

Decision Analysis

1. DukeFan Inc. develops a predictive model to identify buyers and non buyers for its products. Among the 100 customers studied from their database, 30 of them are buyers. The predictive model will put each customer in the study into one of the three groups: identified as buyer, identified as non buyer and identified as inconclusive. When the predictive model is applied to buyers, it successfully identifies buyers 75% of times, 11% of times as inconclusive and the rest as non buyers. When the predictive model is applied to non buyers, it successfully identifies non buyers 85% of times, and 7% of time as buyers.

1). (10 pts.) Use the information provided in the problem above to fill the tables below with prior probability, conditional probability, joint probability and posterior probability, each with 3-decimal points of accuracy. (must show details with equations and appropriate notations)

	A	B	C	D	E	F
1		$P(\text{Buyers})$	Buyers	Non Buyers	$P(\text{Non Buyers})$	
2		Prior Probability	30/100	70/100		
3		simple or marginal				
4						
5		Conditional prob.	Buyers	Non Buyers		
6	Id Buyers	.75		.07	$P(\text{Id Buyer} \text{Buyers}) = \frac{P(\text{Id Buyer} \cap \text{Buyers})}{P(\text{Buyers})} = \frac{.225}{.30}$	
7	Id NonBuyers			.85	$P(\text{Id NonBuyers} \text{Non Buyers}) = \frac{P(\text{Id NonBuy} \cap \text{NonBuy})}{P(\text{NonBuy})} = \frac{.595}{.70}$	
8	Id Inconcl	.11				
9		1.00		1.00		
10						
11	Joint	Buyers	Non Buyers	Row Sum		
12	Id Buyers	.225	.049	.274	$P(\text{Id NonBuy} \text{NonBuy})$	
13	Id NonBuyers	.042	.595	.637	$= P(\text{Id NonBuy} \text{NonBuy})$	
14	Id Inconcl	.033	.056	.089	$P(\text{NonBuyer}) =$	
15	Col Sum	.30	.70	1.00	$= .70 \times .85 = .595$	
16						
17	Posterior Prob.	Buyers	Non Buyers		$P(\text{NonBuy} \text{Id NonBuyer})$	
18	Id Buyers	.821	.179		$= P(\text{NonBuy} \cap \text{Id NonBuy}) / P(\text{Id NonBuy})$	
19	Id NonBuyers	.066	.934		$= .595 / .637 = .934$	
20	Id Inconcl	.371	.629			

$$P(\text{Buyers} | \text{Id Buyers}) = \frac{P(\text{Id Buyer})P(\text{Buyer} \cap \text{Id Buyer})}{P(\text{Id Buyers})} = \frac{.225}{.274}$$

$$P(\text{Id Buyer} \cup \text{Buyer}) = P(\text{Id Buyer}) + P(\text{Buyer}) - P(\text{Id Buyer} \cap \text{Buyer})$$

$$= .30 + .274 - .225 = .349$$

$$P(\text{Buyer} | \text{Id Buyer}) = \frac{P(\text{Buyer})P(\text{Id Buyer} | \text{Buyer})}{P(\text{Buyer})P(\text{Id Buyer} | \text{Buyer}) + P(\text{NonBuy})P(\text{Id Buyer} | \text{NonBuy})}$$

$$= \frac{.30 \times .75}{.30 \times .75 + .70 \times .07} = \frac{.225}{.225 + .049} = \frac{.225}{.274} = .821$$