**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 |

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

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

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

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

$$= 0.227$$

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

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

$$= 0.095 + 0.54$$

$$= 0.635$$

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

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

$$= 0.55$$

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

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

$$= 0.08 * 0.045$$

$$= 0.125$$