AP Statistics Practice Test (page 418)

T6.1 b. The expected number of puzzles is E(X) = 2.3. $P(X > 2.3) = P(X = 3) + P(X = 4) = 0.3 + 0.1 = 0.4$.

T6.2 d. The standard deviation measures how far the values in a distribution typically are from the mean.

T6.3 d. The standard deviation is $\sqrt{0.9^2 + 0.9^2}$.

T6.4 e. All other pairs of variables would likely change together (e.g. those who are taller are likely also weigh more).

T6.5 d. $Y = 1.5X$, so to get the mean and standard deviation of Y, multiply the mean and standard deviation of X by 1.5.

T6.6 b. $\mu_T = 10 + 10 + 10 + 10 = 40$ and $\sigma_T = \sqrt{1^2 + 1^2 + 1^2 + 1^2} = \sqrt{4} = 2$.

T6.7 c. In choice (a) we are looking for 2 successes, not 1, in choice (b) the trials are not independent (not putting the cards back after dealing), in choice (d) we have a fixed number of trials and are counting the number of successes (binomial random variable) and in choice (e) we have a fixed number of trials and are counting the number of successes (binomial random variable).

T6.8 b. This is a binomial setting so the number of cases that the hospital has to deal with is a binomial random variable with $n = 17$ and $p = 0.4$. The question is looking for $P(X > 10) = 1 - P(X \le 10)$.

T6.9 b. This cannot be a geometric distribution because the bar above $X = 1$ is not the tallest. If X was binomial with $n = 8$ and $p = 0.1$, the mean of the distribution would be 8(0.1) = 0.8. This is clearly not where the histogram is centered. Likewise, if $n = 8$ and $p = 0.8$, the mean of the distribution would be 8(0.8) = 6.4, which is clearly not where the histogram is centered.

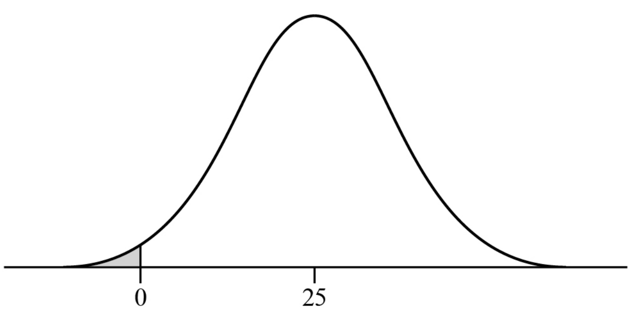
T6.10 c. This is a geometric random variable and we are looking for $P(X = 5)$.

T6.11 (a) If we want at least 10 unbroken eggs, that means no more than 2 broken eggs. So $P(Y \le 2) = 0.78 + 0.11 + 0.07 = 0.96$. There is a 96% chance that at least 10 eggs are unbroken in a randomly selected carton of "store brand" eggs.
(b) $\mu_Y = 0(0.78) + 1(0.11) + 2(0.07) + 3(0.03) + 4(0.01) = 0.38$. If we were to randomly select many cartons of eggs, we would expect about 0.38 to be broken, on average.
(c) $\sigma_Y^2 = (0 - 0.38)^2(0.78) + (1 - 0.38)^2(0.11) + \ldots + (4 - 0.38)^2(0.01) = 0.6756$. So $\sigma_Y = \sqrt{0.6756} = 0.8219$. If we were to randomly select many cartons of eggs, the number of broken eggs would typically vary by about 0.8219 from the mean (0.38).
(d) Let X stand for the number of cartons inspected until (and including) the first carton with at least 2 broken eggs is found. X is a geometric random variable with $p = 0.11$. We are looking for

$P(X \le 3) = P(X=1) + P(X=2) + P(X=3) = (0.11) + (0.89)(0.11) + (0.89)^2(0.11) = 0.2950.$
Using technology: geometcdf(p: 0.11, x value: 3) = 0.2950.

T6.12 (a) Check the BINS. Binary? "Success" = dog owner greets dog first and "Failure" = dog owner does not greet dog first. Independent? We are sampling without replacement, but 12 is less than 10% of all dog owners. Number? We have a fixed number of trials (n = 12). Success? The probability of success is constant for all trials (p = 0.66). This is a binomial setting and X is a binomial random variable with n = 12 and p = 0.66.
(b) $P(X \le 4) = \binom{12}{0}(0.66)^0(0.34)^{12} + \text{L} \ + \binom{12}{4}(0.66)^4(0.34)^8 = 0.0213$. *Using technology*: binomcdf(trials: 12, p: 0.66, x value: 4) = 0.0213. Because this probability is small, it is unlikely to have only 4 or fewer owners greet their dogs first by chance alone. This gives convincing evidence that the claim by the *Ladies Home Journal* is incorrect.

T6.13 (a) Letting $D = A - E$ means that $\mu_D = \mu_A - \mu_E = 50 - 25 = 25$ minutes. Because the amount of time they spend on homework is independent of each other, $\sigma_D^2 = \sigma_A^2 + \sigma_E^2 = 100 + 25 = 125$ and $\sigma_D = \sqrt{125} = 11.18$ minutes.
(b) **Step 1: State the distribution and values of interest.** D follows a N(25, 11.18) distribution and we want to find $P(A < E) = P(A - E < 0) = P(D < 0)$ as shown below. **Step 2: Perform calculations. Show your work.** The standardized score for the boundary value is $z = \frac{0 - 25}{11.18} = -2.24$ and the desired probability is $P(Z < -2.24) = 0.0125$. *Using technology:* The command normalcdf(lower: –1000, upper: 0, μ: 25, σ: 11.18) gives an area of 0.0127. **Step 3: Answer the question.** There is a 0.0127 probability that Ed spent longer on his assignment than Adelaide did on hers.



T6.14 (a) Let X stand for the number of Hispanics in the sample. X has a binomial distribution with $n = 1200$ and $p = 0.13$. Therefore $\mu_X = np = 1200(0.13) = 156$ and $\sigma_X = \sqrt{np(1-p)} = \sqrt{1200(0.13)(0.87)} = 11.6499.$
(b) If the sample contains 15% Hispanics, this means that there were $1200(0.15) = 180$ Hispanics in the sample, which is more than expected. We want to find $P(X \ge 180)$ = $\binom{1200}{180}(0.13)^{180}(0.87)^{1020} + \text{L}$ = 0.0235. Using technology: 1 – binomcdf(trials: 1200, p = 0.13, x value: 179) = 1 – 0.9765 = 0.0235. If we use the Normal approximation to the binomial

distribution, the standardized score for the boundary value is $z = \frac{180 - 156}{11.65} = 2.06$ and the desired probability is $P(Z \geq 2.06) = 1 - 0.9803 = 0.0197$. Because this probability is small, it is unlikely to select 180 or more Hispanics in the sample just by chance. This gives us reason to be suspicious about the sampling process.