HW #3: Solution to Evens
Statistics 1, Sections 4 and 6, Fall 2008

4.2 **a** It is given that $P(E_1) = P(E_2) = 1.5$ and $P(E_3) = .40$. Since $\sum_S P(E_i) = 1$, we know that

$$P(E_4) + P(E_5) = 1 - .15 - .15 - .40 = .30 \qquad \text{(i)}$$

Also, it is given that

$$P(E_4) = 2P(E_5) \qquad \text{(ii)}$$

We have two equations in two unknowns which can be solved simultaneously for $P(E_4)$ and $P(E_5)$. Substituting equation (ii) into equation (i), we have

$$2P(E_5) + P(E_5) = .3$$
$$3P(E_5) = .3 \text{ so that } P(E_5) = .1$$
Then from (i), $P(E_4) + .1 = .3$ and $P(E_4) = .2$.

b To find the necessary probabilities, sum the probabilities of the simple events:

$$P(A) = P(E_1) + P(E_3) + P(E_4) = .15 + .4 + .2 = .75$$
$$P(B) = P(E_2) + P(E_3) = .15 + .4 = .55$$

c-d The following events are in either A or B or both: { E_1, E_2, E_3, E_4}. Only event E_3 is in both A and B.

4.42 Each simple event is equally likely, with probability $1/5$.

a	$A^C = \{E_2, E_4, E_5\}$	$P(A^C) = 3/5$
b	$A \cap B = \{E_1\}$	$P(A \cap B) = 1/5$
c	$B \cap C = \{E_4\}$	$P(B \cap C) = 1/5$
d	$A \cup B = S = \{E_1, E_2, E_3, E_4, E_5\}$	$P(A \cup B) = 1$
e	$B \mid C = \{E_4\}$	$P(B \mid C) = 1/2$
f	$A \mid B = \{E_1\}$	$P(A \mid B) = 1/4$
g	$A \cup B \cup C = S$	$P(A \cup B \cup C) = 1$
h	$(A \cap B)^C = \{E_2, E_3, E_4, E_5\}$	$P(A \cap B)^C = 4/5$

4.56 The two-way table in the text gives probabilities for events A, A^C, B, B^C in the column and row marked "Totals". The interior of the table contains the four two-way intersections as shown below.

$A \cap B$	$A \cap B^C$
$A^C \cap B$	$A^C \cap B^C$

The necessary probabilities can be found using various rules of probability if not directly from the table.

a $P(A) = .4$

b $P(B) = .37$

c $P(A \cap B) = .10$

d $P(A \cup B) = .4 + .37 - .10 = .67$

e $P(A^C) = 1 - .4 = .6$

f $P(A \cup B)^C = 1 - P(A \cup B) = 1 - .67 = .33$

g $P(A \cap B)^C = 1 - P(A \cap B) = .90$

h $P(A \mid B) = P(A \cap B)/P(B) = .1/.37 = .27$

i $P(B \mid A) = P(A \cap B)/P(A) = .1/.4 = .25$

4.66 Similar to Exercise 4.56.

a $P(F) = .35 + .36 = .71$

b $P(G) = .20 + .09 = .29$

c $P(F \mid M) = \dfrac{P(F \cap M)}{P(M)} = \dfrac{.35}{.55} = .63$

d $P(F \mid W) = \dfrac{P(F \cap W)}{P(W)} = \dfrac{.36}{.45} = .80$

e $P(M \mid F) = \dfrac{P(M \cap F)}{P(F)} = \dfrac{.35}{.71} = .49$

e $P(W \mid G) = \dfrac{P(W \cap G)}{P(G)} = \dfrac{.09}{.29} = .31$