

Question 3

Let us use this script to output required probabilities

```
Gender.set_evidence('Female')
Prediction.set_evidence('Yes')
HyperLipidemia.set_evidence('Yes')
print()
print("SEPARATED")
print("P(Prediction =Yes|Hyperlipidemia=Yes,Gender=Female)=", end=
    "\n    \n")
print(VE(Q3, Prediction,[Gender, HyperLipidemia]) [0])
print("P(Prediction =Yes| Hyperlipidemia= Yes) = ", end="")
print(VE(Q3, Prediction, [HyperLipidemia]) [0])
print()
print("SUFFICIENT ")
print("P(Hyperlipidemia=Yes | Prediction= YES , Gender=Female) = ",
    "\n    \n end=")
print(VE(Q3, HyperLipidemia, [Gender, Prediction]) [0])
print("P(Hyperlipidemia=Yes | Prediction= YES ) = ", end="")
print(VE(Q3, HyperLipidemia, [Prediction]) [0])
print()
```

Separated but NOT Sufficient

```
Assignment:('Yes', 'Male', 'Yes') ::: Value:0.42
Assignment:('Yes', 'Male', 'No') ::: Value:0.18
Assignment:('Yes', 'Female', 'Yes') ::: Value:0.21
Assignment:('Yes', 'Female', 'No') ::: Value:0.09
Assignment:('No', 'Male', 'Yes') ::: Value:0.27999999999999997
Assignment:('No', 'Male', 'No') ::: Value:0.12
Assignment:('No', 'Female', 'Yes') ::: Value:0.48999999999999994
Assignment:('No', 'Female', 'No') ::: Value:0.21
```

Using this CPT we get the output:

SEPARATED $P(\text{Prediction} = \text{Yes} \mid \text{Hyperlipidemia} = \text{Yes}, \text{Gender} = \text{Female}) = 0.3$ $P(\text{Prediction} = \text{Yes} \mid \text{Hyperlipidemia} = \text{Yes}) = 0.45$ NOT SUFFICIENT $P(\text{Hyperlipidemia} = \text{Yes} \mid \text{Hyperlipidemia} = \text{YES}, \text{Gender} = \text{Female}) = 0.7$ $P(\text{Hyperlipidemia} = \text{Yes} \mid \text{Hyperlipidemia} = \text{YES}) = 0.7$
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NOT Separated but Sufficient

Assignment:('Yes', 'Male', 'Yes') ::: Value:0.42 Assignment:('Yes', 'Male', 'No') ::: Value:0.18 Assignment:('Yes', 'Female', 'Yes') ::: Value:0.21 Assignment:('Yes', 'Female', 'No') ::: Value:0.09 Assignment:('No', 'Male', 'Yes') ::: Value:0.28 Assignment:('No', 'Male', 'No') ::: Value:0.12 Assignment:('No', 'Female', 'Yes') ::: Value:0.49 Assignment:('No', 'Female', 'No') ::: Value:0.21
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using this CPT we get the output,

SEPARATED $P(\text{Prediction} = \text{Yes} \mid \text{Hyperlipidemia} = \text{Yes}, \text{Gender} = \text{Female}) = 0.7$ $P(\text{Prediction} = \text{Yes} \mid \text{Hyperlipidemia} = \text{Yes}) = 0.7$ SUFFICIENT $P(\text{Hyperlipidemia} = \text{Yes} \mid \text{Prediction} = \text{YES}, \text{Gender} = \text{Female}) = 0.3$ $P(\text{Hyperlipidemia} = \text{Yes} \mid \text{Prediction} = \text{YES}) = 0.45$
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Both CPTs give us the behaviour we require.