Rules:

1. $0 \leq P(x_i) \leq 1$
2. $\sum P(x_i) = 1$
3. Complement: $P(A') = 1 - P(A)$
4. Addition: $P(A\ or\ B) = P(A) + P(B) - P(A\ and\ B)$
5. Multiplication (independent only): $P(A\ and\ B) = P(A)P(B)$

Confusion matrix

$d = P(A\ and\ B), e = P(A\ and\ B'), f = P(A), g = P(A'and\ B), h = P(A'and\ B'), i = P(A'),$
$j = P(B), k = P(B')$

	$P(B)$	$P(B')$	
$P(A)$	d	e	f
$P(A')$	g	h	i
	j	k	1

EXAMPLE1: How accurate are the weather predictions? Look at weather predictions and actual weather for one calendar year (365 days).

Data is a mix of a contingency table with probability example

	A rain	A no rain	
F Rain	27	63	90
F no rain	7	268	275
	34	331	365

$$P(Forecasted\ rain) = \frac{90}{365} = 0.2466$$

$$P(Forecasted\ no\ rain) = \frac{275}{365} = 0.7534$$

$$P(forecast\ rain\ and\ no\ actual\ rain) = \frac{63}{365} = 0.1726$$

56% of American workers have a retirement plan, 68% have health insurance, and 49% have both.

$P(RP) = 0.56, P(HI) = 0.68, P(RP\ and\ HI) = 0.49$

	$P(HI)$	$P(HI')$	
$P(RP)$	0.49	0.07	0.56
$P(RP')$	0.19	0.25	0.44
	0.68	0.32	1

$P(RP'\ and\ HI') = 0.25$

$P(RP'\ or\ HI') = P(RP') + P(HI') - P(RP'\ and\ HI') = 0.44 + 0.32 - 0.25 = 0.51$

Are RP and HI mutually exclusive? NO because the intersection between RP and HI exists (they can happen at the same time)

Are RP and HI independent? $P(RP\ and\ HI)? =? P(RP)P(HI) \Rightarrow 0.49? =? (0.56)(0.68) \Rightarrow$ $0.49 \neq 0.3808 \therefore$ RP and HI are not independent (they are dependent)