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7.23 The expected number of girls is $\mu_X = \sum x_i p_i = 0\left(\frac{1}{8}\right)+1\left(\frac{3}{8}\right)+2\left(\frac{3}{8}\right)+3\left(\frac{1}{8}\right)=1.5$ and the variance is $\sigma_X^2 = \sum (x_i-\mu_x)^2 \cdot p_i = (0-1.5)^2\left(\frac{1}{8}\right)+(1-1.5)^2\left(\frac{3}{8}\right)+(2-1.5)^2\left(\frac{3}{8}\right)+(3-1.5)^2\left(\frac{1}{8}\right)=0.75$ so the standard deviation is $\sigma_X \doteq 0.866$ girls.

7.24 The mean grade is $\mu = 0\times0.01 + 1\times0.05 + 2\times0.30 + 3\times0.43 + 4\times0.21 = 2.78$.

7.25 The mean for owner-occupied units is $\mu = (1)(0.003) + (2)(0.002) + (3)(0.023) + (4)(0.104) + (5)(0.210) + (6)(0.224) + (7)(0.197) + (8)(0.149) + (9)(0.053) + (10)(0.035) = 6.284$ rooms. The mean for renter-occupied units is $\mu = (1)(0.008) + (2)(0.027) + (3)(0.287) + (4)(0.363) + (5)(0.164) + (6)(0.093) + (7)(0.039) + (8)(0.013) + (9)(0.003) + (10)(0.003) = 4.187$ rooms. The larger value of μ for owner-occupied units reflects the fact that the owner distribution was symmetric, rather than skewed to the right, as was the case with the renter distribution. The "center" of the owner distribution is roughly at the central peak class, 6, whereas the "center" of the renter distribution is roughly at the class 4. A comparison of the centers (6.284 > 4.187) matches the observation in Exercise 7.4 that the number of rooms for owner-occupied units tended to be higher than the number of rooms for renter-occupied units.

7.26 If your number is abc, then of the 1000 three-digit numbers, there are six—abc, acb, bac, bca, cab, cba—for which you will win the box. Therefore, you win nothing with probability 994/1000 = 0.994 and \$83.33 with probability 6/1000 = 0.006. The expected payoff on a \$1 bet is $\mu = \$0\times0.994 + \$83.33\times0.006 = \$0.50$. Thus, in the long run, the Tri-State lottery commission will make \$0.50 per play of this lottery game.

7.27 (a) The payoff is either \$0, with a probability of 0.75, or \$3, with a probability of 0.25. (b) For each \$1 bet, the mean payoff is $\mu_X = (\$0)(0.75) + (\$3)(0.25) = \$0.75$. (c) The casino makes 25 cents for every dollar bet (in the long run).

7.28 In Exercise 7.24, we computed the mean grade of $\mu = 2.78$. Thus, the variance is $\sigma_X^2 = (0-2.78)^2(0.01)+(1-2.78)^2(0.05)+(2-2.78)^2(0.30)+(3-2.78)^2(0.43)+(4-2.78)^2(0.21) \doteq 0.7516$ and the standard deviation is $\sigma_X \doteq 0.8669$.

7.29 The means are: $\mu_H = 1\times0.25 + 2\times0.32 + 3\times0.17 + 4\times0.15 + 5\times0.07 + 6\times0.03 + 7\times0.01 = 2.6$ people for a household and $\mu_F = 1\times0 + 2\times0.42 + 3\times0.23 + 4\times0.21 + 5\times0.09 + 6\times0.03 + 7\times0.02 = 3.14$ people for a family. The standard deviations are: $\sigma_H^2 = (1-2.6)^2\times0.25 + (2-2.6)^2\times 0.32 + (3-2.6)^2\times0.17 + (4-2.6)^2\times0.15 + (5-2.6)^2\times0.07 + (6-2.6)^2\times0.03 + (7-2.6)^2\times0.01 = 2.02$, and $\sigma_H = \sqrt{2.02} \doteq 1.421$ people for a household and $\sigma_F^2 = (1-3.14)^2(0) + (2-3.14)^2(0.42) + (3-3.14)^2(0.23) + (4-3.14)^2(0.21) + (5-3.14)^2(0.09) + (6-3.14)^2(0.03) + (7-3.14)^2(0.02) \doteq 1.5604$, and $\sigma_F = \sqrt{1.5604} \doteq 1.249$ people for a family. The family distribution has a slightly larger mean than the household distribution, matching the observation in Exercise 7.12 that family sizes tend to be larger than household sizes. The standard deviation for