1) D: $E(X) = \frac{1}{8}(1+1+2+4+4) + \frac{3}{8}(6) = \frac{15}{4} = 3.75$
2) A: Work backwards in order to solve this problem. For the second dice roll, the expected value (i.e. expected winnings) is \$3.50. Knowing this fact, a player would only exercise the second dice roll if the first dice roll yields a value lower than 3.5. Thus, $E(X) = \frac{1}{6}(4+5+6) + \frac{1}{2}(3.5) = 4.25$.
3) C: $P(U=1, V=1) = P(U=1, V=3) \rightarrow P(V=1) = P(V=3) = \frac{1-.2}{2} = .4$. Further, $P(U=1, V=1) = P(U=1)P(V=1) = .2 \rightarrow P(U=1) = .5$. Thus, $P(U=2) = 1 - .5 - .1 = .4$ and $P(U=2,\ V=3) = (.4)(.4) = .16$
4) D: $P(G) + P(G^C) = 1$ always by the definition of complement.
5) D: There are $\binom{5}{2} = 10$ possible groups. There are $\binom{3}{2} = 3$ groups without Northmore and Laguardia. Thus, $P(No\ Northmore\ or\ Laguardia) = \frac{3}{10}$.
6) B: $\binom{52}{2} = \frac{52!}{50!2!} = \frac{P_{52,2}}{2!}$
7) D: Combinations can allow for repeats. For example, think of scoops of ice cream. I can order a triple scoop cup with one chocolate and 2 vanilla scoops. It doesn't matter how the ice cream is placed in the cup, but I still repeated the vanilla scoop.
8) C: $P(2 < X < 3 | 1 < X < 3) = \frac{1}{4} \,/\, \frac{1}{2} = \frac{1}{2}$.
9) A: Draw a picture. With the given information, only 8 objects fall outside the 4 categories. Hence, $P(No\ category) = \frac{8}{120} = \frac{1}{15}$.
10) B: $P(|X_A + X_B + X_C + X_D - 45| < 1) = P(44 < X_A + X_B + X_C + X_D < 46)$. Let $Y = X_A + X_B + X_C + X_D$. Then $E(Y) = 10 + 11 + 12 + 13 = 46$, $SD(Y) = \sqrt{1^2 + 2^2 + 2^2 + 4^2} = 5$. Thus, we have: $P(44 < Y < 46) = P\left(\frac{44-46}{5} < \frac{Y-46}{5} < \frac{46-46}{5}\right) = P(-.4 < Z < 0) = .1554$.
11) B: $P(at\ least\ 1\ sol'n) = 1 - P(0\ sol'n) = 1 - P(A=1)P(B \neq 1) = 1 - \frac{1}{6} * \frac{5}{6} = \frac{31}{36}$
12) E: Expected gain = $3\left(\frac{1}{4}\right) + 1\left(\frac{1}{2}\right) + X\left(\frac{1}{4}\right) = 0 \rightarrow X = -5$
13) C: Let W = Ron McDon winning. Then, $W = \frac{1}{6}W + \frac{25}{36}$, since after two rolls of no 5's, the game is at the same starting point. Solving the above equation, we have $W = \frac{6}{11} \rightarrow P(Ron\ losing) = 1 - \frac{6}{11} = \frac{5}{11}$. Note that this can also be solved by summing an infinite geometric series (where $a_0 = \frac{1}{6}, r = \frac{25}{36}$) using the formula: $P(W) = \frac{a_0}{1-r} = \frac{6}{11} \rightarrow P(Ron\ losing) = \frac{5}{11}$.
14) B: This is Bayes Rule: $P(A|B)P(B) = P(B|A)P(A)$. Let A = Mrs. Linder gives a pop quiz on Monday and B = the Buccaneers win on Sunday. Then, $P(B) = \frac{(.2)(.6)}{.3} = .4$
15) A: Let $x = P(A \cap B^C)$, $y = P(A \cap B)$, $z = P(A^C \cap B), w = P(A^C \cap B^C)$. Then, $P(A|B^C) = \frac{x}{x+w} = 0.2 \rightarrow 4x - w = 0; P(B|A^C) = \frac{z}{z+w} = \frac{3}{7} \rightarrow 4z - 3w = 0; P(A) = x + y = .3; P(B) = y + z = .5$. Subtract the first two equations to obtain: $4(x-z) + 2w = 0$. Subtract the second two equations to obtain: $x - z = -0.2$. Substitute to solve for $w = .4$. Then, $x = .1, z = .3, y = .2$. Thus, $P\big((A \cap B^C) \cup (A^C \cap B\big) = x + z = .4$.

