2.12 a) $P(A_1 \cap A_2) = P(A_1) + P(A_2) - P(A_1 \cap A_2) = .7 + .5 - .4 = .8$

b) $P(\text{neither is Amer}) = 1 - P(\text{at least one is Amer}) = 1 - .8 = .2$

c) $P(\text{exactly one is Amer}) = P(\text{at least one is Amer}) - P(\text{both are Amer}) = .8 - .4 = .4$

2.18 a) There are six simple events, corresponding to the outcomes CDP, CPD, DCP, DPC, PCD, and PDC. The probability assigned to each is $\frac{1}{6}$

b) $P(C \text{ ranked first}) = P(CDP, CPD) = \frac{1}{6} + \frac{1}{6} = \frac{1}{3} = .333$

c) $P(C \text{ ranked first and } D \text{ last}) = P(CPD) = \frac{1}{6}) = .167$

2.20 Possible outcomes are (1,2), (1,3), (1,4), (1,5), (2,3), (2,4), (2,5), (3,4), (3,5) and (4,5).

a) $P(\text{both are first printings}) = P((1,2)) = \frac{1}{10} = .1$

b) $P(\text{both are second printings}) = P((3,4),(3,5),(4,5)) = \frac{3}{10} = .3$

c) $P(\text{at least one first printing}) = 1 - P(\text{both are second printings}) = 1 - .3 = .7$

d) $P(\text{different printings}) = 1 - P(\text{same printings}) = 1 - [P(\text{both first}) + P(\text{both second})] = 1 - .4 = .6$

2.28 a) P=.1

b) P=.7

c) P=.6

2.30 a) $5 \times 4 = 20$ (5 choices for president, 4 remain for vice president)

b) $5 \times 4 \times 3 = 60$

c) $\begin{pmatrix} 5 \\ 2 \end{pmatrix} = 10$

2.50 a) $P(A_2|A_1) = \frac{P(A_2 \cap A_1)}{P(A_1)} = \frac{.4}{.7} = .571$

b) $P(A_1|A_2) = \frac{P(A_1 \cap A_2)}{P(A_2)} = \frac{.4}{.5} = .8$

c) $P(A_2'|A_1') = 1 - P(A_2|A_1') = 1 - \frac{P(A_2 \cap A_1')}{P(A_1')} = 1 - \frac{.5-.4}{.3} = \frac{2}{3}$

d) $P(A_1 \cap A_2|A_1 \cup A_2) = \frac{P((A_1 \cap A_2) \cap (A_1 \cup A_2))}{P(A_1 \cup A_2)} = \frac{P(A_1 \cap A_2)}{P(A_1 \cup A_2)} = \frac{.4}{.8} = .5$

2.52 a) $P(\text{R from 1st} \cap \text{R from 2nd}) = P(\text{Rfrom 2nd}|\text{R from 1st}) \cdot P(\text{R from 1st}) = \frac{8}{11} \times \frac{6}{10} = .436$

b) $P(\text{same numbers}) = .436 + \frac{4}{10} \times \frac{4}{11} = .581$

2.58

$$\begin{aligned}
P(A \cup B|C) &= \frac{P((A \cup B) \cap C)}{P(C)} \\
&= \frac{P((A \cap C) \cup (B \cap C))}{P(C)} \\
&= \frac{P(A \cap C) + P(B \cap C) - P((A \cap C) \cap (B \cap C))}{P(C)} \\
&= \frac{P(A \cap C)}{P(C)} + \frac{P(B \cap C)}{P(C)} + \frac{P(A \cap B \cap C)}{P(C)} \\
&= P(A|C) + P(B|C) - P(A \cap B|C)
\end{aligned}$$

2.66 $P(\text{small}|\text{on time}) = \frac{.9 \cdot .75}{.9 \cdot .75 + .6 \cdot .25} = .8182$

2.72 $P(\text{no errors}) = (.9)^{10} = .3487$

$P(\text{at least one error}) = 1 - P(\text{no errors}) = 1 - (.9)^{10} = 1 - .3487 = .6513$

$(1-p)^n$

$1-(1-p)^n$

2.76 $P(\text{system works})$

$= P(1 - 2\text{works} \cup 3 - 4\text{works})$

$= P(1 - 2\text{works}) + P(3 - 4\text{works}) - P(1 - 2\text{works} \cap 3 - 4\text{works})$

$= (.9 + .9 - .81) + (.9 \cdot .9) - (.9 + .9 - .81) \cdot (.9 \cdot .9)$

$= .99 + .81 - .8019 = .9981$

2.102 a) $P(\text{all different}) = \frac{(365)(364)\cdots(356)}{(365)^{10}} = .883$

$P(\text{at least two the same}) = 1 - .883 = .117$

b) $P(\text{at least tow the same}) = .476$ for $k = 22$ and $= .507$ for $k = 23$

c) $P(\text{at least two have the same SS number}) = .044$

thus, $P(\text{at least one conincidence}) = .117 + .044 - (.117)(.044) = .158$