**33. (a)** Since there are 15 players and 9 positions, and order matters in a line-up (catcher, pitcher, shortstop etc. are different positions), the number of possibilities is $P_{9,15}$ = (15) (14) … (7) or 15!/(15-9)! = 1,816,214,440.

**(b)** For each of the starting line-ups in part (a), there are 9! possible batting orders. So, multiply the answer from (a) by 9! to get (1,816,214,440)(362,880) = 659,067,881,472,000)

**(c)** Order still matters: There are $P_{3,5}$ = 60 ways to choose three left-handers for the outfield and $P_{6,10}$ = 151,200 ways to choose six right-handers for other positions. The total number of possibilities is (60)(151,200) = 9,072,000.

**36.** There are $\binom{5}{2}$ = 10 possible ways to select the positions for *B*'s votes: *BBAAA*, *BABAA*, *BAABA*, *BAAAB*, *ABBAA*, *ABABA*, *ABAAB*, *AABBA*, *AABABI* and *AAABB*. Only the last two have *A* ahead of *B* throughout the vote count. Since the outcomes are equally likely, the desired probability is $\frac{2}{10}$ = 0.20.

**37.**

a. By the Fundamental Counting Principle, with $n_1 = 3$, $n_2 = 4$, and $n_3 = 5$, there are (3)(4)(5) = 60 runs.

b. With $n_1 = 1$ (just one temperature), $n_2 = 2$, and $n_3 = 5$, there are (1)(2)(5) = 10 such runs.

c. For each of the 5 specific catalysts, there are (3)(4) = 12 pairings of temperature and pressure. Imagine we separate the 60 possible runs into those 5 sets of 12. The number of ways to select exactly one run from each of these 5 sets of 12 is $\binom{12}{1}^5 = 12^5$.

Since there are $\binom{60}{5}$ ways to select the 5 runs overall, the desired probability is $\frac{\binom{12}{1}^5}{\binom{60}{5}} = \frac{12^5}{\binom{60}{5}} = .0456$.

**68.** Let's see how we can implement the hint. If she's flying airline #1, the chance of 2 late flights is (30%)(10%) = 3%; the two flights being "unaffected" by each other means we can multiply their probabilities. Similarly, the chance of 0 late flights on airline #1 is (70%)(90%) = 63%. Since percents add to 100%, the chance of exactly 1 late flight on airline #1 is 100% – (3% + 63%) = 34%. A similar approach works for the other two airlines: the probability of exactly 1 late flight on airline #2 is 35%, and the chance of exactly 1 late flight on airline #3 is 45%.

The initial ("prior") probabilities for the three airlines are $P(A_1) = 50\%$, $P(A_2) = 30\%$, and $P(A_3) = 20\%$. Given that she had exactly 1 late flight (call that event $B$), the conditional ("posterior") probabilities of the three airlines can be calculated using Bayes' Rule:

$$P(A_1 \mid B) = \frac{P(A_1)P(B \mid A_1)}{P(A_1)P(B \mid A_1) + P(A_2)P(B \mid A_2) + P(A_3)P(B \mid A_3)} = \frac{(.5)(.34)}{(.5)(.34)+(.3)(.35)+(.2)(.45)} = \frac{.170}{.365} =$$

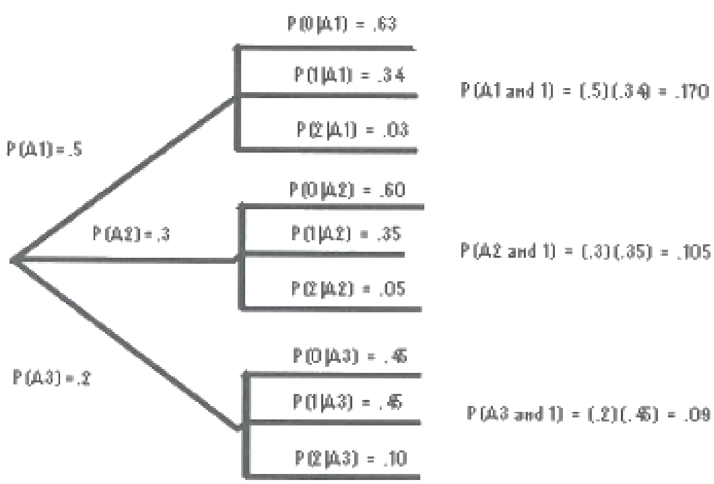
.4657;

$$P(A_2 \mid B) = \frac{P(A_2)P(B \mid A_2)}{P(A_1)P(B \mid A_1) + P(A_2)P(B \mid A_2) + P(A_3)P(B \mid A_3)} = \frac{(.3)(.35)}{.365} = .2877; \text{ and}$$

$$P(A_3 \mid B) = \frac{P(A_3)P(B \mid A_3)}{P(A_1)P(B \mid A_1) + P(A_2)P(B \mid A_2) + P(A_3)P(B \mid A_3)} = \frac{(.2)(.45)}{.365} = .2466.$$

Notice that, except for rounding error, these three posterior probabilities add to 1.

The tree diagram below shows these probabilities.




**77.** Let $p$ denote the probability that a rivet is defective.

**a.** .20 = $P$(seam needs reworking) = 1 – $P$(seam doesn't need reworking) = 1 – $P$(no rivets are defective) = 1 – $P$(1st isn't def $\cap \ldots \cap$ 25th isn't def) = $1 - (1-p)\ldots(1-p) = 1 - (1-p)^{25}$.
Solve for $p$: $(1-p)^{25} = .80 \Rightarrow 1 - p = (.80)^{1/25} \Rightarrow p = 1 - .99111 = .00889$.

**b.** The desired condition is $.10 = 1 - (1-p)^{25}$. Again, solve for $p$: $(1-p)^{25} = .90 \Rightarrow p = 1 - (.90)^{1/25} = 1 - .99579 = .00421$.