Coursework 2 –Bayes Theorem and Bayesian Learning

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A1

a) P (SARS-Cov-4 = False) = 1 – P (SARS-Cov-4 = True) = 0.98

P (SARS-Cov-4 = True | PCR Test = Positive) =

P (PCR Test = Positive | SARS-Cov-4 = True) x P (SARS-Cov-4 = True) / P (PCR Test = Positive | SARS-Cov-4 = True) X P (SARS-Cov-4 = True) + P (PCR Test = Positive | SARS-Cov-4 = False) X P (SARS-Cov-4 = False)

P (SARS-Cov-4 = True | PCR Test = Positive) = 0.9 x 0.02 / 0.9 X 0.02 + 0.2 X 0.98

= 0.018/0.216

=18/216

= 0.0841

b) P (False Positive = Yes | PCR test, SARS-Cov-4)

$\sum_{PCR\ Test, SARS-Cov-4} P(\ False\ Positive = YES \mid PCR\ test, SARS - Cov - 4)$

⇨ P (False Positive = Yes | PCR Test = Positive, SARS-Cov-4 = True) + P (False Positive = Yes | PCR Test = Positive, SARS-Cov-4 = False) + P (False Positive = Yes | PCR Test = Negative, SARS-Cov-4 = True) + P (False Positive = Yes | PCR Test = Negative, SARS-Cov-4 = False)

= P (False Positive = Yes | PCR Test = Positive, SARS-Cov-4 = False) + 0 + 0

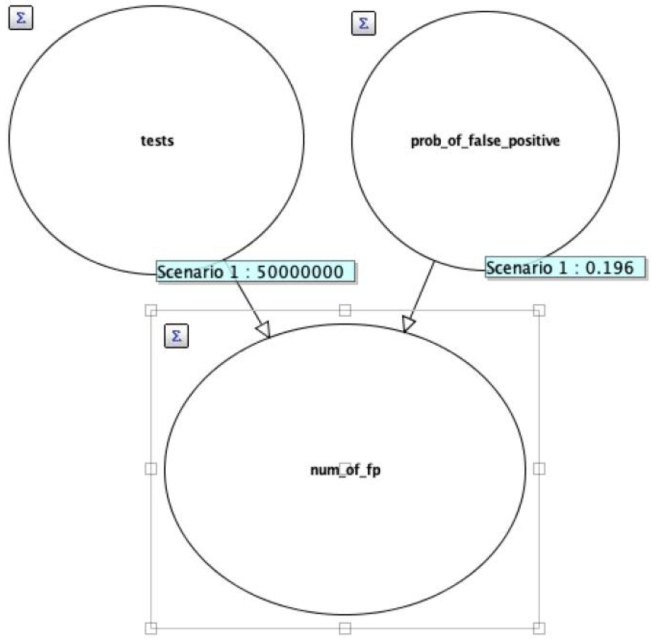
= P (PCR Test = Positive, SARS-Cov-4 = False)

= P (PCR Test = Positive, SARS-Cov-4 = False) x P (SARS-Cov-4 = False)

