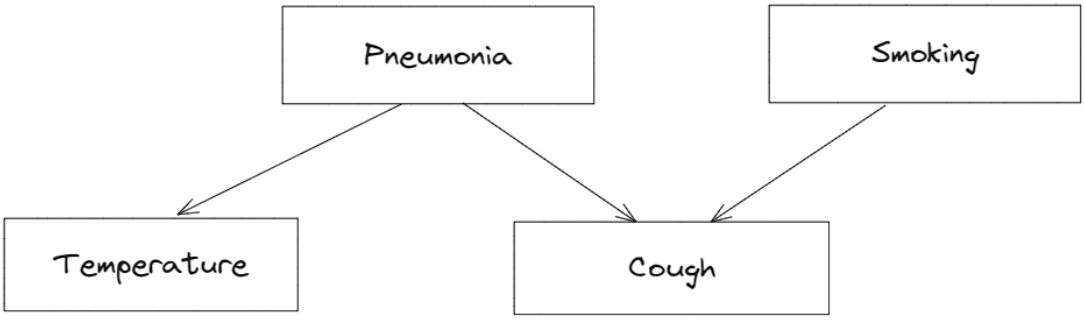
Q. From the figure and the data given below, using Bayes Rule and calculate:

Pneumonia			**Smoking**		
True	0.1			**Yes**	0.2
False	0.9			**No**	0.8

		Cough	
Pneumonia	**Smoking**	**True**	**False**
True	**Yes**	0.95	0.05
True	**No**	0.8	0.2
False	**Yes**	0.6	0.4
False	**No**	0.05	0.95

	Temperature	
Pneumonia	**Yes**	**No**
Yes	0.9	0.1
No	0.2	0.8



Solution:

Let c, be the event for the cough. *(Here, $\underline{c}$ represents to not cough)*

Let p, be the event for pneumonia. *(Here, $\underline{p}$ represents to not pneumonia)*

Let s, be the event for smoking. *(Here, $\underline{s}$ represents to not smoking)*

i. $P(c/(p \,\&\, s)) = 0.95$

ii. $P(\underline{c}/(p \,\&\, s)) = 0.05$

iii. $P(c/(\underline{p} \,\&\, s)) = 0.6$

iv. $P(c/(p \,\&\, \underline{s})) = 0.8$

$$P(c) = [P(c/p \cap s)] * P(p) * P(s) + [P(c/\underline{p} \cap s)] * P(\underline{p}) * P(s) + [P(c/p \cap \underline{s})] * P(p) * P(\underline{s}) + [P(c/\underline{p} \cap \underline{s})] * P(\underline{p}) * P(\underline{s})$$

$$= 0.95 * 0.1 * 0.2 + 0.6 * 0.9 * 0.2 + 0.8 * 0.1 * 0.8 + 0.05 * 0.9 * 0.8$$

$$= 0.019 + 0.108 + 0.064 + 0.036$$

$$= 0.227$$

$$P(c/s) = [P(c/p \cap s)] * P(p) + [P(c/\underline{p} \cap s)] * P(\underline{p})$$

$$= 0.95* 0.1 + 0.6*0.9$$

$$= 0.095 + 0.54$$

$$= 0.635$$

$$P(s/c) = [P(c/s) * P(s)] / P(c)$$

$$= [0.635*0.2] / 0.227$$

$$= 0.55$$

$$P(c/\underline{s}) = [P(c/p \cap \underline{s})] * P(p) * 1 + [P(c/\underline{p} \cap s)] * P(\underline{p}) * 1$$

$$= 0.8 * 0.1 + 0.05 * 0.9$$

$$= 0.08 * 0.045$$

$$= 0.125$$