Assignment 1

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1) A couple has two children,
   a) Find the probability that both children are males, if it is known that at least one of the children is male.
   b) Find the probability that both children are females, if it is known that the elder child is a female.

Solution: If the couple has two children, then the sample space is,

$$S = \{(M,M),(M,F),(F,M),(F,F)\} \quad (0.0.1)$$

a) Let A denote the event of both children being Male, B denote the event of atlease one of the children being Male

$$A = \{(M,M)\} \quad (0.0.2)$$
$$B = \{(M,M),(M,F),(F,M)\} \quad (0.0.3)$$
$$A \cap B = \{(M,M)\} \quad (0.0.4)$$
$$\Pr(AB) = \frac{1}{4} \quad (0.0.5)$$
$$\Pr(B) = \frac{3}{4} \quad (0.0.6)$$

The required probability is given by,

$$\Pr(A \mid B) = \frac{\Pr(AB)}{\Pr(B)} \quad (0.0.7)$$
$$= \frac{1}{3} \quad (0.0.8)$$

b) Let C denote the event of both children being Female, D denote the event of elder child being Female

$$C = \{(F,F)\} \quad (0.0.9)$$
$$D = \{(F,M),(F,F)\} \quad (0.0.10)$$
$$C \cap D = \{(F,F)\} \quad (0.0.11)$$
$$\Pr(CD) = \frac{1}{4} \quad (0.0.12)$$
$$\Pr(D) = \frac{1}{2} \quad (0.0.13)$$

The required probability is given by,

$$\Pr(C \mid D) = \frac{\Pr(CD)}{\Pr(D)} \quad (0.0.14)$$
$$= \frac{1}{2} \quad (0.0.15)$$