16) D: Note that X and Y are binomial variables with $n = 3$. $Var(Z) = Var(X) + 4Var(Y) = 3\left(\frac{1}{3}\right)\left(\frac{2}{3}\right) + 4\left[3\left(\frac{1}{2}\right)\left(\frac{1}{2}\right)\right] = \frac{2}{3} + 3 = \frac{11}{3}$.
17) B: Draw a picture with the lines $y = x + 2$ and $y = x - 2$ where $x \in [0,5], y \in [0,3]$. The area of the portion between the lines is: $15 - \frac{1}{2}(1)(1) - \frac{1}{2}(3)(3) = 10$. Hence, $P(|x - y| < 2) = \frac{10}{15} = \frac{2}{3}$
18) D: $P(G < H|G \leq 2) = \frac{P(G<H\cap G\leq 2)}{P(G\leq 2)} = \frac{P(0<H)P(G=0)+P(1<H)P(G=1)+P(2<H)P(G=2))}{P(G=0)+P(G=1)+P(G=2)}$. Use the complement rule and the given formula to solve for $P(0 < H) = 1 - P(H = 0) = 1 - e^{-1}$. Similarly, $P(H < 1) = 1 - P(H = 0) - P(H = 1) = 1 - e^{-1} - e^{-1} = 1 - 2e^{-1}$ and $P(H < 2) = 1 - \frac{5}{2}e^{-1}$. Using the given formula, $P(G = 0) = e^{-2}, P(G = 1) = 2e^{-2}, P(G = 2) = 2e^{-2}$. Plugging into the first equation, we have: $P(G < H|G \leq 2) = \frac{5e^{-2}-10e^{-3}}{5e^{-2}} = 1 - 2e^{-1}$
19) E: For any random point E, the area of triangle CDE will be exactly half of the area of square $ABCD$ since the height of CDE is the length of one side of $ABCD$. Thus, $P(F\ not\ in\ CDE) = 1 - \frac{1}{2} = \frac{1}{2}$
20) C: Let SS = Strong Sales, P = Positive Result, and N = Negative Result. Then $P(SS) = P(SS|P)P(P) + P(SS|W)P(N)$, Using the information given, we have: $.6 = P(SS|P) * .5 + .4 * .5 \rightarrow P(SS|P) = .8$.
21) A: For 1 play, the expected value is: $10p - 10(1 - p) = 20p - 10 = 10(2p - 1)$. For n plays (including the initial wealth), the expected value is $100 + 10n(2p - 1)$.
22) A: This is a combination problem with repeats. $Total\ \#\ Combos = \binom{7+4-1}{4} = \binom{10}{4} = 210$
23) B: $P(left|no\ signal) = \frac{P(left \cap no\ signal)}{P(no\ signal)} = \frac{.7*.2}{.7*.2+.2*.2+.1} = .5$. Note that you never use your signal when you go straight!
24) E: The different slopes represent a continuous uniform distribution. The probability that the ball flies along any specified line is zero since there are an infinite number of possibilities (i.e. $\frac{1}{\infty} = 0$). Hence, $P(y = 3x\ or\ y = -3x) = 0 + 0 = 0$
25) C: Let M1 = Score on Midterm 1 and M2 = Score on Midterm 2. Let $Y = M1 + M2$. Then $E(Y) = 75 + 85 = 160$ and $SD(Y) = \sqrt{3^2 + 4^2} = 5$. Thus, $P(Y > 165) = P\left(\frac{Y-160}{5} > \frac{165-160}{5}\right) = P(Z > 1) = .1587$
26) C: Let R,Y = # of Red/Yellow balls left in the jar. Then, $P(R \geq Y) = 1 - P(R < Y) = 1 - P(R = 0) = 1 - 3 * \frac{2}{5} * \frac{1}{4} * \frac{2}{3} = \frac{4}{5}$
27) E: This scenario represents none of these distributions since Lazy John's chance of answering a question correctly is always changing (the program explains to Lazy John what he does wrong and since John is a competent person, he will learn from his mistakes and most likely not make the same mistake again, one would hope…).

28) A: The annual number of sweepstakes winners is an integer value *and* it results from a random process; so it is a discrete random variable. The average height of a group of boys could be a non-integer, so it is not a discrete variable. And the number of presidential elections in the 20th century is an integer, but it does not vary and it does not result from a random process; so it is not a random variable.

29) C: $x^2 = 2 \rightarrow x = \sqrt{2}$. Because $f(x)$ is increasing, $f(x) < 2$ when $x = \sqrt{2}$. Thus, $P(f(x) < 2) = \frac{\sqrt{2}}{3}$.

30) A: $P(win) = \frac{5}{5+3} = \frac{5}{8}$. Thus, $P(lose) = 1 - \frac{5}{8} = \frac{3}{8}$.