Exercise #4:

Case 1: Age(0-9)

$$Bel(Age[0\text{-}9]) = P(Age=[0\text{-}9] \mid Gender=Male,\ Susceptibility=High)$$

$$= \frac{P(Gender=Male,\ Susceptibility=High \mid Age=[0\text{-}9]) \times P(Age=[0\text{-}9])}{P(Gender=Male,\ Susceptibility=High)}$$

$$= \frac{P(Gender=Male,\ Susceptibility=High,\ Age=[0\text{-}9])}{P(Gender=Male,\ Susceptibility=High)}$$

Joint probability use chain rule:

$P(Gender=Male, Susceptibility=High, Age=[0\text{-}9]) =$

$P(Gender=Male) \times P(Susceptibility=High \mid Gender=Male, Age=[0\text{-}9]) \times$

$P(Age=[0\text{-}9]) = 0.5500 \times 0.0000 \times 0.0043 = 0.0000$

Since numerator is 0 the probability is 0.0%

0.0000 or 0.0000% is the probability given age is 0-9, the susceptibility is high and gender is male.

Case 2: Age=(40-49)

$$Bel(Age[40\text{-}49]) = P(Age=[40\text{-}49] \mid Gender=Male,\ Susceptibility=High)$$

$$= \frac{P(Gender=Male,\ Susceptibility=High \mid Age=[40\text{-}49]) \times P(Age=[40\text{-}49])}{P(Gender=Male,\ Susceptibility=High)}$$

$$= \frac{P(Gender=Male,\ Susceptibility=High,\ Age=[40\text{-}49])}{P(Gender=Male,\ Susceptibility=High)}$$

Joint probability use chain role:

$P(\text{Gender}=\text{Male}, \text{Susceptibility}=\text{High}, \text{Age}=[40\text{-}49]) =$
$P(\text{Gender}=\text{Male}) \times P(\text{Susceptibility}=\text{High} \mid \text{Gender}=\text{Male}, \text{Age}=[40\text{-}49])$
$\times P(\text{Age}=[40\text{-}49]) = 0.5500 \times 0.5000 \times 0.0900 = 0.02475$

Joint probability use chain role:

$P(\text{Gender}=\text{Male}, \underline{\text{Age}}, \text{Susceptibility}=\text{High}) =$

↳Not defined

$$\sum_i \{ \underset{1}{P(\text{Gender}=\text{Male})} \times \underset{2}{P(\text{Age}=i)} \times \underset{3}{P(\text{Susceptibility}=\text{High} \mid \text{Age}=i, \text{Gender}=\text{Male})} \}$$

Age=i	1	2	3	Π
0-9	0.5500	0.0043	0.0000	0.0000
10-19	0.5500	0.0062	0.3548	0.001209868
20-29	0.5500	0.0935	0.1910	0.009822175
30-39	0.5500	0.1153	0.3010	0.019087915
40-49	0.5500	0.0900	0.5000	0.024750000
50-59	0.5500	0.1072	0.2719	0.016031224
60-69	0.5500	0.2487	0.1509	0.0206408565
70-79	0.5500	0.2735	0.6193	0.0931582025
80-89	0.5500	0.0582	0.1183	0.003786783
90-99	0.5500	0.0030	0.9900	0.001633500
				0.190120524 → Sum of all these

$P(\text{Gender}=\text{Male}, \underline{\text{Age}}, \text{Susceptibility}=\text{High}) = 0.190120524$

↳Not defined

Now we plug it in:

$$\frac{P(Gender=Male, Susceptibility=High, Age=[40\text{-}49])}{P(Gender=Male, Susceptibility=High)}$$

$$= \frac{0.02475}{0.190120524} = 0.1301805796$$

$\boxed{\text{0.1302 or 13.02\% is the probability given 40-49, susceptibility is high and gender is male.}}$

Case 3: Age=(90-99)

$$Bel(Age[90\text{-}99]) = P(Age=[90\text{-}99] \mid Gender=Male, Susceptibility=High)$$

$$= \frac{P(Gender=Male, Susceptibility=High \mid Age=[90\text{-}99]) \times P(Age=[90\text{-}99])}{P(Gender=Male, Susceptibility=High)}$$

$$= \frac{P(Gender=Male, Susceptibility=High, Age=[90\text{-}99])}{P(Gender=Male, Susceptibility=High)}$$

$$P(Gender=Male, Susceptibility=High, Age=[90\text{-}99]) = 0.001633500$$

↳From table above

$$P(Gender=Male, \underbrace{Age}_{\text{Not defined}}, Susceptibility=High) = 0.190120524$$

Now we plug it in:

$$\frac{P(Gender=Male, Susceptibility=High, Age=[90\text{-}99])}{P(Gender=Male, Susceptibility=High)}$$

$$= \frac{0.001633500}{0.190120524} = 0.0085919183$$

$\boxed{\text{0.008591 or 0.8591 is the probability given 90-99, Susceptibility is high and gender is male.}}$