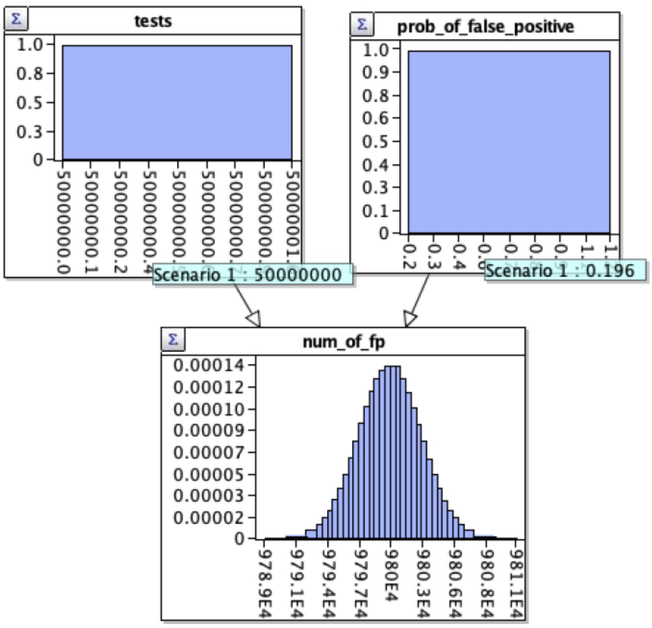
= 0.2 x 0.98

= 0.196

c)



tests
prob_of_false_positive
Scenario 1 : 50000000
Scenario 1 : 0.196
num_of_fp



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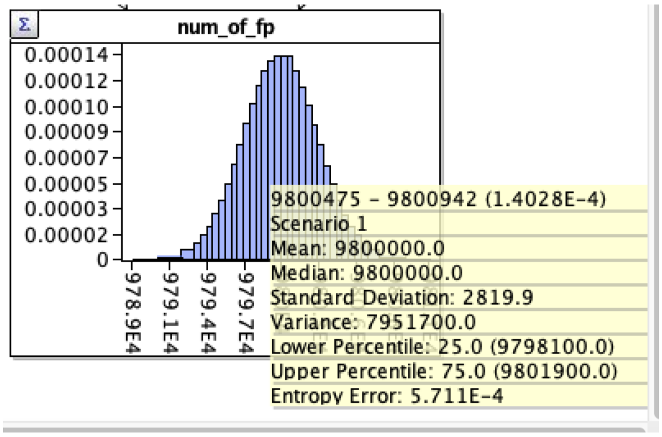


Using the Binomial Distribution, the number of False Positive or FP in the population are 9.8 million.

d)

P (True Positive = Yes | PCR test, SARS-Cov-4)

- ⇨ $\sum_{True\ Positive=True\ |\ PCR\ ,SARS-Cov-4} P(\ True\ Positive = Yes\ |\ PCR\ test, SARS - Cov - 4)$

  - ➔ P (True Positive = Yes | PCR test = Positive, SARS-Cov-4 =True) + P (True Positive = Yes | PCR test = Positive, SARS-Cov-4 =False) + P (True Positive = Yes | PCR test = Negative, SARS-Cov-4 =True) + P (True Positive = Yes | PCR test = Negative, SARS-Cov-4 =False)
  - ➔ P (True Positive = Yes | PCR test = Positive, SARS-Cov-4 = True) + 0 + 0 + 0
  - ➔ P (True Positive = Yes | PCR test = Positive, SARS-Cov-4 = True) x P (PCR test = Positive, SARS-Cov-4 = True) x P (SARS-Cov-4 = True)
  - ➔ 1 x 0.9 x 0.02
  - ➔ 0.018

From the Agena Risk Binomial => 0.9 million

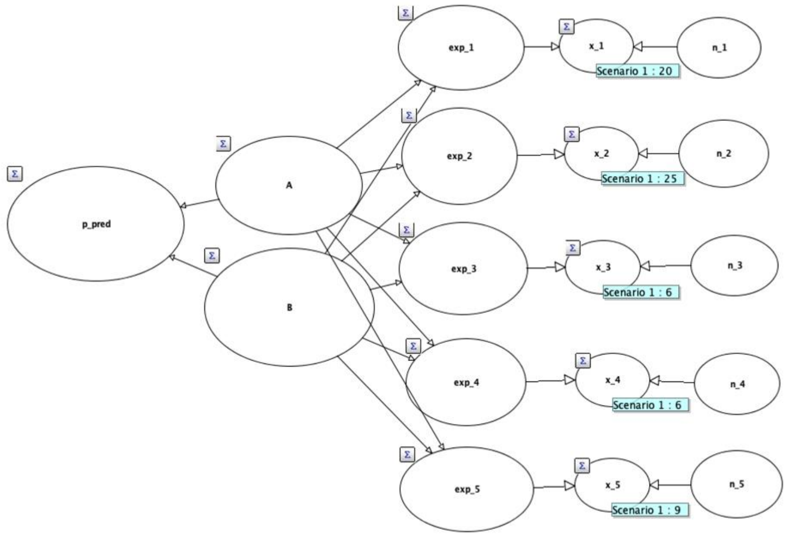
Approximate population to self-isolate => 9.8 + 0.9 => 10.7 million

