covid' with a value of 'true'. The 'P(MAP,e)' value is 0,014325001277029514, and the 'P(MAP|e)' value is 0,9523493251824025.

Bottom Screenshot: The 'Query Mode' window shows the 'Network' tab. The 'MAP Computation' panel is set to 'Exact' with 'Taboo Search' as the search method. The 'Maximum Search Steps' is 25, and the 'Time out (secs)' is 60. The 'MAP Variables' list contains 'Heart Attack'. The 'Variable' table shows 'Heart Attack' with a value of 'true'. The 'P(MAP,e)' value is 0,011850000000000001, and the 'P(MAP|e)' value is 0,7878072249464847. The result is exact.

TEST-2: A person is infected with Covid-19. What is the probability that she does not wear a mask in public places?

According to SAMIAM, given that the person is infected with Covid-19, the probability of her not wearing a mask is ~ 0.64 . As expected, for a person who has coronavirus, is more likely not to wear a mask (normally, probability of not wearing a mask is 0.4)

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Query Mode - [C:\Users\sami\Desktop\bn.net]

in-out degree

root

- Heart Attack
 - true
 - false
- Mask
 - true
 - false

internal

- Covid
 - true
 - false

leaf

- Chest Pain
 - true
 - false
- Red Eyes
 - true
 - false

MAP Computation

☐ Approximate

Search Method: Taboo Search

Initialization Method: Sequential

Maximum Search Steps: 25

☒ Exact

Time out (secs): 60

Update

MAP Variables

Mask

P(MAP,e)=0,32000000000000006
P(MAP|e)=0,64000000000000001
Result is exact.

Variable	Value
Mask	false

TEST-3: A person is not infected with Covid-19. What is the probability that she wears a mask in public places?

According to SAMIAM, given that the person is not infected with Covid-19, the probability of that she wears a mask is ~ 0.84 . As expected, if we know that the person does not have coronavirus, it is more probably that she wears a mask. (Normally, $P(\text{Mask})$ is 0.6 which is lower than 0.84).

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File Edit Mode Query Tools View Preferences Window Help

shenoy-shafer

100%

Query Mode - [C:\Users\sami\Desktop\bn.net]

in-out degree

root

- Heart Attack
- Mask

internal

- Covid
 - true
 - false

leaf

- Chest Pain
- Red Eyes

Network

MAP Computation

☐ Approximate

Search Method: Taboo Search

Initialization Method: Sequential

Maximum Search Steps: 25

☒ Exact

Time out (secs): 60

Update

MAP Variables

Mask

$P(\text{MAP}, e) = 0,42$
 $P(\text{MAP} | e) = 0,8399997997284413$
 Result is exact.

Variable	Value
Mask	true