Dean Foster **Stat 430: First Midterm Answers** October 8, 2009

1. Look at the piece $A^c \cap B \cap C$. It obviously isn't in A. So it isn't in both A and $B \cup C$. Thus it isn't in the second set. But, it is in C. So, it is in at least one of the two sets $A \cap B$ and C, and thus it is in the union. So this piece is in the first set but not the second. So

$$(A \cap B) \cup C \neq A \cap (B \cup C)$$

2. (a) $P(\{7\})$ is undefined
   (b) true
   (c) If $\{2, 4, 6\} \in \mathcal{A}$ then $\{1, 3, 5\} \in \mathcal{A}$.
   (d) $\emptyset \in \mathcal{A}$.
   (e) true
   (f) true
   (g) If $A \subset \Omega$ then if $\mathcal{A}$ includes all subsets of Ω then $A \in \mathcal{A}$. (Note: There are many other ways of correcting this statement. I couldn't think of any creative ones.)
   (h) If $\{5\} \in \mathcal{A}$ then $P(\{5\}) \leq 1/3$.
   (i) true

3. Here are the steps in creating the tables:

	$G \cap E^c$	$G^c \cap E^c$	$G \cap E$	$G^c \cap E$
M				
M^c				
	$.05 * .98$	$.95 * .98$	$.05 * .02$	$.95 * .02$

	$G \cap E^c$	$G^c \cap E^c$	$G \cap E$	$G^c \cap E$
M	$.9 * .05$	1/Million $*.93$	$.5 * .001$	$.5 * .02$
M^c	$.1 * .05$	(1 - 1/million)$*.93$	$.5 * .001$	$.5 * .02$
	.05	.93	.001	.02

	$G \cap E^c$	$G^c \cap E^c$	$G \cap E$	$G^c \cap E$	
M	.045	1/ 1 Million	.0005	.01	.0555
M^c	.005	.93	.0005	.01	.9455
	.05	.93	.001	.02	1

The rest is details.

4. The correct answer is P(D=2) = 1/4, P(D=1) = 1/2, P(D=0) = 1/4. Dean is using equally likely when equally likely isn't the right thing to do. Bob is forgetting that in 8 hours, there is a good chance that the two cars will have arrived at different times and hence the lane they pick is independent.

5. For the first box: P(2 caramels—first box) = (8/12) x (7/11).

   For the second box: P(2 caramels—second box) = (5/10) x (4/9).

   The chance of getting two caramels (summing over disjoint events–Ommm) is: (8/12) x (7/11) x .5 + (5/10) x (4/9) x .5.

   Now desired probability:

$$P(\text{second box—2 caramels}) = \frac{(5/10) * (4/9) * .5}{(8/12) * (7/11) * .5 + (5/10) * (4/9) * .5.}$$