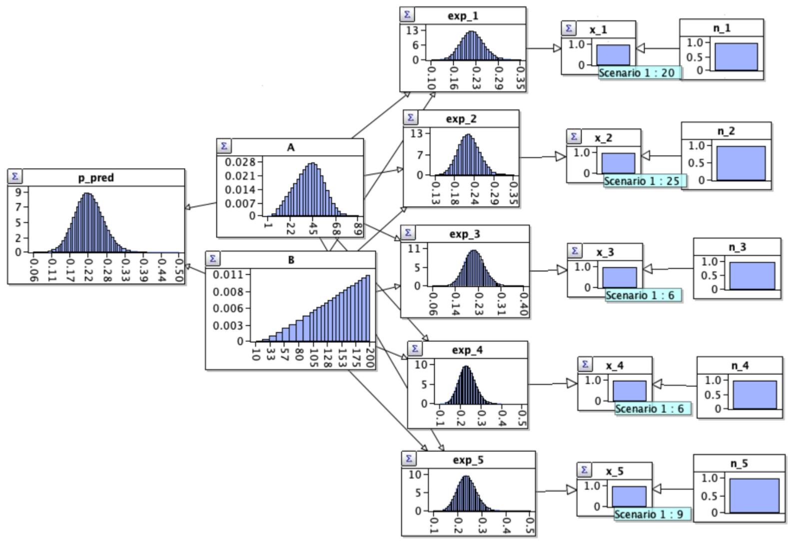
Percentage of Population Rate of Isolation => 10.7 million/50 million

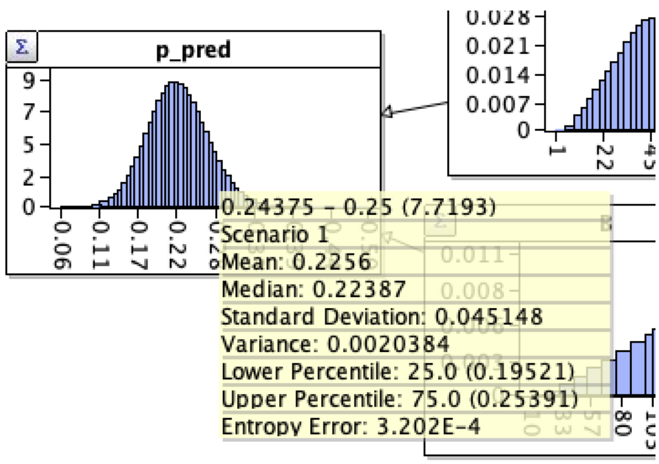
=> 0.214 or 21.4 %

A2

a) Using the given configurations, the BN parameter Learning model is given below for node and graph model both.

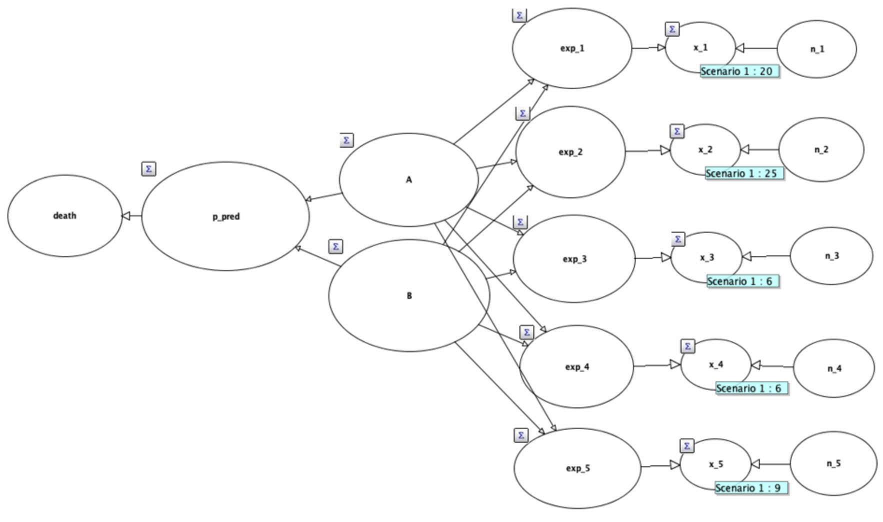


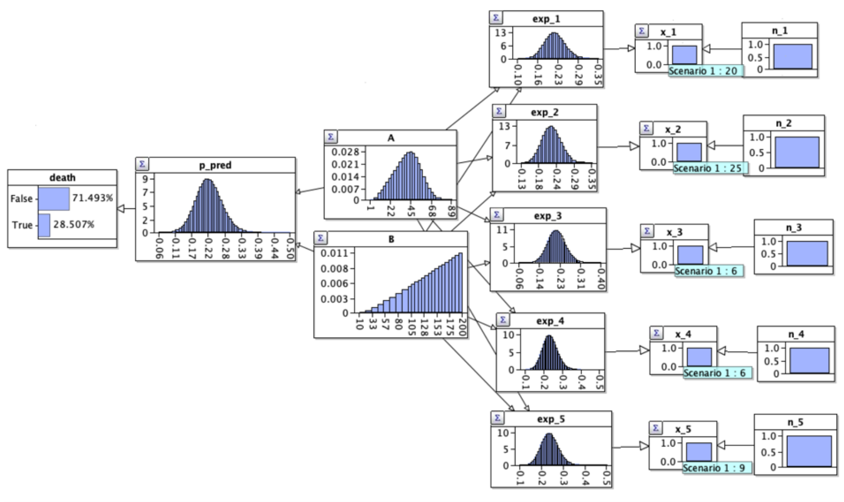


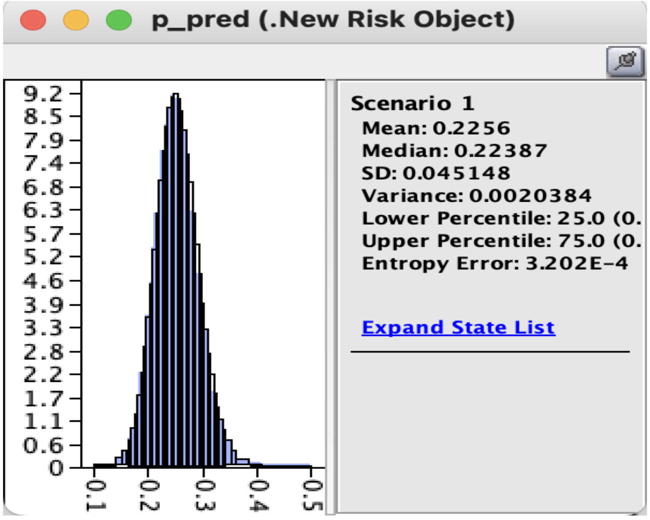


From the mean node p_pred as the estimated P (p| a,b,ni,xi,pi) to be 0.2256

b)







The death rate according to the model is approximately 71.493% for False and 28.508% for True.

c) According to the model that we have created above, we can clearly observe that the death rate does not see any significant change when we apply the therapeutic treatment. If there was any significant change when the therapeutic treatment was given, then it shall be recommended. Therefore, I personally do not recommend using therapeutic treatment.